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Dia- and paramagnetic contributions to magnetizabilities of relativistic hydrogenlike atoms in some low-lying discrete energy eigenstates

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ABSTRACT

In this paper we present tabulated data for relative diamagnetic and paramagnetic contributions to the magnetizability (χ) of the relativistic hydrogenlike atoms with a pointlike, motionless and spinless nucleus of charge Ze . Utilizing general analytical formulas for the diamagnetic (χ_d) and paramagnetic (χ_p) components of χ , recently derived by us (P. Stefańska, 2020) with the aid of the Gordon decomposition technique, valid for an arbitrary discrete energy state, we have computed the numerical values of χ_d/χ and χ_p/χ for the ground state and for the first and the second set of excited states (i.e.: $2s_{1/2}$, $2p_{1/2}$, $2p_{3/2}$, $3s_{1/2}$, $3p_{1/2}$, $3p_{3/2}$, $3d_{3/2}$, and $3d_{5/2}$) of the hydrogen atom ($Z = 1$) and for hydrogenic ions with $2 \leq Z \leq 137$. We compare also the numerical values of the total magnetizabilities for the ground state $1s_{1/2}$ and for each state belonging to the first set of excited states of selected hydrogenlike atoms, obtained with the use of two different values of the fine-structure constant, i.e.: $\alpha^{-1} = 137.035\,999\,139$ (from CODATA 2014) and $\alpha^{-1} = 137.035\,999\,084$ (from CODATA 2018).

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1. Introduction

Electromagnetic susceptibilities of atomic and molecular systems have long been the subject of research for both experimental and theoretical physicists. Most often, to determine these properties, it is necessary to place the tested atom (or molecule) in an external electric or/and magnetic field, and then observe the appropriate changes in this system. From the theoretical point of view, the influence of perturbing fields on atoms can be described by changing the electric charge (or current) density [1]. Within the framework of nonrelativistic Schrödinger–Pauli wave mechanics, the induced electric current density (and – consequently – many magnetic susceptibilities of the atom) may be obtained as the sum of a diamagnetic (Langevin–Larmor) and a paramagnetic (Van Vleck) term [2]. In this approach, the paramagnetic component is often found to be very small in magnitude or even vanishing, while the diamagnetic contribution turns out to be a dominant one.

In the purely relativistic theory, the above described decomposition of the atomic magnetic properties can be performed in some different ways, e.g. with the use of a separate summation over negative-energy states [3–6], by the unitary transformation of the Dirac operator [7], or by using the Gordon decomposition of the electric current density [8–14]. The latter approach was also used in Ref. [15], where the analytical expressions for diamagnetic and paramagnetic contributions to the magnetizability χ of the relativistic one-electron atom in the *ground* state were derived. Recently, we have generalized the considerations from

Ref. [15] to an *arbitrary* discrete energy atomic eigenstate [16], i.e. we have received the magnetizability in the following form

$$\chi = \chi_d + \chi_p, \quad (1)$$

where diamagnetic (χ_d) and paramagnetic (χ_p) parts of χ are obtained as the functions of the three quantum numbers $\{n, \kappa, \mu\}$, which characterize the atomic unperturbed state: n denotes the radial quantum number, the Dirac quantum number κ is an integer different from zero, whereas μ is the magnetic quantum number. By utilizing the Sturmian expansion of the generalized Dirac–Coulomb Green function [17] (for some applications of this technique, see Refs. [18–27]), we arrived at the following general closed-form expressions:

$$\chi_d = -\frac{\alpha^2 a_0^3}{Z^2} \frac{4\kappa^2 + 4\mu^2 - 1}{16(4\kappa^2 - 1)} (n + \gamma_\kappa) \times [N_{n\kappa}(5n^2 + 10n\gamma_\kappa + 2\gamma_\kappa^2 + 1) - 3\kappa(n + \gamma_\kappa)] \quad (2)$$

and

$$\chi_p = \chi'_p + \chi''_p, \quad (3)$$

where

$$\chi'_p = \frac{\alpha^2 a_0^3}{Z^2} \sum_{+,-} \left(1 - \frac{4\mu^2}{(2\kappa \mp 1)^2}\right) \frac{(n + \gamma_\kappa \mp N_{n\kappa})^2}{128N_{n\kappa}(N_{n\kappa} - \kappa \pm 1)} \times \left[2\kappa - 4(n + \gamma_\kappa)N_{n\kappa} \pm 2n(n + 2\gamma_\kappa)\right]$$

$$\begin{aligned}
& + \frac{n! \Gamma(n + 2\gamma_\kappa + 1)}{(N_{n\kappa} - \kappa)(\gamma_{1\mp\kappa} - \gamma_\kappa - n + 1) \Gamma(2\gamma_{1\mp\kappa} + 1)} \\
& \times \sum_{k=0}^n \sum_{p=0}^n \tilde{z}_{n\kappa}^{(\pm)}(k) \tilde{z}_{n\kappa}^{(\pm)}(p) \\
& \times {}_3F_2 \left(\begin{matrix} \gamma_{1\mp\kappa} - \gamma_\kappa - k, \gamma_{1\mp\kappa} - \gamma_\kappa - p, \gamma_{1\mp\kappa} - \gamma_\kappa - n + 1 \\ \gamma_{1\mp\kappa} - \gamma_\kappa - n + 2, 2\gamma_{1\mp\kappa} + 1 \end{matrix}; 1 \right)
\end{aligned} \quad (4)$$

(here $\sum_{+,-}(\dots)$ denotes that the components with the upper and lower signs should be added together), with

$$\tilde{z}_{n\kappa}^{(\pm)}(k) = \frac{(-)^k}{k!(n-k)!} [(n-k) \pm (N_{n\kappa} - \kappa)]^2 \frac{\Gamma(\gamma_\kappa + \gamma_{1\mp\kappa} + k + 1)}{\Gamma(k + 2\gamma_\kappa + 1)} \quad (5)$$

and analogously for $\tilde{z}_{n\kappa}^{(\pm)}(p)$, while

$$\chi_p'' = \frac{\alpha^2 a_0^3}{Z^2} \frac{\kappa(\kappa^2 - \mu^2)\mu^2}{4\kappa^2 - 1} \frac{2\kappa(n + \gamma_\kappa) - N_{n\kappa}}{2N_{n\kappa}}. \quad (6)$$

In the above equations, α is the Sommerfeld's fine structure constant, a_0 stands for the Bohr radius, $\Gamma(\zeta)$ denotes the Euler's gamma function, ${}_3F_2$ is the generalized hypergeometric function,

$$N_{n\kappa} = \sqrt{n^2 + 2n\gamma_\kappa + \kappa^2}, \quad (7)$$

and

$$\gamma_\kappa = \sqrt{\kappa^2 - (\alpha Z)^2}. \quad (8)$$

By exploiting Eqs. (2)–(6), we have verified that, as one would expect, the sum $\chi_d + \chi_p$ coincides with the total magnetizability of the Dirac one-electron atoms in an arbitrary energy state, found by us a few years ago [22,23].

It should be clearly indicated here that our recent paper [16], apart from the analytical results presented above, contains only a few representative tables with the values of the relative para- and diamagnetic contributions to χ for some excited states of selected hydrogenlike ions. Because in the scientific literature in vain to look for other such general results concerning the quantities discussed here, in this article we present a more comprehensive numerical data compared to those in Ref. [16]. Our results will be discussed briefly in the next section.

2. Discussion of results

Computational results presented in this work have been obtained with the aid of the exact analytical formulas given in Eqs. (2)–(6). Table 1 contains the values of the relative dia- and paramagnetic contributions to the magnetizability for the ground state ($1s_{1/2}$) of the relativistic one-electron atoms. In Tables 2–5 we have included the results for states belonging to the first set of excited states, i.e.: $2s_{1/2}$, $2p_{1/2}$, and $2p_{3/2}$, whereas results for the second excited atomic states (i.e. $3s_{1/2}$, $3p_{1/2}$, $3p_{3/2}$, $3d_{3/2}$ and $3d_{5/2}$) are presented in Tables 6–14. For each state, all possible values of the magnetic quantum number μ were considered.

All tabulated data were computed with the use of the newest value $\alpha^{-1} = 137.035\,999\,084$ of the inverse of the fine-structure constant recommended by the Committee on Data for Science and Technology (CODATA) [28]. To show how the change in the value of α affects the value of the magnetic susceptibilities, we performed additional calculations for the total magnetizability χ with the current value of α^{-1} and also with the previous value $\alpha^{-1} = 137.035\,999\,139$ (from CODATA 2014) [29]. The appropriate juxtaposition of the numerical values of χ for the ground state and for the first excited states of selected hydrogenlike ions is presented in Table 15.

A few representative results for the relative para- and diamagnetic contributions to the magnetizability of the hydrogenic ground state can be found in the work of Szmytkowski [15]. Since they were obtained by utilizing the $\alpha^{-1} = 137.0359895$ (from CODATA 1986) [30], we have decided to make yet additional calculations (not presented here) for χ_p/χ and χ_d/χ for the state $1s_{1/2}$, taking into account just mentioned value of the inverse of the fine-structure constant. This allows us to compare our results with data provided in [15]. The agreement between these results turns out to be almost perfect. We have found some inconsistencies for the ion with $Z = 120$ only: our value for $\chi_p''/\chi = -1.136288773734$ is different from Szmytkowski's result $\chi_p''/\chi = -1.28$. Therefore, also $\chi_p/\chi = -1.122168785351$ found by us does not overlap with $\chi_p/\chi = -1.26$ predicted in Ref. [15].

After analyzing all the numbers from Tables 1–14 we conclude that always for all states with $\kappa < 0$ and simultaneously with the maximal value of μ (i.e. when the magnetic quantum number μ is equal to the total angular momentum quantum number j), we have $|\chi_p'| \ll |\chi_p''|$. Such relation occurs also for the atomic ground state; this agrees with the conclusions from [15]. Furthermore, for the class of atomic states described above, the diamagnetic contribution χ_d always dominates over the paramagnetic one χ_p . However, the one exception to this rule is the ground state $1s_{1/2}$, for which such relation occurs not for the whole range of atomic number, but only for $Z < 130$.

The opposite relation, i.e. $|\chi_p''| \ll |\chi_p'|$, applies to the states with the angular-plus-parity symmetry quantum number $\kappa > 0$. For states with $\kappa < 0$ it holds only if $\mu < j$ takes place simultaneously. Generally, for these states, one can observe that χ_p is greater than the χ_d . Nevertheless, there are some states from the class described above, for which such dominance does not occur for the entire atomic number range; it is most evident in the case of small Z 's and gradually decreases to a certain Z_c value, for which both contributions are almost equal, and then the diamagnetic component slowly begins to dominate over the paramagnetic one. For the first set of excited states, we have found $Z_c = 117$ for $2p_{1/2}$ and $Z_c = 103$ for $2p_{3/2}$ (with $\mu = \pm 1/2$), whereas for the higher excited states such alignment of diamagnetic and paramagnetic contributions is already taking place for lower values of the nuclear charge number, i.e. there are $Z_c = 84$ for $3p_{1/2}$ and $Z_c = 85$ for $3p_{3/2}$ (with $\mu = \pm 1/2$).

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Explanation of tables

- Table 1.** Relative dia- and paramagnetic contributions to magnetizabilities for the ground state ($1s_{1/2}$) of hydrogenlike atoms, obtained with $\alpha^{-1} = 137.035\,999\,084$ (CODATA 2018)
- Table 2.** Relative dia- and paramagnetic contributions to magnetizabilities of hydrogenlike atoms in the excited state $2s_{1/2}$, obtained with $\alpha^{-1} = 137.035\,999\,084$ (CODATA 2018)
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- Table 4.** Relative dia- and paramagnetic contributions to magnetizabilities of hydrogenlike atoms in the excited state $2p_{3/2}$ ($\mu = \pm 1/2$), obtained with $\alpha^{-1} = 137.035\,999\,084$ (CODATA 2018)
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- Table 15.** Relativistic total magnetizabilities $\chi = \chi_d + \chi_p$ (in the units of $\alpha^2 a_0^3$) for states $1s_{1/2}$, $2s_{1/2}$, $2p_{1/2}$ and $2p_{3/2}$ of selected hydrogenlike ions, obtained with $\alpha^{-1} = 137.035\,999\,139$ (CODATA 2014) [the upper entries] and with $\alpha^{-1} = 137.035\,999\,084$ (CODATA 2018) [the lower entries]

In all the tables we have used the following notations:

| | |
|----------|---|
| χ | the atomic magnetizability |
| χ_d | the diamagnetic part of the atomic magnetizability |
| χ_p | the paramagnetic part of the atomic magnetizability |
| Z | the nuclear charge number |
| α | the fine-structure constant |
| a_0 | the Bohr radius |
| $a(b)$ | this means $a \times 10^b$ |
| μ | the magnetic quantum number; $\mu = -j, \dots, j$ |

The atomic states are referred to as $\mathcal{N}\chi_j$, due to the following guidelines:

| | |
|------------------------------|---|
| \mathcal{N} | the principal quantum number |
| $\mathcal{N} = n + \kappa $ | [Note that for the radial quantum number $n = 0$, κ is the negative integer!] |
| κ | the Dirac quantum number; $\kappa = (l - j)(2j + 1)$ |
| j | the total angular momentum quantum number; $j = \kappa - \frac{1}{2} = l \pm \frac{1}{2}$ |
| $x \equiv s$ | states with the orbital angular momentum quantum number $l = 0$ |
| $x \equiv p$ | states with the orbital angular momentum quantum number $l = 1$ |
| $x \equiv d$ | states with the orbital angular momentum quantum number $l = 2$ |

Table 1
Relative dia- and paramagnetic contributions to magnetizabilities for the ground state ($1s_{1/2}$) of hydrogenlike atoms, obtained with $\alpha^{-1} = 137.035\,999\,084$ (CODATA 2018).

| Z | χ_p'/χ | χ_p''/χ | χ_p/χ | χ_d/χ |
|----|---------------------|---------------------|---------------------|-------------------|
| 1 | 7.993225387407(-12) | -1.331354759680(-5) | -1.331353960358(-5) | 1.000013313540(0) |
| 2 | 1.279184947915(-10) | -5.326269990834(-5) | -5.326257198984(-5) | 1.000053262572(0) |
| 3 | 6.478143650017(-10) | -1.198729999112(-4) | -1.198723520968(-4) | 1.000119872352(0) |
| 4 | 2.048418388944(-9) | -2.131870673237(-4) | -2.131850189053(-4) | 1.000213185019(0) |
| 5 | 5.004179511809(-9) | -3.332646709060(-4) | -3.332596667264(-4) | 1.000333259667(0) |
| 6 | 1.038468035684(-8) | -4.801828300072(-4) | -4.801724453268(-4) | 1.000480172445(0) |
| 7 | 1.925647436422(-8) | -6.540359456921(-4) | -6.540166892178(-4) | 1.000654016689(0) |
| 8 | 3.288534421110(-8) | -8.549359618726(-4) | -8.549030765284(-4) | 1.000854903077(0) |
| 9 | 5.273898944038(-8) | -1.083012556972(-3) | -1.082959817983(-3) | 1.001082959818(0) |
| 10 | 8.049015276968(-8) | -1.338413366754(-3) | -1.338332876601(-3) | 1.001338332877(0) |
| 11 | 1.180201961475(-7) | -1.621304239043(-3) | -1.621186218847(-3) | 1.001621186219(0) |
| 12 | 1.674231392816(-7) | -1.931869521198(-3) | -1.931702098059(-3) | 1.001931702098(0) |
| 13 | 2.310101750929(-7) | -2.270312381279(-3) | -2.270081371104(-3) | 1.002270081371(0) |
| 14 | 3.113146783598(-7) | -2.636855163996(-3) | -2.636543849318(-3) | 1.002636543849(0) |
| 15 | 4.110977257192(-7) | -3.031739782654(-3) | -3.031328684928(-3) | 1.003031328685(0) |
| 16 | 5.333541472005(-7) | -3.455228148404(-3) | -3.454694794257(-3) | 1.003454694794(0) |
| 17 | 6.813191315903(-7) | -3.907602638308(-3) | -3.906921319177(-3) | 1.003906921319(0) |
| 18 | 8.584754101815(-7) | -4.389166603822(-3) | -4.388308128412(-3) | 1.004388308128(0) |
| 19 | 1.068561045862(-6) | -4.900244921482(-3) | -4.899176360437(-3) | 1.004899176360(0) |
| 20 | 1.315577857055(-6) | -5.441184587753(-3) | -5.439869009895(-3) | 1.005439869010(0) |
| 21 | 1.603800508770(-6) | -6.012355360154(-3) | -6.010751559645(-3) | 1.006010751556(0) |
| 22 | 1.937786305953(-6) | -6.614150447000(-3) | -6.612212660694(-3) | 1.006612212661(0) |
| 23 | 2.322385727482(-6) | -7.246987248267(-3) | -7.244664862540(-3) | 1.007246648625(0) |
| 24 | 2.762753742565(-6) | -7.911308150342(-3) | -7.908545396600(-3) | 1.007908545397(0) |
| 25 | 3.264361954924(-6) | -8.607581377638(-3) | -8.604317015683(-3) | 1.008604317016(0) |
| 26 | 3.833011624170(-6) | -9.336301904322(-3) | -9.332468892698(-3) | 1.009332468893(0) |
| 27 | 4.474847617973(-6) | -1.009799242967(-2) | -1.009351758205(-2) | 1.010093517582(0) |
| 28 | 5.196373353354(-6) | -1.089320442088(-2) | -1.088800804753(-2) | 1.010888008048(0) |
| 29 | 6.004466790399(-6) | -1.172251922749(-2) | -1.171651476070(-2) | 1.011716514761(0) |
| 30 | 6.906397547205(-6) | -1.258654927187(-2) | -1.257964287432(-2) | 1.012579642874(0) |
| 31 | 7.909845210794(-6) | -1.348593932073(-2) | -1.347802947552(-2) | 1.013478029476(0) |
| 32 | 9.022918925256(-6) | -1.442136784294(-2) | -1.441234492402(-2) | 1.014412344924(0) |
| 33 | 1.025417834541(-5) | -1.539354845931(-2) | -1.538329428096(-2) | 1.015383294281(0) |
| 34 | 1.161265605206(-5) | -1.640323149077(-2) | -1.639161883472(-2) | 1.016391618835(0) |
| 35 | 1.310788153331(-5) | -1.745120561162(-2) | -1.743809773008(-2) | 1.017438097730(0) |
| 36 | 1.474990684572(-5) | -1.853829961525(-2) | -1.852354970840(-2) | 1.018523549708(0) |
| 37 | 1.654933407918(-5) | -1.966538430043(-2) | -1.964883496635(-2) | 1.019648834966(0) |
| 38 | 1.851734476059(-5) | -2.083337448691(-2) | -2.081485714215(-2) | 1.020814857142(0) |
| 39 | 2.066573134346(-5) | -2.204323116979(-2) | -2.202256543844(-2) | 1.022022565438(0) |
| 40 | 2.300693094437(-5) | -2.329596382315(-2) | -2.327295689220(-2) | 1.023272956892(0) |
| 41 | 2.555406150152(-5) | -2.459263286429(-2) | -2.456707880279(-2) | 1.024567078803(0) |
| 42 | 2.832096054754(-5) | -2.593435229084(-2) | -2.590603133030(-2) | 1.025906031330(0) |
| 43 | 3.132222680612(-5) | -2.732229250441(-2) | -2.729097027761(-2) | 1.027290970278(0) |
| 44 | 3.457326484245(-5) | -2.875768333547(-2) | -2.872311007062(-2) | 1.028723110071(0) |
| 45 | 3.809033301923(-5) | -3.024181728570(-2) | -3.020372695269(-2) | 1.030203726953(0) |
| 46 | 4.189059503439(-5) | -3.177605300563(-2) | -3.173416241060(-2) | 1.031734162411(0) |
| 47 | 4.599217534389(-5) | -3.336181902681(-2) | -3.331582685146(-2) | 1.033315826851(0) |
| 48 | 5.041421880284(-5) | -3.500061777012(-2) | -3.495020355132(-2) | 1.034950203551(0) |
| 49 | 5.517695489177(-5) | -3.669402985361(-2) | -3.663885289872(-2) | 1.036638852899(0) |
| 50 | 6.030176693178(-5) | -3.844371872555(-2) | -3.838341695862(-2) | 1.038383416959(0) |
| 51 | 6.581126673426(-5) | -4.025143565144(-2) | -4.018562438470(-2) | 1.040185624385(0) |
| 52 | 7.172937517642(-5) | -4.211902508604(-2) | -4.204729571087(-2) | 1.042047295711(0) |
| 53 | 7.808140924641(-5) | -4.404843046531(-2) | -4.397034905606(-2) | 1.043970349056(0) |
| 54 | 8.489417615898(-5) | -4.604170045631(-2) | -4.595680628015(-2) | 1.045956806280(0) |
| 55 | 9.219607520804(-5) | -4.810099570765(-2) | -4.800879963244(-2) | 1.048008799632(0) |
| 56 | 1.000172080950(-4) | -5.022859614723(-2) | -5.012857893914(-2) | 1.050128578939(0) |
| 57 | 1.083894985542(-4) | -5.242690887955(-2) | -5.231851938100(-2) | 1.052318519381(0) |
| 58 | 1.173468221873(-4) | -5.469847674029(-2) | -5.458112991810(-2) | 1.054581129918(0) |
| 59 | 1.269251475263(-4) | -5.704598757277(-2) | -5.691906242524(-2) | 1.056919062425(0) |
| 60 | 1.371626894569(-4) | -5.947228429791(-2) | -5.933512160845(-2) | 1.059335121608(0) |
| 61 | 1.481000762720(-4) | -6.198037585788(-2) | -6.183227578161(-2) | 1.061832275782(0) |
| 62 | 1.597805317727(-4) | -6.457344912295(-2) | -6.441366859117(-2) | 1.064413668591(0) |
| 63 | 1.722500740069(-4) | -6.725488186183(-2) | -6.708263178782(-2) | 1.067082631788(0) |
| 64 | 1.855577324290(-4) | -7.002825688786(-2) | -6.984269915543(-2) | 1.069842699155(0) |
| 65 | 1.997557854872(-4) | -7.289737750736(-2) | -7.269762172188(-2) | 1.072697621722(0) |
| 66 | 2.149000208985(-4) | -7.586628441219(-2) | -7.565138439130(-2) | 1.075651384391(0) |
| 67 | 2.310500211589(-4) | -7.893927417673(-2) | -7.870822415557(-2) | 1.078708224156(0) |
| 68 | 2.482694771736(-4) | -8.212091954009(-2) | -8.187265006292(-2) | 1.081872650063(0) |
| 69 | 2.666265332680(-4) | -8.541609167830(-2) | -8.514946514504(-2) | 1.085149465145(0) |
| 70 | 2.861941672846(-4) | -8.882998469838(-2) | -8.854379053110(-2) | 1.088543790531(0) |
| 71 | 3.070506099776(-4) | -9.236814261797(-2) | -9.206109200799(-2) | 1.092061092008(0) |
| 72 | 3.292798085013(-4) | -9.603648913052(-2) | -9.570720932202(-2) | 1.095707209322(0) |
| 73 | 3.529719394731(-4) | -9.984136049844(-2) | -9.948838855896(-2) | 1.099488388559(0) |
| 74 | 3.782239778806(-4) | -1.037895419655(-1) | -1.034113179876(-1) | 1.103411317988(0) |

(continued on next page)

Table 1 (continued)

| Z | χ_p'/χ | χ_p''/χ | χ_p/χ | χ_a/χ |
|-----|---------------------|---------------------|---------------------|---------------------|
| 75 | 4.051403290254(-4) | -1.078883081373(-1) | -1.074831678083(-1) | 1.107483167808(0) |
| 76 | 4.338335317732(-4) | -1.121454678452(-1) | -1.117116343134(-1) | 1.111711634313(0) |
| 77 | 4.644250426428(-4) | -1.165694140865(-1) | -1.161049890438(-1) | 1.116104989044(0) |
| 78 | 4.970461117505(-4) | -1.211691797283(-1) | -1.206721336166(-1) | 1.120672133617(0) |
| 79 | 5.318387633723(-4) | -1.259544997662(-1) | -1.254226610028(-1) | 1.125422661003(0) |
| 80 | 5.689568959565(-4) | -1.309358810604(-1) | -1.303669241644(-1) | 1.130366924164(0) |
| 81 | 6.085675188674(-4) | -1.361246806222(-1) | -1.355161131033(-1) | 1.135516113103(0) |
| 82 | 6.508521460563(-4) | -1.415331937034(-1) | -1.408823415574(-1) | 1.140882341557(0) |
| 83 | 6.960083703401(-4) | -1.471747531558(-1) | -1.464787447855(-1) | 1.146478744785(0) |
| 84 | 7.442516461343(-4) | -1.530638417862(-1) | -1.523195901401(-1) | 1.152319590140(0) |
| 85 | 7.958173135076(-4) | -1.592162197418(-1) | -1.584204024283(-1) | 1.158420402428(0) |
| 86 | 8.509629024776(-4) | -1.656490693320(-1) | -1.647981064295(-1) | 1.164798106430(0) |
| 87 | 9.099707638092(-4) | -1.723811601471(-1) | -1.714711893833(-1) | 1.171471189383(0) |
| 88 | 9.731510815115(-4) | -1.794330378837(-1) | -1.784598868022(-1) | 1.178459886802(0) |
| 89 | 1.040845333157(-3) | -1.868272409574(-1) | -1.857863956243(-1) | 1.185786395624(0) |
| 90 | 1.113430277562(-3) | -1.945885498124(-1) | -1.934751195348(-1) | 1.193475119535(0) |
| 91 | 1.191322565939(-3) | -2.027442748505(-1) | -2.015529522845(-1) | 1.201552952285(0) |
| 92 | 1.274984093171(-3) | -2.113245901714(-1) | -2.100496060783(-1) | 1.210049606078(0) |
| 93 | 1.364928231493(-3) | -2.203629218845(-1) | -2.189979936530(-1) | 1.218997993653(0) |
| 94 | 1.461727121008(-3) | -2.298964017290(-1) | -2.284346746080(-1) | 1.228434674608(0) |
| 95 | 1.566020232010(-3) | -2.399663992278(-1) | -2.384003789958(-1) | 1.238400378996(0) |
| 96 | 1.678524465558(-3) | -2.506191487587(-1) | -2.489406242931(-1) | 1.248940624293(0) |
| 97 | 1.800046124531(-3) | -2.619064919583(-1) | -2.601064458338(-1) | 1.260106445834(0) |
| 98 | 1.931495171995(-3) | -2.738867610655(-1) | -2.719552658935(-1) | 1.271955265894(0) |
| 99 | 2.073902303388(-3) | -2.866258355299(-1) | -2.845519332265(-1) | 1.284551933226(0) |
| 100 | 2.228439502290(-3) | -3.001984129893(-1) | -2.979699734870(-1) | 1.297969973487(0) |
| 101 | 2.396444938159(-3) | -3.146895472740(-1) | -3.122931023358(-1) | 1.312293102336(0) |
| 102 | 2.579453315054(-3) | -3.301965214410(-1) | -3.276170681259(-1) | 1.327617068126(0) |
| 103 | 2.779233116419(-3) | -3.468311444151(-1) | -3.440519112987(-1) | 1.344051911299(0) |
| 104 | 2.997832646188(-3) | -3.647225876705(-1) | -3.617247550243(-1) | 1.361724755024(0) |
| 105 | 3.237637389591(-3) | -3.840209165120(-1) | -3.807832791224(-1) | 1.380783279122(0) |
| 106 | 3.501442079986(-3) | -4.049015233008(-1) | -4.014000812208(-1) | 1.401400081221(0) |
| 107 | 3.792542067772(-3) | -4.275707439549(-1) | -4.237782018871(-1) | 1.423778201887(0) |
| 108 | 4.114850306397(-3) | -4.522730441566(-1) | -4.481581938502(-1) | 1.448158193850(0) |
| 109 | 4.473048748181(-3) | -4.793003131711(-1) | -4.748272644229(-1) | 1.474827264423(0) |
| 110 | 4.872786570884(-3) | -5.090040249401(-1) | -5.041312383692(-1) | 1.504131238369(0) |
| 111 | 5.320943060411(-3) | -5.418113563950(-1) | -5.364904133345(-1) | 1.536490413335(0) |
| 112 | 5.825981177812(-3) | -5.782468541442(-1) | -5.724208729663(-1) | 1.572420872966(0) |
| 113 | 6.398430548305(-3) | -6.189620171812(-1) | -6.125635866329(-1) | 1.612563586633(0) |
| 114 | 7.051558756987(-3) | -6.647763939801(-1) | -6.577248352231(-1) | 1.657724835223(0) |
| 115 | 7.802322592975(-3) | -7.167357931784(-1) | -7.089334705854(-1) | 1.708933470585(0) |
| 116 | 8.672745677533(-3) | -7.761965535868(-1) | -7.675238079093(-1) | 1.767523807909(0) |
| 117 | 9.691963547256(-3) | -8.449505986658(-1) | -8.352586351185(-1) | 1.835258635119(0) |
| 118 | 1.089934676196(-2) | -9.254163511904(-1) | -9.145170044284(-1) | 1.914517004428(0) |
| 119 | 1.234942911898(-2) | -1.020939910774(0) | -1.008590481655(0) | 2.008590481655(0) |
| 120 | 1.411998838318(-2) | -1.136288773734(0) | -1.122168785351(0) | 2.122168785351(0) |
| 121 | 1.632591382888(-2) | -1.278498948240(0) | -1.262173034411(0) | 2.262173034411(0) |
| 122 | 1.914435210472(-2) | -1.458410765526(0) | -1.439266413421(0) | 2.439266413421(0) |
| 123 | 2.286351365837(-2) | -1.693649393260(0) | -1.670785879601(0) | 2.670785879601(0) |
| 124 | 2.798595023766(-2) | -2.014931157121(0) | -1.986945206883(0) | 2.986945206883(0) |
| 125 | 3.547345100762(-2) | -2.481016279985(0) | -2.445542828977(0) | 3.445542828977(0) |
| 126 | 4.742727181095(-2) | -3.220239955450(0) | -3.172812683639(0) | 4.172812683639(0) |
| 127 | 6.948675269886(-2) | -4.576954603612(0) | -4.507467850913(0) | 5.507467850913(0) |
| 128 | 1.236943624188(-1) | -7.896965524390(0) | -7.773271161972(0) | 8.773271161972(0) |
| 129 | 4.671971257368(-1) | -2.887960887960(1) | -2.841241175386(1) | 2.941241175386(1) |
| 130 | -2.886021555343(-1) | 1.725106298974(1) | 1.696246083420(1) | -1.596246083420(1) |
| 131 | -1.141973503762(-1) | 6.590277294229(0) | 6.476079943853(0) | -5.476079943853(0) |
| 132 | -7.266241290516(-2) | 4.040141318962(0) | 3.967478906057(0) | -2.967478906057(0) |
| 133 | -5.401319051565(-2) | 2.885554320964(0) | 2.831541130449(0) | -1.831541130449(0) |
| 134 | -4.337226713121(-2) | 2.217569915068(0) | 2.174197647937(0) | -1.174197647937(0) |
| 135 | -3.641222639015(-2) | 1.770724396684(0) | 1.734312170294(0) | -7.343121702936(-1) |
| 136 | -3.133487404024(-2) | 1.432017622051(0) | 1.400682748011(0) | -4.006827480105(-1) |
| 137 | -2.648578662072(-2) | 1.077014262204(0) | 1.050528475584(0) | -5.052847558359(-2) |



Table 2
Relative dia- and paramagnetic contributions to magnetizabilities of hydrogenlike atoms in the excited state $2s_{1/2}$, obtained with $\alpha^{-1} = 137.035\,999\,084$ (CODATA 2018).

| Z | χ_p'/χ | χ_p''/χ | χ_p/χ | χ_d/χ |
|----|----------------------|---------------------|---------------------|-------------------|
| 1 | -5.709143196213(-13) | -9.509505032691(-7) | -9.509510741834(-7) | 1.00000950951(0) |
| 2 | -9.135092425089(-12) | -3.804203572799(-6) | -3.804212707892(-6) | 1.000003804213(0) |
| 3 | -4.625031488258(-11) | -8.560964342320(-6) | -8.561010592635(-6) | 1.000008561011(0) |
| 4 | -1.461911348772(-10) | -1.522324288427(-5) | -1.522338907541(-5) | 1.000015223389(0) |
| 5 | -3.569662629401(-10) | -2.379385648774(-5) | -2.379421345400(-5) | 1.000023794213(0) |
| 6 | -7.403429182705(-10) | -3.427643285474(-5) | -3.427717319766(-5) | 1.000034277173(0) |
| 7 | -1.371878159304(-9) | -4.667541422209(-5) | -4.667678610025(-5) | 1.000046676786(0) |
| 8 | -2.340957209705(-9) | -6.099606241823(-5) | -6.099840337544(-5) | 1.000060998403(0) |
| 9 | -3.750838799438(-9) | -7.724446486641(-5) | -7.724821570521(-5) | 1.000077248216(0) |
| 10 | -5.718707543961(-9) | -9.542754154796(-5) | -9.543326025551(-5) | 1.000095433260(0) |
| 11 | -8.375733387883(-9) | -1.155530529416(-4) | -1.155614286750(-4) | 1.000115561429(0) |
| 12 | -1.186713814261(-8) | -1.376296089568(-4) | -1.376414760950(-4) | 1.000137641476(0) |
| 13 | -1.635226915057(-8) | -1.616666788823(-4) | -1.616830311514(-4) | 1.000161683031(0) |
| 14 | -2.200468011149(-8) | -1.876746023720(-4) | -1.876966070521(-4) | 1.000187696607(0) |
| 15 | -2.901221910893(-8) | -2.156646014946(-4) | -2.156936137137(-4) | 1.000215693614(0) |
| 16 | -3.757712387784(-8) | -2.456487938752(-4) | -2.456863709990(-4) | 1.000245686371(0) |
| 17 | -4.791612435617(-8) | -2.776402069587(-4) | -2.776881230831(-4) | 1.000277688123(0) |
| 18 | -6.026055256550(-8) | -3.116527934311(-4) | -3.117130539837(-4) | 1.000311713054(0) |
| 19 | -7.485645986774(-8) | -3.477014478329(-4) | -3.47763042928(-4) | 1.00034776304(0) |
| 20 | -9.196474164586(-8) | -3.858020244074(-4) | -3.858939891490(-4) | 1.000385893989(0) |
| 21 | -1.118612694582(-7) | -4.259713562247(-4) | -4.260832174942(-4) | 1.000426083217(0) |
| 22 | -1.348370307161(-7) | -4.682272756310(-4) | -4.683621126617(-4) | 1.000468362117(0) |
| 23 | -1.611982759347(-7) | -5.125886360713(-4) | -5.127498343472(-4) | 1.000512749834(0) |
| 24 | -1.912666736076(-7) | -5.590753353421(-4) | -5.592666020157(-4) | 1.000559266602(0) |
| 25 | -2.253794727524(-7) | -6.077083403317(-4) | -6.079337198044(-4) | 1.000607933720(0) |
| 26 | -2.638896731759(-7) | -6.585097133115(-4) | -6.587736029846(-4) | 1.000658773603(0) |
| 27 | -3.071662035031(-7) | -7.115026398468(-4) | -7.118098060503(-4) | 1.000711809806(0) |
| 28 | -3.555941070107(-7) | -7.667114583991(-4) | -7.670670525061(-4) | 1.000767067053(0) |
| 29 | -4.095747353047(-7) | -8.241616916987(-4) | -8.245712664340(-4) | 1.000824571266(0) |
| 30 | -4.695259498712(-7) | -8.838800799712(-4) | -8.843496059211(-4) | 1.000884349606(0) |
| 31 | -5.358823315302(-7) | -9.458946161087(-4) | -9.464304984403(-4) | 1.000946430498(0) |
| 32 | -6.090953978066(-7) | -1.010234582881(-3) | -1.010843678279(-3) | 1.001010843678(0) |
| 33 | -6.89638282317(-7) | -1.076930592290(-3) | -1.077620226119(-3) | 1.001077620226(0) |
| 34 | -7.779836975702(-7) | -1.146014627184(-3) | -1.146792610882(-3) | 1.001146792611(0) |
| 35 | -8.746487169613(-7) | -1.217520085239(-3) | -1.218394733956(-3) | 1.001218394734(0) |
| 36 | -9.801504829439(-7) | -1.291481825446(-3) | -1.292461975929(-3) | 1.001292461976(0) |
| 37 | -1.095028734321(-6) | -1.367936217240(-3) | -1.369031245974(-3) | 1.001369031246(0) |
| 38 | -1.219841616799(-6) | -1.446921192409(-3) | -1.448141034026(-3) | 1.001448141034(0) |
| 39 | -1.355165955313(-6) | -1.528476299950(-3) | -1.529831465905(-3) | 1.001529831466(0) |
| 40 | -1.501597533930(-6) | -1.612642764038(-3) | -1.614144361572(-3) | 1.001614144362(0) |
| 41 | -1.659751383183(-6) | -1.699463545291(-3) | -1.701123296674(-3) | 1.001701123297(0) |
| 42 | -1.830262074667(-6) | -1.788983405519(-3) | -1.790813667594(-3) | 1.001790813668(0) |
| 43 | -2.013784022681(-6) | -1.881248976188(-3) | -1.883262760210(-3) | 1.001883262760(0) |
| 44 | -2.210991792663(-6) | -1.976308830793(-3) | -1.978519822585(-3) | 1.001978519823(0) |
| 45 | -2.422580416118(-6) | -2.074213561418(-3) | -2.076636141834(-3) | 1.002076636142(0) |
| 46 | -2.649265711682(-6) | -2.175015859719(-3) | -2.177665125431(-3) | 1.002177665125(0) |
| 47 | -2.891784611900(-6) | -2.278770602624(-3) | -2.281662387236(-3) | 1.002281662387(0) |
| 48 | -3.150895495230(-6) | -2.385534943055(-3) | -2.388685838550(-3) | 1.002388685839(0) |
| 49 | -3.427378522723(-6) | -2.495368405998(-3) | -2.498795784521(-3) | 1.002498795785(0) |
| 50 | -3.722035978698(-6) | -2.608332990275(-3) | -2.612055026254(-3) | 1.002612055026(0) |
| 51 | -4.035692614682(-6) | -2.724493276406(-3) | -2.728528969021(-3) | 1.002728528969(0) |
| 52 | -4.369195995740(-6) | -2.843916540967(-3) | -2.848285736963(-3) | 1.002848285737(0) |
| 53 | -4.723416848203(-6) | -2.966672877907(-3) | -2.971396294755(-3) | 1.002971396295(0) |
| 54 | -5.099249407656(-6) | -3.092835327293(-3) | -3.097934576701(-3) | 1.003097934577(0) |
| 55 | -5.497611765905(-6) | -3.222480012025(-3) | -3.227977623791(-3) | 1.003227977624(0) |
| 56 | -5.919446215427(-6) | -3.355686283081(-3) | -3.361605729296(-3) | 1.003361605729(0) |
| 57 | -6.365719589637(-6) | -3.492536873921(-3) | -3.498902593511(-3) | 1.003498902594(0) |
| 58 | -6.837423597059(-6) | -3.633118064721(-3) | -3.639955488318(-3) | 1.003639955488(0) |
| 59 | -7.335575147225(-6) | -3.777519857168(-3) | -3.784855432315(-3) | 1.003784855432(0) |
| 60 | -7.861216665841(-6) | -3.925836160621(-3) | -3.933697377287(-3) | 1.003933697377(0) |
| 61 | -8.415416396434(-6) | -4.078164990506(-3) | -4.086580406902(-3) | 1.004086580407(0) |
| 62 | -8.999268685294(-6) | -4.234608679892(-3) | -4.243607948578(-3) | 1.004243607949(0) |
| 63 | -9.613894246136(-6) | -4.395274105298(-3) | -4.404887999544(-3) | 1.004404888000(0) |
| 64 | -1.026044040040(-5) | -4.560272927845(-3) | -4.570533368245(-3) | 1.004570533368(0) |
| 65 | -1.094008128858(-5) | -4.729721851021(-3) | -4.740661932310(-3) | 1.004740661932(0) |
| 66 | -1.165401804736(-5) | -4.903742896401(-3) | -4.915396914449(-3) | 1.004915396914(0) |
| 67 | -1.240347894662(-5) | -5.082463698826(-3) | -5.094867177772(-3) | 1.005094867178(0) |
| 68 | -1.318971947961(-5) | -5.266017822677(-3) | -5.279207542157(-3) | 1.005279207542(0) |
| 69 | -1.401402239871(-5) | -5.454545101064(-3) | -5.468559123462(-3) | 1.005468559123(0) |
| 70 | -1.487769768804(-5) | -5.648191999890(-3) | -5.663069697578(-3) | 1.005663069698(0) |
| 71 | -1.578208246321(-5) | -5.847112009023(-3) | -5.862894091487(-3) | 1.005862894091(0) |
| 72 | -1.672854078714(-5) | -6.051466062960(-3) | -6.068194603747(-3) | 1.006068194604(0) |
| 73 | -1.771846338911(-5) | -6.261422993686(-3) | -6.279141457075(-3) | 1.006279141457(0) |
| 74 | -1.875326727286(-5) | -6.477160018695(-3) | -6.495913285967(-3) | 1.006495913286(0) |

(continued on next page)

Table 2 (continued)

| Z | χ_p'/X | χ_p''/X | χ_p/X | χ_a/X |
|-----|---------------------|---------------------|---------------------|-------------------|
| 75 | -1.983439519733(-5) | -6.698863267445(-3) | -6.718697662642(-3) | 1.006718697663(0) |
| 76 | -2.096331501130(-5) | -6.926728349928(-3) | -6.947691664939(-3) | 1.006947691665(0) |
| 77 | -2.214151882096(-5) | -7.160960971407(-3) | -7.183102490228(-3) | 1.007183102490(0) |
| 78 | -2.337052196585(-5) | -7.401777597859(-3) | -7.425148119825(-3) | 1.007425148120(0) |
| 79 | -2.465186177578(-5) | -7.649406177186(-3) | -7.674058038962(-3) | 1.007674058039(0) |
| 80 | -2.598709607691(-5) | -7.904086921860(-3) | -7.930074017937(-3) | 1.007930074018(0) |
| 81 | -2.737780141077(-5) | -8.166073159333(-3) | -8.193450960743(-3) | 1.008193450961(0) |
| 82 | -2.882557092471(-5) | -8.435632257350(-3) | -8.464457828275(-3) | 1.008464457828(0) |
| 83 | -3.033201188587(-5) | -8.713046632156(-3) | -8.743378644042(-3) | 1.008743378644(0) |
| 84 | -3.189874276397(-5) | -8.998614848627(-3) | -9.030513591391(-3) | 1.009030513591(0) |
| 85 | -3.352738981950(-5) | -9.292652822521(-3) | -9.326180212340(-3) | 1.009326180212(0) |
| 86 | -3.521958312425(-5) | -9.595495136378(-3) | -9.630714719503(-3) | 1.009630714720(0) |
| 87 | -3.697695193002(-5) | -9.907496482150(-3) | -9.944473434080(-3) | 1.009944473434(0) |
| 88 | -3.880111928733(-5) | -1.022903324543(-2) | -1.026783436472(-2) | 1.010267834365(0) |
| 89 | -4.069369580107(-5) | -1.056050524824(-2) | -1.060119894404(-2) | 1.010601198944(0) |
| 90 | -4.265627239076(-5) | -1.090233766974(-2) | -1.094499394213(-2) | 1.010944993942(0) |
| 91 | -4.469041190168(-5) | -1.125498316698(-2) | -1.129967357888(-2) | 1.011299673579(0) |
| 92 | -4.679763938710(-5) | -1.161892422134(-2) | -1.166572186072(-2) | 1.011665721861(0) |
| 93 | -4.897943085089(-5) | -1.199467573970(-2) | -1.204365517055(-2) | 1.012043655171(0) |
| 94 | -5.123720020325(-5) | -1.238278794462(-2) | -1.243402514482(-2) | 1.012434025145(0) |
| 95 | -5.357228413837(-5) | -1.278384959239(-2) | -1.283742187653(-2) | 1.012837421877(0) |
| 96 | -5.598592458977(-5) | -1.319849156498(-2) | -1.325447748957(-2) | 1.013254477490(0) |
| 97 | -5.847924835608(-5) | -1.362739088889(-2) | -1.368587013724(-2) | 1.013685870137(0) |
| 98 | -6.105324341291(-5) | -1.407127524323(-2) | -1.413232848665(-2) | 1.014132328487(0) |
| 99 | -6.370873133311(-5) | -1.453092803050(-2) | -1.459463676183(-2) | 1.014594636762(0) |
| 100 | -6.644633512472(-5) | -1.500719409599(-2) | -1.507364043111(-2) | 1.015073640431(0) |
| 101 | -6.926644165615(-5) | -1.550098619843(-2) | -1.557025264008(-2) | 1.015570252640(0) |
| 102 | -7.216915766756(-5) | -1.601329235314(-2) | -1.608546151081(-2) | 1.016085461511(0) |
| 103 | -7.515425815608(-5) | -1.654518419308(-2) | -1.662033845124(-2) | 1.016620338451(0) |
| 104 | -7.822112565957(-5) | -1.709782652186(-2) | -1.717604764752(-2) | 1.017176047648(0) |
| 105 | -8.136867863644(-5) | -1.767248826894(-2) | -1.775385694758(-2) | 1.017753856948(0) |
| 106 | -8.459528672649(-5) | -1.827055510179(-2) | -1.835515038851(-2) | 1.018355150389(0) |
| 107 | -8.789867015800(-5) | -1.889354400546(-2) | -1.898144267562(-2) | 1.018981442676(0) |
| 108 | -9.127577990367(-5) | -1.954312021075(-2) | -1.963439599065(-2) | 1.019634395991(0) |
| 109 | -9.472265434076(-5) | -2.022111694078(-2) | -2.031583959512(-2) | 1.020315839595(0) |
| 110 | -9.823424707643(-5) | -2.092955856029(-2) | -2.102779280736(-2) | 1.021027792807(0) |
| 111 | -1.018042191772(-4) | -2.167068785842(-2) | -2.177249207760(-2) | 1.021772492078(0) |
| 112 | -1.054246871764(-4) | -2.244699838666(-2) | -2.255242307384(-2) | 1.022552423074(0) |
| 113 | -1.090859157646(-4) | -2.326127302354(-2) | -2.337035893930(-2) | 1.023370358939(0) |
| 114 | -1.127759407734(-4) | -2.411663026879(-2) | -2.422940620956(-2) | 1.024229406210(0) |
| 115 | -1.164801036079(-4) | -2.501658021269(-2) | -2.513306031630(-2) | 1.025133060316(0) |
| 116 | -1.201804722098(-4) | -2.596509272569(-2) | -2.608527319790(-2) | 1.026085273198(0) |
| 117 | -1.238551152311(-4) | -2.696668123519(-2) | -2.709053635042(-2) | 1.027090536350(0) |
| 118 | -1.274771843322(-4) | -2.802650659718(-2) | -2.815398378151(-2) | 1.028153983782(0) |
| 119 | -1.310137427990(-4) | -2.915050717871(-2) | -2.928152092151(-2) | 1.029281520922(0) |
| 120 | -1.344242545220(-4) | -3.034556357064(-2) | -3.047998782516(-2) | 1.030479987825(0) |
| 121 | -1.376586118935(-4) | -3.161970970820(-2) | -3.175736832010(-2) | 1.031757368320(0) |
| 122 | -1.406545279842(-4) | -3.298240716997(-2) | -3.312306169795(-2) | 1.033123061698(0) |
| 123 | -1.433340369006(-4) | -3.444490701340(-2) | -3.458824105030(-2) | 1.034588241050(0) |
| 124 | -1.455987183785(-4) | -3.602073532097(-2) | -3.616633403935(-2) | 1.036166334039(0) |
| 125 | -1.473230564577(-4) | -3.772635754655(-2) | -3.787368060301(-2) | 1.037873680603(0) |
| 126 | -1.483449988777(-4) | -3.958210799923(-2) | -3.973045299811(-2) | 1.039730452998(0) |
| 127 | -1.484521917260(-4) | -4.161352431764(-2) | -4.176197650937(-2) | 1.041761976509(0) |
| 128 | -1.473612987021(-4) | -4.385332236606(-2) | -4.400068366476(-2) | 1.044000683665(0) |
| 129 | -1.446858014455(-4) | -4.634442632311(-2) | -4.648911212456(-2) | 1.046489112125(0) |
| 130 | -1.398836422235(-4) | -4.914482572747(-2) | -4.928470936969(-2) | 1.049284709370(0) |
| 131 | -1.321673764618(-4) | -5.233579507865(-2) | -5.246796245511(-2) | 1.052467962455(0) |
| 132 | -1.203389979337(-4) | -5.603680078457(-2) | -5.615713978250(-2) | 1.056157139783(0) |
| 133 | -1.024572038869(-4) | -6.043513434026(-2) | -6.053759154414(-2) | 1.060537591544(0) |
| 134 | -7.507539135388(-5) | -6.585289744582(-2) | -6.592797283717(-2) | 1.065927972837(0) |
| 135 | -3.111842488788(-5) | -7.293124915285(-2) | -7.296236757773(-2) | 1.072962367578(0) |
| 136 | 4.854711576328(-5) | -8.335223861232(-2) | -8.330369149655(-2) | 1.083303691497(0) |
| 137 | 3.157064194156(-4) | -1.099754480747(-1) | -1.096597416553(-1) | 1.109659741655(0) |



Table 3
Relative dia- and paramagnetic contributions to magnetizabilities of hydrogenlike atoms in the excited state $2p_{1/2}$, obtained with $\alpha^{-1} = 137.035\,999\,084$ (CODATA 2018).

| Z | χ_p'/χ | χ_p''/χ | χ_p/χ | χ_d/χ |
|----|-------------------|---------------------|-------------------|---------------------|
| 1 | 1.000074890026(0) | 3.323431213802(-11) | 1.000074890060(0) | -7.489005955767(-5) |
| 2 | 1.000299623832(0) | 5.319109788891(-10) | 1.000299624364(0) | -2.996243641131(-4) |
| 3 | 1.000674392738(0) | 2.694166981127(-9) | 1.000674395432(0) | -6.743954318263(-4) |
| 4 | 1.001199516074(0) | 8.520955556455(-9) | 1.001199524595(0) | -1.199524595252(-3) |
| 5 | 1.001875441885(0) | 2.082215337109(-8) | 1.001875462707(0) | -1.875462706807(-3) |
| 6 | 1.002702747905(0) | 4.322515023852(-8) | 1.002702791130(0) | -2.702791130493(-3) |
| 7 | 1.003682142838(0) | 8.018596139738(-8) | 1.003682223024(0) | -3.682223024007(-3) |
| 8 | 1.004814467914(0) | 1.370029142747(-7) | 1.004814604917(0) | -4.814604916545(-3) |
| 9 | 1.006100698756(0) | 2.198329739423(-7) | 1.006100918589(0) | -6.100918588908(-3) |
| 10 | 1.007541947553(0) | 3.357107842120(-7) | 1.007542283264(0) | -7.542283263792(-3) |
| 11 | 1.009139465545(0) | 4.925705146067(-7) | 1.009139958116(0) | -9.139958115511(-3) |
| 12 | 1.010894645839(0) | 6.992706173824(-7) | 1.010895345110(0) | -1.875462706807(-2) |
| 13 | 1.012809026564(0) | 9.656216134742(-7) | 1.012809992186(0) | -1.280999218597(-2) |
| 14 | 1.014884294378(0) | 1.302417041811(-6) | 1.014885596795(0) | -1.488559679481(-2) |
| 15 | 1.017122288340(0) | 1.721467722998(-6) | 1.017124009808(0) | -1.712400980821(-2) |
| 16 | 1.019525004178(0) | 2.235639506079(-6) | 1.019527239817(0) | -1.952723981712(-2) |
| 17 | 1.022094598943(0) | 2.858894686017(-6) | 1.022097457837(0) | -2.209745783730(-2) |
| 18 | 1.024833396107(0) | 3.606337300003(-6) | 1.024837002444(0) | -2.483700244390(-2) |
| 19 | 1.027743891096(0) | 4.494262532630(-6) | 1.027748385358(0) | -2.774838535816(-2) |
| 20 | 1.030828757302(0) | 5.540210483888(-6) | 1.030834297512(0) | -3.083429751207(-2) |
| 21 | 1.034090852595(0) | 6.763024579693(-6) | 1.034097615619(0) | -3.409761561917(-2) |
| 22 | 1.037533226368(0) | 8.182914932833(-6) | 1.037541409283(0) | -3.754140928267(-2) |
| 23 | 1.041159127148(0) | 9.821526992809(-6) | 1.041168948675(0) | -4.116894867489(-2) |
| 24 | 1.044972010810(0) | 1.170201585652(-5) | 1.044983712826(0) | -4.498371282558(-2) |
| 25 | 1.048975549433(0) | 1.384912664835(-5) | 1.048989398560(0) | -4.898939856003(-2) |
| 26 | 1.053173640851(0) | 1.628928141830(-5) | 1.053189930132(0) | -5.318993013203(-2) |
| 27 | 1.057570418928(0) | 1.905067305100(-5) | 1.057589469601(0) | -5.758946960089(-2) |
| 28 | 1.062170264640(0) | 2.216336672674(-5) | 1.062192428007(0) | -6.219242800665(-2) |
| 29 | 1.066977817993(0) | 2.565940952912(-5) | 1.067003477403(0) | -6.700347740268(-2) |
| 30 | 1.071997990862(0) | 2.957294885302(-5) | 1.072027563811(0) | -7.202756381074(-2) |
| 31 | 1.077235980809(0) | 3.394036033128(-5) | 1.077269921170(0) | -7.726992116972(-2) |
| 32 | 1.082697285970(0) | 3.880038607099(-5) | 1.082736086357(0) | -8.273608635652(-2) |
| 33 | 1.088387721081(0) | 4.419428406972(-5) | 1.088431915365(0) | -8.843191536508(-2) |
| 34 | 1.094313434748(0) | 5.016598977092(-5) | 1.094363600738(0) | -9.436360073817(-2) |
| 35 | 1.100480928065(0) | 5.676229081581(-5) | 1.100537690356(0) | -1.005376903562(-1) |
| 36 | 1.106897074681(0) | 6.403301615908(-5) | 1.106961107697(0) | -1.069611076974(-1) |
| 37 | 1.113569142456(0) | 7.203124083726(-5) | 1.113641173697(0) | -1.136411736967(-1) |
| 38 | 1.120504816834(0) | 8.081350781535(-5) | 1.120585630342(0) | -1.205856303415(-1) |
| 39 | 1.127712226091(0) | 9.044006848904(-5) | 1.127802666160(0) | -1.278026661598(-1) |
| 40 | 1.135199968626(0) | 1.009751435907(-4) | 1.135300943770(0) | -1.353009437700(-1) |
| 41 | 1.142977142476(0) | 1.124872064377(-4) | 1.143089629682(0) | -1.430896296824(-1) |
| 42 | 1.151053377269(0) | 1.250492906767(-4) | 1.151178426560(0) | -1.511784265598(-1) |
| 43 | 1.159438868846(0) | 1.387393249173(-4) | 1.159577608171(0) | -1.595776081713(-1) |
| 44 | 1.168144416799(0) | 1.536404969207(-4) | 1.168298057295(0) | -1.682980572954(-1) |
| 45 | 1.177181465211(0) | 1.698416503150(-4) | 1.177351306861(0) | -1.773513068609(-1) |
| 46 | 1.186562146927(0) | 1.874377171523(-4) | 1.186749584644(0) | -1.867495846442(-1) |
| 47 | 1.196299331691(0) | 2.065301900160(-4) | 1.196505861881(0) | -1.965058618808(-1) |
| 48 | 1.206406678551(0) | 2.272276378275(-4) | 1.206633906189(0) | -2.066339061890(-1) |
| 49 | 1.216898692982(0) | 2.496462700059(-4) | 1.217148339252(0) | -2.171483392523(-1) |
| 50 | 1.22790789207(0) | 2.739105542032(-4) | 1.228064699761(0) | -2.280646997608(-1) |
| 51 | 1.239099358280(0) | 3.001538934921(-4) | 1.239399512173(0) | -2.393995121732(-1) |
| 52 | 1.250841842561(0) | 3.285193696231(-4) | 1.251170361931(0) | -2.511703619307(-1) |
| 53 | 1.263036817275(0) | 3.591605598203(-4) | 1.263395977834(0) | -2.633959778344(-1) |
| 54 | 1.275704079954(0) | 3.922424355572(-4) | 1.276096322390(0) | -2.760963223897(-1) |
| 55 | 1.288864748672(0) | 4.279423528730(-4) | 1.289292691025(0) | -2.892926910251(-1) |
| 56 | 1.302541370069(0) | 4.664511450753(-4) | 1.303007821214(0) | -3.030078212140(-1) |
| 57 | 1.316758038337(0) | 5.079743301600(-4) | 1.317266012668(0) | -3.172660126676(-1) |
| 58 | 1.331540526479(0) | 5.527334469909(-4) | 1.332093259926(0) | -3.320932599260(-1) |
| 59 | 1.346916431325(0) | 6.009675362711(-4) | 1.347517398862(0) | -3.475173988615(-1) |
| 60 | 1.362915334039(0) | 6.529347846402(-4) | 1.363568268823(0) | -3.635682688232(-1) |
| 61 | 1.379568978048(0) | 7.089143529183(-4) | 1.380277892401(0) | -3.802778924009(-1) |
| 62 | 1.396911466669(0) | 7.692084126474(-4) | 1.397680675081(0) | -3.976806750814(-1) |
| 63 | 1.414979482989(0) | 8.341444187492(-4) | 1.415813627407(0) | -4.158136274075(-1) |
| 64 | 1.433812535004(0) | 9.040776504138(-4) | 1.434716612654(0) | -4.347166126543(-1) |
| 65 | 1.453453229447(0) | 9.793940573981(-4) | 1.454432623504(0) | -4.544326235043(-1) |
| 66 | 1.473947578305(0) | 1.060513454880(-3) | 1.475008091759(0) | -4.750080917594(-1) |
| 67 | 1.495345342667(0) | 1.147893117087(-3) | 1.496493235784(0) | -4.964932357842(-1) |
| 68 | 1.517700419323(0) | 1.242031828299(-3) | 1.518942451152(0) | -5.189424511516(-1) |
| 69 | 1.541071276432(0) | 1.343474459855(-3) | 1.542414750892(0) | -5.424147508918(-1) |
| 70 | 1.565521445695(0) | 1.452817153697(-3) | 1.566974262849(0) | -5.669742628490(-1) |
| 71 | 1.591120079775(0) | 1.570713207387(-3) | 1.592690792983(0) | -5.926907929826(-1) |
| 72 | 1.617942585271(0) | 1.697879772768(-3) | 1.619640465043(0) | -6.196404650435(-1) |
| 73 | 1.646071343490(0) | 1.835105501327(-3) | 1.647906448991(0) | -6.479064489909(-1) |
| 74 | 1.675596533559(0) | 1.983259294690(-3) | 1.677579792853(0) | -6.775797928534(-1) |

(continued on next page)

Table 3 (continued)

| Z | X_p'/X | X_p''/X | X_p/X | X_a/X |
|-----|--------------------|---------------------|--------------------|---------------------|
| 75 | 1.706617075246(0) | 2.143300349557(-3) | 1.708760375596(0) | -7.087603755960(-1) |
| 76 | 1.739241712321(0) | 2.316289724234(-3) | 1.741558002045(0) | -7.415580020451(-1) |
| 77 | 1.773590261518(0) | 2.503403700465(-3) | 1.776093665218(0) | -7.760936652180(-1) |
| 78 | 1.809795057440(0) | 2.705949271791(-3) | 1.812501006712(0) | -8.125010067117(-1) |
| 79 | 1.848002630229(0) | 2.925382161148(-3) | 1.850928012391(0) | -8.509280123906(-1) |
| 80 | 1.888375660983(0) | 3.163327859700(-3) | 1.891538988843(0) | -8.915389888431(-1) |
| 81 | 1.931095270115(0) | 3.421606291027(-3) | 1.934516876406(0) | -9.345168764060(-1) |
| 82 | 1.976363706753(0) | 3.702260846520(-3) | 1.980065967600(0) | -9.800659675995(-1) |
| 83 | 2.024407523686(0) | 4.007592717943(-3) | 2.028415116404(0) | -1.028415116404(0) |
| 84 | 2.075481343337(0) | 4.340201683757(-3) | 2.079821545020(0) | -1.079821545020(0) |
| 85 | 2.129872347291(0) | 4.703034802877(-3) | 2.134575382094(0) | -1.134575382094(0) |
| 86 | 2.187905657005(0) | 5.099444855390(-3) | 2.193005101861(0) | -1.193005101861(0) |
| 87 | 2.249950819214(0) | 5.533260874478(-3) | 2.255484080088(0) | -1.255484080088(0) |
| 88 | 2.316429670115(0) | 6.008873779837(-3) | 2.322438543894(0) | -1.322438543894(0) |
| 89 | 2.387825932999(0) | 6.531341009331(-3) | 2.394357274009(0) | -1.394357274009(0) |
| 90 | 2.464697012251(0) | 7.106515236778(-3) | 2.471803527488(0) | -1.471803527488(0) |
| 91 | 2.547688593543(0) | 7.741203880491(-3) | 2.555429797423(0) | -1.555429797423(0) |
| 92 | 2.637552861608(0) | 8.443368325348(-3) | 2.645996229933(0) | -1.645996229933(0) |
| 93 | 2.735171426655(0) | 9.222374860032(-3) | 2.744393801515(0) | -1.744393801515(0) |
| 94 | 2.841584443548(0) | 1.008931365830(-2) | 2.851673757206(0) | -1.851673757206(0) |
| 95 | 2.958027967754(0) | 1.105740829757(-2) | 2.969085376051(0) | -1.969085376051(0) |
| 96 | 3.085982401330(0) | 1.214254721912(-2) | 3.098124948549(0) | -2.098124948549(0) |
| 97 | 3.227236070683(0) | 1.336398162218(-2) | 3.240600052305(0) | -2.240600052305(0) |
| 98 | 3.383969753904(0) | 1.474525384345(-2) | 3.398715007747(0) | -2.398715007747(0) |
| 99 | 3.558870680526(0) | 1.631545006638(-2) | 3.575186130593(0) | -2.575186130593(0) |
| 100 | 3.755288733967(0) | 1.811091754549(-2) | 3.773399651512(0) | -2.773399651512(0) |
| 101 | 3.977454284718(0) | 2.017766030416(-2) | 3.997631945022(0) | -2.997631945022(0) |
| 102 | 4.230788023710(0) | 2.257474778317(-2) | 4.253362771494(0) | -3.253362771494(0) |
| 103 | 4.522351563814(0) | 2.537927358081(-2) | 4.547730837395(0) | -3.547730837395(0) |
| 104 | 4.861519543117(0) | 2.869375354097(-2) | 4.890213296658(0) | -3.890213296658(0) |
| 105 | 5.261011604536(0) | 3.265748739504(-2) | 5.293669091931(0) | -4.293669091931(0) |
| 106 | 5.738531102127(0) | 3.746460310178(-2) | 5.775995705229(0) | -4.775995705229(0) |
| 107 | 6.319471920592(0) | 4.339386631798(-2) | 6.362865786910(0) | -5.362865786910(0) |
| 108 | 7.041604654956(0) | 5.086029303393(-2) | 7.092464947990(0) | -6.092464947990(0) |
| 109 | 7.963665196704(0) | 6.050974929129(-2) | 8.024174945995(0) | -7.024174945995(0) |
| 110 | 9.182248141083(0) | 7.340503444177(-2) | 9.255653175525(0) | -8.255653175525(0) |
| 111 | 1.086817393243(1) | 9.142648379182(-2) | 1.095960041622(1) | -9.959600416223(0) |
| 112 | 1.335474774835(1) | 1.182442052808(-1) | 1.347299195364(1) | -1.247299195364(1) |
| 113 | 1.739124797578(1) | 1.621104739860(-1) | 1.755335844977(1) | -1.655335844977(1) |
| 114 | 2.508619478263(1) | 2.462507072859(-1) | 2.533244548992(1) | -2.433244548992(1) |
| 115 | 4.554759063676(1) | 4.709960565894(-1) | 4.601858669335(1) | -4.501858669335(1) |
| 116 | 2.656447288014(2) | 2.894887420381(0) | 2.685396162218(2) | -2.675396162218(2) |
| 117 | -6.791511219956(1) | -7.803151696928(-1) | -6.869542736925(1) | 6.969542736925(1) |
| 118 | -2.982588983562(1) | -3.614870124267(-1) | -3.018737684805(1) | 3.118737684805(1) |
| 119 | -1.898765813661(1) | -2.428959542888(-1) | -1.923055409090(1) | 2.023055409090(1) |
| 120 | -1.385810718557(1) | -1.872370815011(-1) | -1.404534426707(1) | 1.504534426707(1) |
| 121 | -1.086534158027(1) | -1.551673921564(-1) | -1.102050897242(1) | 1.202050897242(1) |
| 122 | -8.902907732784(0) | -1.345039014812(-1) | -9.037411634265(0) | 1.003741163426(1) |
| 123 | -7.515640978911(0) | -1.202392230510(-1) | -7.635880201962(0) | 8.635880201962(0) |
| 124 | -6.481898592276(0) | -1.099397400467(-1) | -6.591838332322(0) | 7.591838332322(0) |
| 125 | -5.680791339788(0) | -1.022834057574(-1) | -5.783074745545(0) | 6.783074745545(0) |
| 126 | -5.040739135272(0) | -9.649355231112(-2) | -5.137232687583(0) | 6.137232687583(0) |
| 127 | -4.516614799447(0) | -9.208784638456(-2) | -4.608702645831(0) | 5.608702645831(0) |
| 128 | -4.078507064196(0) | -8.875559109208(-2) | -4.167262655288(0) | 5.167262655288(0) |
| 129 | -3.705741733772(0) | -8.629352415779(-2) | -3.792035257929(0) | 4.792035257929(0) |
| 130 | -3.383485401826(0) | -8.457105234768(-2) | -3.468056454174(0) | 4.468056454174(0) |
| 131 | -3.100696091855(0) | -8.351213135130(-2) | -3.184208223207(0) | 4.184208223207(0) |
| 132 | -2.848796230779(0) | -8.308868025899(-2) | -2.931884911038(0) | 3.931884911038(0) |
| 133 | -2.620704478985(0) | -8.332578595180(-2) | -2.704030264937(0) | 3.704030264937(0) |
| 134 | -2.409920812250(0) | -8.432726190009(-2) | -2.494248074150(0) | 3.494248074150(0) |
| 135 | -2.209099959021(0) | -8.635726025060(-2) | -2.295457219271(0) | 3.295457219271(0) |
| 136 | -2.005598901727(0) | -9.016945255827(-2) | -2.095768354285(0) | 3.095768354285(0) |
| 137 | -1.721726523137(0) | -1.015916589665(-1) | -1.823318182103(0) | 2.823318182103(0) |



Table 4
 Relative dia- and paramagnetic contributions to magnetizabilities of hydrogenlike atoms in the excited state $2p_{3/2}$ ($\mu = \pm 1/2$), obtained with $\alpha^{-1} = 137.035999084$ (CODATA 2018).

| Z | χ_p'/χ | χ_p''/χ | χ_p/χ | χ_d/χ |
|----|--------------------|----------------------|---------------------|--------------------|
| 1 | 9.999400944725(-1) | -6.646019615265(-11) | 9.999400944060(-1) | 5.990559400935(-5) |
| 2 | 9.997604048392(-1) | -1.063282473528(-9) | 9.997604037760(-1) | 2.395962240474(-4) |
| 3 | 9.994610119036(-1) | -5.382187296677(-9) | 9.994610065214(-1) | 5.389934785563(-4) |
| 4 | 9.990420501878(-1) | -1.700736249134(-8) | 9.990420331804(-1) | 9.579668195500(-4) |
| 5 | 9.985037077083(-1) | -4.151245218696(-8) | 9.985036661958(-1) | 1.496333804192(-3) |
| 6 | 9.978462256620(-1) | -8.605635804056(-8) | 9.978461396057(-1) | 2.153860394331(-3) |
| 7 | 9.970698980245(-1) | -1.593778693858(-7) | 9.970697386467(-1) | 2.930261353320(-3) |
| 8 | 9.961750710599(-1) | -2.717891436200(-7) | 9.961747992707(-1) | 3.825200729271(-3) |
| 9 | 9.951621427444(-1) | -4.351680627472(-7) | 9.951617075763(-1) | 4.838292423700(-3) |
| 10 | 9.940315621051(-1) | -6.629494965253(-7) | 9.940308991557(-1) | 5.969100844349(-3) |
| 11 | 9.927838284747(-1) | -9.701155071018(-7) | 9.927828583592(-1) | 7.217141640811(-3) |
| 12 | 9.914194906631(-1) | -1.373184534367(-6) | 9.9141811174786(-1) | 8.581882521390(-3) |
| 13 | 9.899391460501(-1) | -1.890199605470(-6) | 9.899372558505(-1) | 1.006274414951(-2) |
| 14 | 9.883434395978(-1) | -2.540715616066(-6) | 9.883408988822(-1) | 1.165910111781(-2) |
| 15 | 9.866330627878(-1) | -3.345785734813(-6) | 9.866297170020(-1) | 1.337028299795(-2) |
| 16 | 9.848087524830(-1) | -4.327946986492(-6) | 9.848044245360(-1) | 1.519557546398(-2) |
| 17 | 9.828712897180(-1) | -5.511205072816(-6) | 9.828657785130(-1) | 1.713422148702(-2) |
| 18 | 9.808214984194(-1) | -6.921018493508(-6) | 9.808145774009(-1) | 1.918542259906(-2) |
| 19 | 9.786602440589(-1) | -8.584282033655(-6) | 9.786516597769(-1) | 2.134834022312(-2) |
| 20 | 9.763884322421(-1) | -1.052930968653(-5) | 9.763779029324(-1) | 2.362209706762(-2) |
| 21 | 9.740070072350(-1) | -1.278581708419(-5) | 9.739942214179(-1) | 2.600577858206(-2) |
| 22 | 9.715169504320(-1) | -1.538490351099(-5) | 9.715015655284(-1) | 2.849843447155(-2) |
| 23 | 9.689192787662(-1) | -1.835903357810(-5) | 9.689009197326(-1) | 3.109908026736(-2) |
| 24 | 9.662150430678(-1) | -2.174201863935(-5) | 9.661933010491(-1) | 3.380669895086(-2) |
| 25 | 9.634053263700(-1) | -2.556899803167(-5) | 9.633797573720(-1) | 3.662024262801(-2) |
| 26 | 9.604912421685(-1) | -2.987642022526(-5) | 9.604613657483(-1) | 3.953863425173(-2) |
| 27 | 9.574739326346(-1) | -3.470202397109(-5) | 9.574392306107(-1) | 4.256076938933(-2) |
| 28 | 9.543545667872(-1) | -4.008481953525(-5) | 9.543144819676(-1) | 4.568551803235(-2) |
| 29 | 9.511343386241(-1) | -4.606507011167(-5) | 9.510882735540(-1) | 4.891172644603(-2) |
| 30 | 9.478144652176(-1) | -5.268427350660(-5) | 9.477617809441(-1) | 5.223821905592(-2) |
| 31 | 9.443961847752(-1) | -5.998514418993(-5) | 9.443361996311(-1) | 5.566380036895(-2) |
| 32 | 9.408807546693(-1) | -6.801159581015(-5) | 9.408127430735(-1) | 5.918725692655(-2) |
| 33 | 9.372694494369(-1) | -7.680872427157(-5) | 9.371926407126(-1) | 6.280735928739(-2) |
| 34 | 9.335635587539(-1) | -8.642279147372(-5) | 9.334771359625(-1) | 6.652286403754(-2) |
| 35 | 9.297643853840(-1) | -9.690120981480(-5) | 9.296674841741(-1) | 7.033251582585(-2) |
| 36 | 9.258732431050(-1) | -1.082925275625(-4) | 9.257649505775(-1) | 7.423504942254(-2) |
| 37 | 9.218914546160(-1) | -1.206464151974(-4) | 9.217708082008(-1) | 7.822919179923(-2) |
| 38 | 9.178203494242(-1) | -1.340136528353(-4) | 9.176863357713(-1) | 8.231366422865(-2) |
| 39 | 9.136612617162(-1) | -1.484461188384(-4) | 9.135128155974(-1) | 8.648718440261(-2) |
| 40 | 9.094155282128(-1) | -1.639967797244(-4) | 9.092515314331(-1) | 9.074846856688(-2) |
| 41 | 9.050844860095(-1) | -1.807196814880(-4) | 9.049037663281(-1) | 9.509623367195(-2) |
| 42 | 9.006694704036(-1) | -1.986699424496(-4) | 9.004708004612(-1) | 9.952919953885(-2) |
| 43 | 8.961718127084(-1) | -2.179037477489(-4) | 8.959539089606(-1) | 1.040460910394(-1) |
| 44 | 8.915928380552(-1) | -2.384783456053(-4) | 8.913543597096(-1) | 1.086456402904(-1) |
| 45 | 8.869338631830(-1) | -2.604520454695(-4) | 8.866734111376(-1) | 1.133265888624(-1) |
| 46 | 8.821961942160(-1) | -2.838842181930(-4) | 8.819123099978(-1) | 1.180876900022(-1) |
| 47 | 8.773811244279(-1) | -3.088352983507(-4) | 8.770722891296(-1) | 1.229277108704(-1) |
| 48 | 8.724899319936(-1) | -3.353667888513(-4) | 8.721545652048(-1) | 1.278454347952(-1) |
| 49 | 8.675238777251(-1) | -3.635412679796(-4) | 8.671603364571(-1) | 1.328396635429(-1) |
| 50 | 8.624842027919(-1) | -3.934223990187(-4) | 8.620907803929(-1) | 1.379092196071(-1) |
| 51 | 8.573721264234(-1) | -4.250749426084(-4) | 8.569470514808(-1) | 1.430529485192(-1) |
| 52 | 8.521888435904(-1) | -4.585647720023(-4) | 8.517302788184(-1) | 1.482697211816(-1) |
| 53 | 8.469355226634(-1) | -4.939588913950(-4) | 8.464415637720(-1) | 1.535584362280(-1) |
| 54 | 8.416133030445(-1) | -5.313254575032(-4) | 8.410819775870(-1) | 1.589180224130(-1) |
| 55 | 8.362232927690(-1) | -5.707338045900(-4) | 8.356525589645(-1) | 1.643474410355(-1) |
| 56 | 8.307665660722(-1) | -6.122544731395(-4) | 8.301543115990(-1) | 1.698456884010(-1) |
| 57 | 8.252441609158(-1) | -6.559592423993(-4) | 8.245882016734(-1) | 1.754117983266(-1) |
| 58 | 8.196570764700(-1) | -7.019211670244(-4) | 8.189551553030(-1) | 1.810448446970(-1) |
| 59 | 8.140062705431(-1) | -7.502146180736(-4) | 8.132560559250(-1) | 1.867439440750(-1) |
| 60 | 8.082926569522(-1) | -8.009153286290(-4) | 8.074917416236(-1) | 1.925082583764(-1) |
| 61 | 8.025171028277(-1) | -8.541004443296(-4) | 8.016630023834(-1) | 1.983369976166(-1) |
| 62 | 7.966804258416(-1) | -9.098485791356(-4) | 7.957705772624(-1) | 2.042294227376(-1) |
| 63 | 7.907833913500(-1) | -9.682398766659(-4) | 7.898151514733(-1) | 2.101848485267(-1) |
| 64 | 7.848267094404(-1) | -1.029356077482(-3) | 7.837973533629(-1) | 2.162026466371(-1) |
| 65 | 7.788110318692(-1) | -1.093280592724(-3) | 7.777177512764(-1) | 2.222822487236(-1) |
| 66 | 7.727369488774(-1) | -1.160098584549(-3) | 7.715768502928(-1) | 2.284231497072(-1) |
| 67 | 7.666049858702(-1) | -1.229897053849(-3) | 7.653750888164(-1) | 2.346249111836(-1) |
| 68 | 7.604155999423(-1) | -1.302764935793(-3) | 7.591128350065(-1) | 2.408871649935(-1) |
| 69 | 7.541691762319(-1) | -1.378793203780(-3) | 7.527903830281(-1) | 2.472096169719(-1) |
| 70 | 7.478660240824(-1) | -1.458074982448(-3) | 7.464079490999(-1) | 2.535920509001(-1) |
| 71 | 7.415063729900(-1) | -1.540705670456(-3) | 7.399656673195(-1) | 2.600343326805(-1) |
| 72 | 7.350903683113(-1) | -1.626783073841(-3) | 7.334635852375(-1) | 2.665364147625(-1) |
| 73 | 7.286180667038(-1) | -1.716407550811(-3) | 7.269016591530(-1) | 2.730983408470(-1) |
| 74 | 7.220894312673(-1) | -1.809682168972(-3) | 7.202797490983(-1) | 2.797202509017(-1) |

(continued on next page)

Table 4 (continued)

| Z | χ_p'/X | χ_p''/X | χ_p/X | χ_a/X |
|-----|---------------------|---------------------|---------------------|--------------------|
| 75 | 7.155043263530(-1) | -1.906712876056(-3) | 7.135976134769(-1) | 2.864023865231(-1) |
| 76 | 7.088625120007(-1) | -2.007608685373(-3) | 7.068549033154(-1) | 2.931450966846(-1) |
| 77 | 7.021636379614(-1) | -2.112481877333(-3) | 7.000511560840(-1) | 2.999488439160(-1) |
| 78 | 6.954072372557(-1) | -2.221448218551(-3) | 6.931857890372(-1) | 3.068142109628(-1) |
| 79 | 6.885927192166(-1) | -2.334627200235(-3) | 6.862580920163(-1) | 3.137419079837(-1) |
| 80 | 6.817193619514(-1) | -2.452142297758(-3) | 6.792672196536(-1) | 3.207327803464(-1) |
| 81 | 6.747863041585(-1) | -2.574121253557(-3) | 6.722121829050(-1) | 3.277878170950(-1) |
| 82 | 6.677925362174(-1) | -2.700696385783(-3) | 6.650918398316(-1) | 3.349081601684(-1) |
| 83 | 6.607368904664(-1) | -2.832004925427(-3) | 6.579048855410(-1) | 3.420951144590(-1) |
| 84 | 6.536180305673(-1) | -2.968189385024(-3) | 6.506498411822(-1) | 3.493501588178(-1) |
| 85 | 6.464344398440(-1) | -3.109397962444(-3) | 6.433250418815(-1) | 3.566749581185(-1) |
| 86 | 6.391844084654(-1) | -3.255784983776(-3) | 6.359286234816(-1) | 3.640713765184(-1) |
| 87 | 6.318660193253(-1) | -3.407511389864(-3) | 6.284585079354(-1) | 3.715414920646(-1) |
| 88 | 6.244771324492(-1) | -3.564745271706(-3) | 6.209123871775(-1) | 3.790876128225(-1) |
| 89 | 6.170153677351(-1) | -3.727662460714(-3) | 6.132877052744(-1) | 3.867122947256(-1) |
| 90 | 6.094780858022(-1) | -3.896447180695(-3) | 6.055816386215(-1) | 3.944183613785(-1) |
| 91 | 6.018623666908(-1) | -4.071292769506(-3) | 5.977910739213(-1) | 4.022089260787(-1) |
| 92 | 5.941649861116(-1) | -4.252402479537(-3) | 5.899125836321(-1) | 4.100874163679(-1) |
| 93 | 5.863823888967(-1) | -4.439990367676(-3) | 5.819423985290(-1) | 4.180576014710(-1) |
| 94 | 5.785106592443(-1) | -4.634282287134(-3) | 5.738763769571(-1) | 4.261236230429(-1) |
| 95 | 5.705454872821(-1) | -4.835516995603(-3) | 5.657099702865(-1) | 4.342900297135(-1) |
| 96 | 5.624821313879(-1) | -5.043947396685(-3) | 5.574381839912(-1) | 4.425618160088(-1) |
| 97 | 5.543153756091(-1) | -5.259841934541(-3) | 5.490555336745(-1) | 4.509444663255(-1) |
| 98 | 5.460394813983(-1) | -5.483486165294(-3) | 5.405559952330(-1) | 4.594440047670(-1) |
| 99 | 5.376481327372(-1) | -5.715184533101(-3) | 5.319329482041(-1) | 4.680675017959(-1) |
| 100 | 5.291343735392(-1) | -5.955262384130(-3) | 5.231791111550(-1) | 4.768208888450(-1) |
| 101 | 5.204905360015(-1) | -6.204068258196(-3) | 5.142864677433(-1) | 4.857135322567(-1) |
| 102 | 5.117081583044(-1) | -6.461976505811(-3) | 5.052461817985(-1) | 4.947538182015(-1) |
| 103 | 5.027778897169(-1) | -6.729390288342(-3) | 4.960484994285(-1) | 5.039515005715(-1) |
| 104 | 4.936893807489(-1) | -7.006745031305(-3) | 4.866826357176(-1) | 5.133173642824(-1) |
| 105 | 4.844311554581(-1) | -7.294512416272(-3) | 4.771366430418(-1) | 5.228633569582(-1) |
| 106 | 4.749904623527(-1) | -7.593205016365(-3) | 4.673972573364(-1) | 5.326027426636(-1) |
| 107 | 4.653530994845(-1) | -7.903381705006(-3) | 4.574497177795(-1) | 5.425502822205(-1) |
| 108 | 4.555032082313(-1) | -8.225653999204(-3) | 4.472775542321(-1) | 5.527224457679(-1) |
| 109 | 4.454230288711(-1) | -8.560693539346(-3) | 4.368623353317(-1) | 5.631376646683(-1) |
| 110 | 4.350926092136(-1) | -8.909240960317(-3) | 4.261833682533(-1) | 5.738166317467(-1) |
| 111 | 4.244894551587(-1) | -9.272116478006(-3) | 4.152173386807(-1) | 5.847826613193(-1) |
| 112 | 4.135881088653(-1) | -9.650232606856(-3) | 4.039378762584(-1) | 5.960621237416(-1) |
| 113 | 4.023596359541(-1) | -1.004460954641(-2) | 3.923150264077(-1) | 6.076849735923(-1) |
| 114 | 3.907709974037(-1) | -1.045639394001(-2) | 3.803146034636(-1) | 6.196853965364(-1) |
| 115 | 3.787842739037(-1) | -1.088688193437(-2) | 3.678973919693(-1) | 6.321026080307(-1) |
| 116 | 3.663556994918(-1) | -1.133754778091(-2) | 3.550181517109(-1) | 6.449818482891(-1) |
| 117 | 3.534344459285(-1) | -1.181007965731(-2) | 3.416243662712(-1) | 6.583756337288(-1) |
| 118 | 3.399610773441(-1) | -1.230642501025(-2) | 3.276546523339(-1) | 6.723453476661(-1) |
| 119 | 3.258655629355(-1) | -1.282884862101(-2) | 3.130367143144(-1) | 6.869632856856(-1) |
| 120 | 3.110646886459(-1) | -1.338000792037(-2) | 2.976846807255(-1) | 7.023153192745(-1) |
| 121 | 2.954586383298(-1) | -1.396305206833(-2) | 2.814955862615(-1) | 7.185044137385(-1) |
| 122 | 2.789264066879(-1) | -1.458175436292(-2) | 2.643446523250(-1) | 7.356553476750(-1) |
| 123 | 2.613195359776(-1) | -1.524069233081(-2) | 2.460788436468(-1) | 7.539211563532(-1) |
| 124 | 2.424533932801(-1) | -1.594549757623(-2) | 2.265078957039(-1) | 7.734921042961(-1) |
| 125 | 2.220947466080(-1) | -1.670321030550(-2) | 2.053915363025(-1) | 7.946084636975(-1) |
| 126 | 1.999436076035(-1) | -1.752279554152(-2) | 1.824208120620(-1) | 8.175791879380(-1) |
| 127 | 1.756058905806(-1) | -1.841591759808(-2) | 1.571899729825(-1) | 8.428100270175(-1) |
| 128 | 1.485507746440(-1) | -1.939814352299(-2) | 1.291526311210(-1) | 8.708473688790(-1) |
| 129 | 1.180413763984(-1) | -2.049089290084(-2) | 9.755048349757(-2) | 9.024495165024(-1) |
| 130 | 8.301617456742(-2) | -2.172476103579(-2) | 6.129141353163(-2) | 9.387085864684(-1) |
| 131 | 4.187306306191(-2) | -2.314554999793(-2) | 1.872751306398(-2) | 9.812724869360(-1) |
| 132 | -7.956742366717(-3) | -2.482612749043(-2) | -3.278286985715(-2) | 1.032782869857(0) |
| 133 | -7.094382391634(-2) | -2.689236244598(-2) | -9.783618636232(-2) | 1.097836186362(0) |
| 134 | -1.558434945552(-1) | -2.958898367887(-2) | -1.854324782340(-1) | 1.185432478234(0) |
| 135 | -2.833345206198(-1) | -3.348992917873(-2) | -3.168244497986(-1) | 1.316824449799(0) |
| 136 | -5.232969101326(-1) | -4.052078443812(-2) | -5.638176945707(-1) | 1.563817694571(0) |
| 137 | -1.980378563221(0) | -8.080909352125(-2) | -2.061187656742(0) | 3.061187656742(0) |



Table 5
Relative dia- and paramagnetic contributions to magnetizabilities of hydrogenlike atoms in the excited state $2p_{3/2}$ ($\mu = \pm 3/2$), obtained with $\alpha^{-1} = 137.035\,999\,084$ (CODATA 2018).

| Z | χ_p'/χ | χ_p''/χ | χ_p/χ | χ_d/χ |
|----|----------------------|---------------------|---------------------|-------------------|
| 1 | -1.459736107538(-13) | -6.656537471650(-6) | -6.656537617623(-6) | 1.00006656538(0) |
| 2 | -2.335796642897(-12) | -2.662756786883(-5) | -2.662757020463(-5) | 1.000026627570(0) |
| 3 | -1.182681755791(-11) | -5.991734591152(-5) | -5.991735773834(-5) | 1.000059917358(0) |
| 4 | -3.738675872202(-11) | -1.065329653780(-4) | -1.065330027648(-4) | 1.000106533003(0) |
| 5 | -9.130193600708(-11) | -1.664843629754(-4) | -1.664844542773(-4) | 1.000166484454(0) |
| 6 | -1.893887806560(-10) | -2.397843237631(-4) | -2.397845131519(-4) | 1.000239784513(0) |
| 7 | -3.510086778680(-10) | -3.264484881370(-4) | -3.264488391457(-4) | 1.000326448839(0) |
| 8 | -5.990861407348(-10) | -4.264953603782(-4) | -4.264959594643(-4) | 1.000426495959(0) |
| 9 | -9.601303423666(-10) | -5.399463187787(-4) | -5.399472789091(-4) | 1.000539947279(0) |
| 10 | -1.464260033299(-9) | -6.668256273518(-4) | -6.668270916119(-4) | 1.000666827092(0) |
| 11 | -2.145231875569(-9) | -8.071604491406(-4) | -8.071625943724(-4) | 1.000807162594(0) |
| 12 | -3.040472229216(-9) | -9.609808611378(-4) | -9.609839016100(-4) | 1.000960983902(0) |
| 13 | -4.191112431358(-9) | -1.128319870833(-3) | -1.128324061945(-3) | 1.001128324062(0) |
| 14 | -5.642027612541(-9) | -1.309213434404(-3) | -1.309219076431(-3) | 1.001309219076(0) |
| 15 | -7.441879099576(-9) | -1.503700476570(-3) | -1.503707918449(-3) | 1.001503707918(0) |
| 16 | -9.643160458799(-9) | -1.711822912131(-3) | -1.711832555291(-3) | 1.001711832555(0) |
| 17 | -1.230224723843(-8) | -1.933625669212(-3) | -1.933637971460(-3) | 1.001933637971(0) |
| 18 | -1.547945047361(-8) | -2.169156714239(-3) | -2.169172193689(-3) | 1.002169172194(0) |
| 19 | -1.923907402260(-8) | -2.418467078667(-3) | -2.418486317741(-3) | 1.002418486318(0) |
| 20 | -2.364947580800(-8) | -2.681610887504(-3) | -2.681634536980(-3) | 1.002681634537(0) |
| 21 | -2.878313304169(-8) | -2.958645389640(-3) | -2.958674172773(-3) | 1.002958674173(0) |
| 22 | -3.471671151806(-8) | -3.249630990027(-3) | -3.249665706738(-3) | 1.003249665707(0) |
| 23 | -4.153113906534(-8) | -3.554631283743(-3) | -3.554672814882(-3) | 1.003554672815(0) |
| 24 | -4.931168325076(-8) | -3.873713091975(-3) | -3.873762403658(-3) | 1.003873762404(0) |
| 25 | -5.814803344104(-8) | -4.206946499955(-3) | -4.207004647988(-3) | 1.004207004648(0) |
| 26 | -6.813438732611(-8) | -4.554404896897(-3) | -4.554473031284(-3) | 1.004554473031(0) |
| 27 | -7.936954201979(-8) | -4.916165017977(-3) | -4.916244387519(-3) | 1.004916244388(0) |
| 28 | -9.195698985837(-8) | -5.292306988400(-3) | -5.292398945390(-3) | 1.005292398945(0) |
| 29 | -1.060050190242(-7) | -5.682914369599(-3) | -5.683020374618(-3) | 1.005683020375(0) |
| 30 | -1.216268191286(-7) | -6.088074207626(-3) | -6.088195834445(-3) | 1.006088195834(0) |
| 31 | -1.389405918965(-7) | -6.507877083781(-3) | -6.508016024373(-3) | 1.006508016024(0) |
| 32 | -1.580696671007(-7) | -6.942417167539(-3) | -6.942575237206(-3) | 1.006942575237(0) |
| 33 | -1.791426239043(-7) | -7.391792271831(-3) | -7.391971414455(-3) | 1.007391971414(0) |
| 34 | -2.022934177759(-7) | -7.856103910746(-3) | -7.856306204163(-3) | 1.007856306204(0) |
| 35 | -2.276615131518(-7) | -8.335457359716(-3) | -8.335685021229(-3) | 1.008335685021(0) |
| 36 | -2.553920220267(-7) | -8.829961718255(-3) | -8.830217110277(-3) | 1.008830217110(0) |
| 37 | -2.856358486674(-7) | -9.339729975321(-3) | -9.340015611169(-3) | 1.009340015611(0) |
| 38 | -3.185498406482(-7) | -9.864879077378(-3) | -9.865197627219(-3) | 1.009865197627(0) |
| 39 | -3.542969464220(-7) | -1.040552999924(-2) | -1.040588429619(-2) | 1.010405884296(0) |
| 40 | -3.930463796477(-7) | -1.096180781779(-2) | -1.096220086417(-2) | 1.010962200864(0) |
| 41 | -4.349737905081(-7) | -1.153384178860(-2) | -1.153427676239(-2) | 1.011534276762(0) |
| 42 | -4.802614442626(-7) | -1.212176542568(-2) | -1.212224568712(-2) | 1.012122245687(0) |
| 43 | -5.290984072908(-7) | -1.272571658426(-2) | -1.272624568267(-2) | 1.012726245683(0) |
| 44 | -5.816807408971(-7) | -1.334583754690(-2) | -1.334641922764(-2) | 1.013346419228(0) |
| 45 | -6.382117031582(-7) | -1.398227511288(-2) | -1.398291332458(-2) | 1.013982913325(0) |
| 46 | -6.989019591087(-7) | -1.463518069107(-2) | -1.463587959303(-2) | 1.014635879593(0) |
| 47 | -7.639697995770(-7) | -1.530471039635(-2) | -1.530547436615(-2) | 1.015305474366(0) |
| 48 | -8.336413689952(-7) | -1.599102514975(-2) | -1.599185879112(-2) | 1.015991858791(0) |
| 49 | -9.081509025259(-7) | -1.669429078234(-2) | -1.669519893324(-2) | 1.016695198933(0) |
| 50 | -9.877409728625(-7) | -1.741467814313(-2) | -1.741566588410(-2) | 1.017415665884(0) |
| 51 | -1.072662747079(-6) | -1.815236321099(-2) | -1.815343587374(-2) | 1.018153435874(0) |
| 52 | -1.163176253925(-6) | -1.890752721088(-2) | -1.890869038714(-2) | 1.018908690387(0) |
| 53 | -1.259550661971(-6) | -1.968035673435(-2) | -1.968161628501(-2) | 1.019681616285(0) |
| 54 | -1.362064569050(-6) | -2.047104386464(-2) | -2.047240592921(-2) | 1.020472405929(0) |
| 55 | -1.471006303438(-6) | -2.127978630649(-2) | -2.128125731280(-2) | 1.021281257313(0) |
| 56 | -1.586674237255(-6) | -2.210678752081(-2) | -2.210837419505(-2) | 1.022108374195(0) |
| 57 | -1.709377112584(-6) | -2.295225686435(-2) | -2.295396624147(-2) | 1.022953966241(0) |
| 58 | -1.839434380836(-6) | -2.381640973474(-2) | -2.381824916912(-2) | 1.023818249169(0) |
| 59 | -1.977176555908(-6) | -2.469946772082(-2) | -2.470144489738(-2) | 1.024701444897(0) |
| 60 | -2.122945581718(-6) | -2.560165875879(-2) | -2.560378170437(-2) | 1.025603781704(0) |
| 61 | -2.277095214709(-6) | -2.652321729409(-2) | -2.652549438930(-2) | 1.026525494389(0) |
| 62 | -2.439991421977(-6) | -2.746438444947(-2) | -2.746682444090(-2) | 1.027466824441(0) |
| 63 | -2.612012795683(-6) | -2.842540819940(-2) | -2.842802021220(-2) | 1.028428020212(0) |
| 64 | -2.793550984443(-6) | -2.940654355100(-2) | -2.940933710199(-2) | 1.029409337102(0) |
| 65 | -2.985011142455(-6) | -3.040805273194(-2) | -3.041103774308(-2) | 1.030411037743(0) |
| 66 | -3.186812397116(-6) | -3.143020538538(-2) | -3.143339219778(-2) | 1.031433392198(0) |
| 67 | -3.399388335954(-6) | -3.247327877244(-2) | -3.247667816077(-2) | 1.032476678161(0) |
| 68 | -3.623187513741(-6) | -3.353755798228(-2) | -3.354118116979(-2) | 1.033541181170(0) |
| 69 | -3.858673980662(-6) | -3.462333615035(-2) | -3.462719482433(-2) | 1.034627194824(0) |
| 70 | -4.106327832518(-6) | -3.573091468499(-2) | -3.573502101282(-2) | 1.035735021013(0) |
| 71 | -4.366645783930(-6) | -3.686060350273(-2) | -3.686497014851(-2) | 1.036864970149(0) |
| 72 | -4.640141765615(-6) | -3.801272127278(-2) | -3.801736141454(-2) | 1.038017361415(0) |
| 73 | -4.927347546823(-6) | -3.918759567099(-2) | -3.919252301854(-2) | 1.039192523019(0) |
| 74 | -5.228813384107(-6) | -4.038556364373(-2) | -4.039079245712(-2) | 1.040390792457(0) |

(continued on next page)

Table 5 (continued)

| Z | χ_p'/X | χ_p''/X | χ_p/X | χ_a/X |
|-----|---------------------|---------------------|---------------------|-------------------|
| 75 | -5.545108697629(-6) | -4.160697168212(-2) | -4.161251679081(-2) | 1.041612516791(0) |
| 76 | -5.876822776323(-6) | -4.285217610703(-2) | -4.285805292980(-2) | 1.042858052930(0) |
| 77 | -6.224565513233(-6) | -4.412154336543(-2) | -4.412776793094(-2) | 1.044127767931(0) |
| 78 | -6.588968172484(-6) | -4.541545033845(-2) | -4.542203930662(-2) | 1.045422039307(0) |
| 79 | -6.970684189386(-6) | -4.673428466177(-2) | -4.674125534596(-2) | 1.046741255346(0) |
| 80 | -7.370390005251(-6) | -4.807844505885(-2) | -4.808581544885(-2) | 1.048085815449(0) |
| 81 | -7.788785938608(-6) | -4.944834168766(-2) | -4.945613047360(-2) | 1.049456130474(0) |
| 82 | -8.226597094583(-6) | -5.084439650141(-2) | -5.085262309850(-2) | 1.050852623099(0) |
| 83 | -8.684574314308(-6) | -5.226704362401(-2) | -5.227572819833(-2) | 1.052275728198(0) |
| 84 | -9.163495166332(-6) | -5.371672974095(-2) | -5.372589323611(-2) | 1.053725893236(0) |
| 85 | -9.664164982110(-6) | -5.519391450622(-2) | -5.520357867120(-2) | 1.055203578671(0) |
| 86 | -1.018741793777(-5) | -5.669907096623(-2) | -5.670925838417(-2) | 1.056709258384(0) |
| 87 | -1.073411818449(-5) | -5.823268600126(-2) | -5.824342011944(-2) | 1.058243420119(0) |
| 88 | -1.130516102991(-5) | -5.979526078554(-2) | -5.980656594657(-2) | 1.059806565947(0) |
| 89 | -1.190147417324(-5) | -6.138731126673(-2) | -6.139921274090(-2) | 1.061399212741(0) |
| 90 | -1.252401899669(-5) | -6.300936866567(-2) | -6.302189268466(-2) | 1.063021892685(0) |
| 91 | -1.317379191629(-5) | -6.466197999764(-2) | -6.467515378956(-2) | 1.064675153790(0) |
| 92 | -1.385182579506(-5) | -6.634570861593(-2) | -6.635956044172(-2) | 1.066359560442(0) |
| 93 | -1.455919142176(-5) | -6.806113477890(-2) | -6.807569397032(-2) | 1.068075693970(0) |
| 94 | -1.529699905882(-5) | -6.980885624190(-2) | -6.982415324096(-2) | 1.069824153241(0) |
| 95 | -1.606640006298(-5) | -7.158948887497(-2) | -7.160555527503(-2) | 1.071605555275(0) |
| 96 | -1.686858858251(-5) | -7.340366730792(-2) | -7.342053589650(-2) | 1.073420535897(0) |
| 97 | -1.770480333522(-5) | -7.525204560406(-2) | -7.526975040739(-2) | 1.075269750407(0) |
| 98 | -1.857632947155(-5) | -7.713529796403(-2) | -7.715387429350(-2) | 1.077153874294(0) |
| 99 | -1.948450052738(-5) | -7.905411946145(-2) | -7.907360396198(-2) | 1.079073603962(0) |
| 100 | -2.043070047145(-5) | -8.100922681185(-2) | -8.102965751232(-2) | 1.081029657512(0) |
| 101 | -2.141636585273(-5) | -8.300135917683(-2) | -8.302277554269(-2) | 1.083022775543(0) |
| 102 | -2.244298805308(-5) | -8.503127900520(-2) | -8.505372199326(-2) | 1.085053721993(0) |
| 103 | -2.351211565134(-5) | -8.709977291316(-2) | -8.712328502881(-2) | 1.087123285029(0) |
| 104 | -2.462535690494(-5) | -8.920765260556(-2) | -8.923227796246(-2) | 1.089232277962(0) |
| 105 | -2.578438235577(-5) | -9.135575584061(-2) | -9.138154022297(-2) | 1.091381540223(0) |
| 106 | -2.699092756746(-5) | -9.354494744029(-2) | -9.357193836786(-2) | 1.093571938368(0) |
| 107 | -2.824679600157(-5) | -9.577612034904(-2) | -9.580436714504(-2) | 1.095804367145(0) |
| 108 | -2.955386204083(-5) | -9.805019674347(-2) | -9.807975060551(-2) | 1.098079750606(0) |
| 109 | -3.091407416794(-5) | -1.003681291960(-1) | -1.003990432702(-1) | 1.100399043270(0) |
| 110 | -3.232945830916(-5) | -1.027309018953(-1) | -1.027632313536(-1) | 1.102763231354(0) |
| 111 | -3.380212135251(-5) | -1.051395319269(-1) | -1.051733340483(-1) | 1.105173334048(0) |
| 112 | -3.533425485096(-5) | -1.075950706180(-1) | -1.076304048729(-1) | 1.107630404873(0) |
| 113 | -3.692813892172(-5) | -1.100986049487(-1) | -1.101355330876(-1) | 1.110135533088(0) |
| 114 | -3.858614635381(-5) | -1.126512590353(-1) | -1.126898451817(-1) | 1.112689845182(0) |
| 115 | -4.031074693626(-5) | -1.152541956894(-1) | -1.152945064363(-1) | 1.115294506436(0) |
| 116 | -4.210451202099(-5) | -1.179086180559(-1) | -1.179507225679(-1) | 1.117950722568(0) |
| 117 | -4.397011933471(-5) | -1.206157713376(-1) | -1.206597414569(-1) | 1.120659741457(0) |
| 118 | -4.591035805549(-5) | -1.233769446084(-1) | -1.234228549664(-1) | 1.123422854966(0) |
| 119 | -4.792813417096(-5) | -1.261934727230(-1) | -1.262414008572(-1) | 1.126241400857(0) |
| 120 | -5.002647613584(-5) | -1.290667383281(-1) | -1.291167648042(-1) | 1.129116764804(0) |
| 121 | -5.220854084827(-5) | -1.319981739810(-1) | -1.320503825218(-1) | 1.132050382522(0) |
| 122 | -5.447761996551(-5) | -1.349892643834(-1) | -1.350437420033(-1) | 1.135043742003(0) |
| 123 | -5.683714658129(-5) | -1.380415487372(-1) | -1.380983858837(-1) | 1.138098385884(0) |
| 124 | -5.929070228871(-5) | -1.411566232298(-1) | -1.412159139321(-1) | 1.141215913932(0) |
| 125 | -6.184202465425(-5) | -1.443361436582(-1) | -1.443979856829(-1) | 1.144397985683(0) |
| 126 | -6.449501513066(-5) | -1.475818281999(-1) | -1.476463232150(-1) | 1.147646323215(0) |
| 127 | -6.725374743841(-5) | -1.508954603408(-1) | -1.509627140883(-1) | 1.150962714088(0) |
| 128 | -7.012247644777(-5) | -1.542788919719(-1) | -1.543490144484(-1) | 1.154349014448(0) |
| 129 | -7.310564759605(-5) | -1.577340466629(-1) | -1.578071523105(-1) | 1.157807152311(0) |
| 130 | -7.620790687734(-5) | -1.612629231283(-1) | -1.613391310351(-1) | 1.161339131035(0) |
| 131 | -7.943411144501(-5) | -1.648675988967(-1) | -1.649470330082(-1) | 1.164947033008(0) |
| 132 | -8.278934087035(-5) | -1.685502341995(-1) | -1.686330235404(-1) | 1.168633023540(0) |
| 133 | -8.627890910453(-5) | -1.723130760915(-1) | -1.723993550006(-1) | 1.172399355001(0) |
| 134 | -8.990837719467(-5) | -1.761584628233(-1) | -1.762483712005(-1) | 1.176248371200(0) |
| 135 | -9.368356680911(-5) | -1.800888284805(-1) | -1.801825120473(-1) | 1.180182512047(0) |
| 136 | -9.761057463165(-5) | -1.841067079109(-1) | -1.842043184855(-1) | 1.184204318486(0) |
| 137 | -1.016957876894(-4) | -1.882147419599(-1) | -1.883164377476(-1) | 1.188316437747(0) |

Table 6
Relative dia- and paramagnetic contributions to magnetizabilities of hydrogenlike atoms in the excited state $3s_{1/2}$, obtained with $\alpha^{-1} = 137.035\,999\,084$ (CODATA 2018).

| Z | χ_p'/χ | χ_p''/χ | χ_p/χ | χ_d/χ |
|----|---------------------|---------------------|---------------------|-------------------|
| 1 | -1.429350016908(-9) | -1.929449188815(-7) | -1.943742688984(-7) | 1.000000194374(0) |
| 2 | -5.719405736176(-9) | -7.718424266792(-7) | -7.775618324154(-7) | 1.00000077562(0) |
| 3 | -1.287618535032(-8) | -1.736880837419(-6) | -1.749757022770(-6) | 1.000001749757(0) |
| 4 | -2.290972313821(-8) | -3.088374209821(-6) | -3.111283932959(-6) | 1.000003111284(0) |
| 5 | -3.583407540823(-8) | -4.826762650738(-6) | -4.862596726147(-6) | 1.000004862597(0) |
| 6 | -5.166732883074(-8) | -6.952612740844(-6) | -7.004280069674(-6) | 1.000007004280(0) |
| 7 | -7.043161117231(-8) | -9.466618083406(-6) | -9.537049694578(-6) | 1.000009537050(0) |
| 8 | -9.215310444725(-8) | -1.236959997729(-5) | -1.246175308174(-5) | 1.000012461753(0) |
| 9 | -1.168620605059(-7) | -1.566250821556(-5) | -1.577937027607(-5) | 1.000015779370(0) |
| 10 | -1.445928190829(-7) | -1.934642201127(-5) | -1.949101483035(-5) | 1.000019491015(0) |
| 11 | -1.753838283314(-7) | -2.342255105240(-5) | -2.359793488074(-5) | 1.000023597935(0) |
| 12 | -2.092776678752(-7) | -2.789223668813(-5) | -2.810151435600(-5) | 1.000028101514(0) |
| 13 | -2.463210744112(-7) | -3.275695324875(-5) | -3.300327432316(-5) | 1.000033003274(0) |
| 14 | -2.865649699029(-7) | -3.801830950219(-5) | -3.830487447210(-5) | 1.000038304874(0) |
| 15 | -3.300644924050(-7) | -4.367805025003(-5) | -4.400811474244(-5) | 1.000044008115(0) |
| 16 | -3.768790295682(-7) | -4.973805806639(-5) | -5.011493709595(-5) | 1.000050114937(0) |
| 17 | -4.270722548731(-7) | -5.620035518340(-5) | -5.662742743828(-5) | 1.000056627427(0) |
| 18 | -4.807121666507(-7) | -6.306710552734(-5) | -6.354781769399(-5) | 1.000063547818(0) |
| 19 | -5.378711299482(-7) | -7.034061690962(-5) | -7.087848803957(-5) | 1.000070878488(0) |
| 20 | -5.986259213066(-7) | -7.802334337753(-5) | -7.862196929884(-5) | 1.000078621969(0) |
| 21 | -6.630577765199(-7) | -8.611788772981(-5) | -8.678094550633(-5) | 1.000086780946(0) |
| 22 | -7.312524414502(-7) | -9.462700420254(-5) | -9.535825664399(-5) | 1.000095358257(0) |
| 23 | -8.033002259824(-7) | -1.035536013314(-4) | -1.043569015574(-4) | 1.000104356902(0) |
| 24 | -8.792960612029(-7) | -1.129007449966(-4) | -1.137800410578(-4) | 1.000113780041(0) |
| 25 | -9.593395598969(-7) | -1.226716616574(-4) | -1.236310012173(-4) | 1.000123631001(0) |
| 26 | -1.043535080462(-6) | -1.328697417839(-4) | -1.339132768644(-4) | 1.000133913277(0) |
| 27 | -1.131991794348(-6) | -1.434985434931(-4) | -1.446305352875(-4) | 1.000144630535(0) |
| 28 | -1.224823757129(-6) | -1.545617963994(-4) | -1.557866201566(-4) | 1.000155786620(0) |
| 29 | -1.322149983335(-6) | -1.660634056867(-4) | -1.673855556700(-4) | 1.000167385556(0) |
| 30 | -1.424094525172(-6) | -1.780074564130(-4) | -1.794315509382(-4) | 1.000179431551(0) |
| 31 | -1.530786555258(-6) | -1.903982180585(-4) | -1.919290046138(-4) | 1.000191929005(0) |
| 32 | -1.642360453534(-6) | -2.032401493262(-4) | -2.048825097797(-4) | 1.000204882510(0) |
| 33 | -1.758955898493(-6) | -2.165379032092(-4) | -2.182968591077(-4) | 1.000218296859(0) |
| 34 | -1.880717962900(-6) | -2.302963323368(-4) | -2.321770502997(-4) | 1.000232177050(0) |
| 35 | -2.007797214174(-6) | -2.445204946115(-4) | -2.465282918257(-4) | 1.000246528292(0) |
| 36 | -2.140349819622(-6) | -2.592156591546(-4) | -2.613560089743(-4) | 1.000261356009(0) |
| 37 | -2.278537656718(-6) | -2.743873125728(-4) | -2.766658502295(-4) | 1.000276665850(0) |
| 38 | -2.422528428644(-6) | -2.900411655648(-4) | -2.924636939934(-4) | 1.000292463694(0) |
| 39 | -2.572495785320(-6) | -3.061831598846(-4) | -3.087556556699(-4) | 1.000308755665(0) |
| 40 | -2.728619450149(-6) | -3.228194756819(-4) | -3.255480951320(-4) | 1.000325548095(0) |
| 41 | -2.891085352745(-6) | -3.399565392381(-4) | -3.428476245908(-4) | 1.000342847625(0) |
| 42 | -3.060085767918(-6) | -3.576010311225(-4) | -3.606611168904(-4) | 1.000360661117(0) |
| 43 | -3.235819461184(-6) | -3.757598947901(-4) | -3.789957142513(-4) | 1.000378995714(0) |
| 44 | -3.418491841132(-6) | -3.944403456481(-4) | -3.978588374892(-4) | 1.000397858837(0) |
| 45 | -3.608315118964(-6) | -4.136498806165(-4) | -4.172581957354(-4) | 1.000417258196(0) |
| 46 | -3.805508475558(-6) | -4.333962882137(-4) | -4.372017966893(-4) | 1.000437201797(0) |
| 47 | -4.010298236436(-6) | -4.536876591978(-4) | -4.576979574343(-4) | 1.000457697957(0) |
| 48 | -4.222918055020(-6) | -4.745323977966(-4) | -4.787553158516(-4) | 1.000478755316(0) |
| 49 | -4.443609104622(-6) | -4.959392335638(-4) | -5.003828426684(-4) | 1.000500382843(0) |
| 50 | -4.672620279609(-6) | -5.179172338997(-4) | -5.225898541793(-4) | 1.000522589854(0) |
| 51 | -4.910208406237(-6) | -5.404758172791(-4) | -5.453860256853(-4) | 1.000545386026(0) |
| 52 | -5.156638463672(-6) | -5.636247672302(-4) | -5.687814056938(-4) | 1.000568781406(0) |
| 53 | -5.412183815759(-6) | -5.873742471157(-4) | -5.927864309315(-4) | 1.000592786431(0) |
| 54 | -5.677126454141(-6) | -6.117348157675(-4) | -6.174119422217(-4) | 1.000617411942(0) |
| 55 | -5.951757253357(-6) | -6.367174440314(-4) | -6.426692012848(-4) | 1.000642669201(0) |
| 56 | -6.236376238624(-6) | -6.623335322856(-4) | -6.685699085242(-4) | 1.000668569909(0) |
| 57 | -6.531292867035(-6) | -6.885949289976(-4) | -6.951262218646(-4) | 1.000695126222(0) |
| 58 | -6.836826322971(-6) | -7.155139503931(-4) | -7.223507767161(-4) | 1.000722350777(0) |
| 59 | -7.153305828579(-6) | -7.431034013154(-4) | -7.502567071439(-4) | 1.000750256707(0) |
| 60 | -7.481070970245(-6) | -7.713765973587(-4) | -7.788576683290(-4) | 1.000778857668(0) |
| 61 | -7.820472042051(-6) | -8.003473883707(-4) | -8.081678604128(-4) | 1.000808167860(0) |
| 62 | -8.171870407294(-6) | -8.300301834214(-4) | -8.382020538287(-4) | 1.000838202054(0) |
| 63 | -8.535638879218(-6) | -8.604399773508(-4) | -8.689756162300(-4) | 1.000868975616(0) |
| 64 | -8.912162122219(-6) | -8.915923790124(-4) | -9.005045411346(-4) | 1.000900504541(0) |
| 65 | -9.301837074872(-6) | -9.235036413435(-4) | -9.328054784184(-4) | 1.000932805478(0) |
| 66 | -9.705073396256(-6) | -9.561906934041(-4) | -9.658957668004(-4) | 1.000965895767(0) |
| 67 | -1.012229393716(-5) | -9.896711745394(-4) | -9.997934684766(-4) | 1.000999793468(0) |
| 68 | -1.055393523792(-5) | -1.023963470836(-3) | -1.034517406074(-3) | 1.001034517406(0) |
| 69 | -1.100044805471(-5) | -1.059086754057(-3) | -1.070087202112(-3) | 1.001070087202(0) |
| 70 | -1.146229791645(-5) | -1.095061023263(-3) | -1.106523321179(-3) | 1.001106523321(0) |
| 71 | -1.193996571441(-5) | -1.131907149338(-3) | -1.143847115052(-3) | 1.001143847115(0) |
| 72 | -1.243394832709(-5) | -1.169646922675(-3) | -1.182080871002(-3) | 1.001182080871(0) |
| 73 | -1.294475928289(-5) | -1.208303104285(-3) | -1.221247863568(-3) | 1.001221247864(0) |
| 74 | -1.347292946364(-5) | -1.247899480632(-3) | -1.261372410095(-3) | 1.001261372410(0) |

(continued on next page)

Table 6 (continued)

| Z | χ_p'/χ | χ_p''/χ | χ_p/χ | χ_a/χ |
|-----|---------------------|---------------------|---------------------|-------------------|
| 75 | -1.401900785207(-5) | -1.288460922531(-3) | -1.302479930383(-3) | 1.001302479930(0) |
| 76 | -1.458356232667(-5) | -1.330013448470(-3) | -1.344597010797(-3) | 1.001344597011(0) |
| 77 | -1.516718050801(-5) | -1.372584292759(-3) | -1.387751473267(-3) | 1.001387751473(0) |
| 78 | -1.577047066049(-5) | -1.416201978967(-3) | -1.431972449627(-3) | 1.001431972450(0) |
| 79 | -1.639406265434(-5) | -1.460896399140(-3) | -1.477290461795(-3) | 1.001477290462(0) |
| 80 | -1.703860899303(-5) | -1.506698899367(-3) | -1.523737508360(-3) | 1.001523737508(0) |
| 81 | -1.770478591169(-5) | -1.553642372301(-3) | -1.571347158213(-3) | 1.001571347158(0) |
| 82 | -1.839329455300(-5) | -1.601761357358(-3) | -1.620154651911(-3) | 1.001620154652(0) |
| 83 | -1.910486222750(-5) | -1.651092149344(-3) | -1.670197011572(-3) | 1.001670197012(0) |
| 84 | -1.984024376606(-5) | -1.701672916412(-3) | -1.721513160178(-3) | 1.001721513160(0) |
| 85 | -2.060022297342(-5) | -1.753543828312(-3) | -1.774144051286(-3) | 1.001774144051(0) |
| 86 | -2.138561419232(-5) | -1.806747196058(-3) | -1.828132810251(-3) | 1.001828132810(0) |
| 87 | -2.219726398924(-5) | -1.861327624259(-3) | -1.883524888248(-3) | 1.001883524888(0) |
| 88 | -2.303605297399(-5) | -1.917332177526(-3) | -1.940368230500(-3) | 1.001940368230(0) |
| 89 | -2.390289776676(-5) | -1.974810562571(-3) | -1.998713460338(-3) | 1.001998713460(0) |
| 90 | -2.479875312832(-5) | -2.033815327828(-3) | -2.058614080956(-3) | 1.002058614081(0) |
| 91 | -2.572461427080(-5) | -2.094402082662(-3) | -2.120126696933(-3) | 1.002120126697(0) |
| 92 | -2.668151936886(-5) | -2.156629738581(-3) | -2.183311257950(-3) | 1.002183311258(0) |
| 93 | -2.767055229397(-5) | -2.220560775153(-3) | -2.248231327447(-3) | 1.002248231327(0) |
| 94 | -2.869284559738(-5) | -2.286261533783(-3) | -2.314954379381(-3) | 1.002314954379(0) |
| 95 | -2.974958377131(-5) | -2.353802542978(-3) | -2.383552126749(-3) | 1.002383552127(0) |
| 96 | -3.084200682198(-5) | -2.423258879272(-3) | -2.454100886094(-3) | 1.002454100886(0) |
| 97 | -3.197141419334(-5) | -2.494710568690(-3) | -2.526681982884(-3) | 1.002526681983(0) |
| 98 | -3.313916908629(-5) | -2.568243034411(-3) | -2.601382203497(-3) | 1.002601382203(0) |
| 99 | -3.434670322525(-5) | -2.643947597236(-3) | -2.678294300461(-3) | 1.002678294300(0) |
| 100 | -3.559552213241(-5) | -2.721922036650(-3) | -2.757517558782(-3) | 1.002757517559(0) |
| 101 | -3.688721098020(-5) | -2.802271221601(-3) | -2.839158432581(-3) | 1.002839158433(0) |
| 102 | -3.822344110449(-5) | -2.885107821841(-3) | -2.923331262946(-3) | 1.002923331263(0) |
| 103 | -3.960597727578(-5) | -2.970553112666(-3) | -3.010159089942(-3) | 1.003010159090(0) |
| 104 | -4.103668584359(-5) | -3.058737888408(-3) | -3.099774574252(-3) | 1.003099774574(0) |
| 105 | -4.251754389068(-5) | -3.149803503095(-3) | -3.192321046986(-3) | 1.003192321047(0) |
| 106 | -4.405064956076(-5) | -3.243903060462(-3) | -3.287953710023(-3) | 1.003287953710(0) |
| 107 | -4.563823375597(-5) | -3.341202780233(-3) | -3.386841013989(-3) | 1.003386841014(0) |
| 108 | -4.728267344167(-5) | -3.441883573492(-3) | -3.489166246934(-3) | 1.003489166247(0) |
| 109 | -4.898650684731(-5) | -3.546142867417(-3) | -3.595129374264(-3) | 1.003595129374(0) |
| 110 | -5.075245091664(-5) | -3.654196729128(-3) | -3.704949180045(-3) | 1.003704949180(0) |
| 111 | -5.258342144330(-5) | -3.766282350542(-3) | -3.818865771985(-3) | 1.003818865772(0) |
| 112 | -5.448255643285(-5) | -3.882660971816(-3) | -3.937143528249(-3) | 1.003937143528(0) |
| 113 | -5.645324336915(-5) | -4.003621341424(-3) | -4.060074584793(-3) | 1.004060074585(0) |
| 114 | -5.849915124130(-5) | -4.129483837838(-3) | -4.187982989079(-3) | 1.004187982989(0) |
| 115 | -6.062426842289(-5) | -4.260605413649(-3) | -4.321229682072(-3) | 1.004321229682(0) |
| 116 | -6.283294780993(-5) | -4.397385571195(-3) | -4.460218519005(-3) | 1.004460218519(0) |
| 117 | -6.512996104884(-5) | -4.540273644492(-3) | -4.605403605540(-3) | 1.004605403606(0) |
| 118 | -6.752056426897(-5) | -4.689777753046(-3) | -4.757298317315(-3) | 1.004757298317(0) |
| 119 | -7.001057854366(-5) | -4.846475920293(-3) | -4.916486498837(-3) | 1.004916486499(0) |
| 120 | -7.260648944829(-5) | -5.011030030491(-3) | -5.083636519940(-3) | 1.005083636520(0) |
| 121 | -7.531557172932(-5) | -5.184203560319(-3) | -5.259519132049(-3) | 1.005259519132(0) |
| 122 | -7.814604750967(-5) | -5.366884409192(-3) | -5.445030456702(-3) | 1.005445030457(0) |
| 123 | -8.110729007068(-5) | -5.560114737924(-3) | -5.641222027995(-3) | 1.005641222028(0) |
| 124 | -8.421009079852(-5) | -5.765130631579(-3) | -5.849340722378(-3) | 1.005849340722(0) |
| 125 | -8.746701563855(-5) | -5.983415843772(-3) | -6.070882859411(-3) | 1.006070882859(0) |
| 126 | -9.089289165517(-5) | -6.216776245247(-3) | -6.307669136902(-3) | 1.006307669137(0) |
| 127 | -9.450548835121(-5) | -6.467445624033(-3) | -6.561951112384(-3) | 1.006561951112(0) |
| 128 | -9.832650073085(-5) | -6.738240623307(-3) | -6.836567124038(-3) | 1.006836567124(0) |
| 129 | -1.023830193286(-4) | -7.032795905317(-3) | -7.135178924645(-3) | 1.007135178925(0) |
| 130 | -1.067098258052(-4) | -7.355936921351(-3) | -7.462646747156(-3) | 1.007462646747(0) |
| 131 | -1.113531758160(-4) | -7.714303512479(-3) | -7.825656688295(-3) | 1.007825656688(0) |
| 132 | -1.163774757509(-4) | -8.117467393942(-3) | -8.233844869693(-3) | 1.008233844870(0) |
| 133 | -1.218781907415(-4) | -8.580125978219(-3) | -8.702004168961(-3) | 1.008702004168(0) |
| 134 | -1.280101951356(-4) | -9.126996621297(-3) | -9.255006816432(-3) | 1.009255006816(0) |
| 135 | -1.350634311007(-4) | -9.806090102056(-3) | -9.941153533156(-3) | 1.009941153533(0) |
| 136 | -1.437496559230(-4) | -1.073989663373(-2) | -1.088364628965(-2) | 1.010883646289(0) |
| 137 | -1.590304502902(-4) | -1.282647438883(-2) | -1.298550483912(-2) | 1.012985504839(0) |



Table 7
Relative dia- and paramagnetic contributions to magnetizabilities of hydrogenlike atoms in the excited state $3p_{1/2}$, obtained with $\alpha^{-1} = 137.035\,999\,084$ (CODATA 2018).

| Z | χ_p'/χ | χ_p''/χ | χ_p/χ | χ_d/χ |
|----|-------------------|---------------------|-------------------|---------------------|
| 1 | 1.000133147008(0) | 9.847824567274(-12) | 1.000133147018(0) | -1.331470179971(-4) |
| 2 | 1.000532811623(0) | 1.576430253022(-10) | 1.000532811781(0) | -5.328117809590(-4) |
| 3 | 1.001199665583(0) | 7.987253029434(-10) | 1.001199666382(0) | -1.199666381692(-3) |
| 4 | 1.002134831675(0) | 2.527280742689(-9) | 1.002134834202(0) | -2.134834202355(-3) |
| 5 | 1.003339888604(0) | 6.179288735281(-9) | 1.003339894783(0) | -3.339894783198(-3) |
| 6 | 1.004816877858(0) | 1.283668198739(-8) | 1.004816890694(0) | -4.816890694203(-3) |
| 7 | 1.006568312633(0) | 2.383275448470(-8) | 1.006568336466(0) | -6.568336465904(-3) |
| 8 | 1.008597188894(0) | 4.075886301895(-8) | 1.008597229653(0) | -8.597229652998(-3) |
| 9 | 1.010906998650(0) | 6.547247924897(-8) | 1.010907064123(0) | -1.090706412271(-2) |
| 10 | 1.013501745573(0) | 1.001066613954(-7) | 1.013501845679(0) | -1.350184567939(-2) |
| 11 | 1.016385963077(0) | 1.470810277442(-7) | 1.016386110158(0) | -1.638611015798(-2) |
| 12 | 1.019564735027(0) | 2.091143283492(-7) | 1.019564944142(0) | -1.956494414175(-2) |
| 13 | 1.023043719246(0) | 2.892387268969(-7) | 1.023044008485(0) | -2.304400848507(-2) |
| 14 | 1.026829174033(0) | 3.908159218728(-7) | 1.026829564849(0) | -2.682956484926(-2) |
| 15 | 1.030927987935(0) | 5.17552552286(-7) | 1.030928505491(0) | -3.092850549066(-2) |
| 16 | 1.035347713040(0) | 6.735339780113(-7) | 1.035348386574(0) | -3.534838657400(-2) |
| 17 | 1.040096602103(0) | 8.632198662543(-7) | 1.040097465323(0) | -4.009746532265(-2) |
| 18 | 1.045183649864(0) | 1.091496407271(-6) | 1.045184741360(0) | -4.518474136043(-2) |
| 19 | 1.050618638958(0) | 1.363690806824(-6) | 1.050620002649(0) | -5.062000264858(-2) |
| 20 | 1.056412190872(0) | 1.685605102081(-6) | 1.056413876477(0) | -5.641387647677(-2) |
| 21 | 1.062575822479(0) | 2.063550704426(-6) | 1.062577886030(0) | -6.257788602994(-2) |
| 22 | 1.069122008738(0) | 2.504386740979(-6) | 1.069124513125(0) | -6.912451312490(-2) |
| 23 | 1.076064252230(0) | 3.015562614907(-6) | 1.076067267793(0) | -7.606726779285(-2) |
| 24 | 1.083417160313(0) | 3.605165263531(-6) | 1.083420765479(0) | -8.342076547871(-2) |
| 25 | 1.091196530765(0) | 4.281971661077(-6) | 1.091200812737(0) | -9.120081273699(-2) |
| 26 | 1.099419446923(0) | 5.055507191320(-6) | 1.099424502430(0) | -9.942450243020(-2) |
| 27 | 1.108104383471(0) | 5.936110606236(-6) | 1.108110319581(0) | -1.081103195814(-1) |
| 28 | 1.117271324196(0) | 6.935006392318(-6) | 1.117278259202(0) | -1.172782592021(-1) |
| 29 | 1.126941893229(0) | 8.064385489222(-6) | 1.126949957614(0) | -1.269499576144(-1) |
| 30 | 1.137139501521(0) | 9.337495449157(-6) | 1.137148839017(0) | -1.371488390169(-1) |
| 31 | 1.147889510573(0) | 1.076874129388(-5) | 1.147900279314(0) | -1.479002793139(-1) |
| 32 | 1.159219415748(0) | 1.237379852422(-5) | 1.159231789547(0) | -1.592317895467(-1) |
| 33 | 1.171159051899(0) | 1.416973997060(-5) | 1.171173221639(0) | -1.711732216389(-1) |
| 34 | 1.183740824433(0) | 1.617517844923(-5) | 1.183756999612(0) | -1.837569996117(-1) |
| 35 | 1.196999969525(0) | 1.841042751647(-5) | 1.197018379953(0) | -1.970183799529(-1) |
| 36 | 1.210974847763(0) | 2.089768300439(-5) | 1.210995745446(0) | -2.109957454457(-1) |
| 37 | 1.225707276289(0) | 2.366122848692(-5) | 1.225730937517(0) | -2.257309375171(-1) |
| 38 | 1.241242905392(0) | 2.672766838569(-5) | 1.241269633060(0) | -2.412696330602(-1) |
| 39 | 1.257631646572(0) | 3.012619309817(-5) | 1.257661772765(0) | -2.576617727650(-1) |
| 40 | 1.274928160421(0) | 3.38888134491(-5) | 1.274962049303(0) | -2.749620493026(-1) |
| 41 | 1.293192414242(0) | 3.805104592099(-5) | 1.293230465287(0) | -2.932304652875(-1) |
| 42 | 1.312490321249(0) | 4.265163024089(-5) | 1.312532972879(0) | -3.125329728794(-1) |
| 43 | 1.332894475584(0) | 4.773366454054(-5) | 1.332942209249(0) | -3.329422092488(-1) |
| 44 | 1.354485000248(0) | 5.334479241415(-5) | 1.354538345040(0) | -3.545383450403(-1) |
| 45 | 1.377350528683(0) | 5.953788060481(-5) | 1.377410066564(0) | -3.774100665639(-1) |
| 46 | 1.401589345185(0) | 6.637172775341(-5) | 1.401655716912(0) | -4.016557169124(-1) |
| 47 | 1.427310714892(0) | 7.391189128941(-5) | 1.427384626784(0) | -4.273846267836(-1) |
| 48 | 1.454636441139(0) | 8.223165601759(-5) | 1.454718672795(0) | -4.547186727947(-1) |
| 49 | 1.483702696765(0) | 9.141317347813(-5) | 1.483794109938(0) | -4.837941099384(-1) |
| 50 | 1.514662187285(0) | 1.015488081815(-4) | 1.514763736093(0) | -5.147637360933(-1) |
| 51 | 1.547686718189(0) | 1.127427358108(-4) | 1.547799460925(0) | -5.477994609247(-1) |
| 52 | 1.582970257253(0) | 1.251128500768(-4) | 1.583095370103(0) | -5.830953701027(-1) |
| 53 | 1.620732606861(0) | 1.387930499643(-4) | 1.620871399911(0) | -6.208713999106(-1) |
| 54 | 1.661223832925(0) | 1.539359988165(-4) | 1.661377768924(0) | -6.613777689241(-1) |
| 55 | 1.704729638688(0) | 1.707164727153(-4) | 1.704900355160(0) | -7.049003551604(-1) |
| 56 | 1.751577927209(0) | 1.893354502600(-4) | 1.751767262659(0) | -7.517672626592(-1) |
| 57 | 1.802146871017(0) | 2.100251424228(-4) | 1.802356896159(0) | -8.023568961593(-1) |
| 58 | 1.856874908770(0) | 2.330552244207(-4) | 1.857107963994(0) | -8.571079639944(-1) |
| 59 | 1.916273228017(0) | 2.587406184045(-4) | 1.916531968635(0) | -9.165319686350(-1) |
| 60 | 1.980941486531(0) | 2.874512964252(-4) | 1.981228937827(0) | -9.812289378271(-1) |
| 61 | 2.051587796765(0) | 3.196247428824(-4) | 2.051907421508(0) | -1.051907421508(-1) |
| 62 | 2.129054385933(0) | 3.557819577149(-4) | 2.129410167891(0) | -1.129410167891(-1) |
| 63 | 2.214350905670(0) | 3.965482318848(-4) | 2.214747453902(0) | -1.214747453902(-1) |
| 64 | 2.308698190891(0) | 4.426804418369(-4) | 2.309140871332(0) | -1.309140871332(-1) |
| 65 | 2.413586503009(0) | 4.951033805074(-4) | 2.414081606390(0) | -1.414081606390(-1) |
| 66 | 2.530854177614(0) | 5.549588184566(-4) | 2.531409136433(0) | -1.531409136433(-1) |
| 67 | 2.662795533464(0) | 6.236728210148(-4) | 2.663419206285(0) | -1.663419206285(-1) |
| 68 | 2.812311583884(0) | 7.030497698413(-4) | 2.813014633654(0) | -1.813014633654(-1) |
| 69 | 2.983124760068(0) | 7.954063217420(-4) | 2.983920166389(0) | -1.983920166389(-1) |
| 70 | 3.180091782061(0) | 9.037666024309(-4) | 3.180995548664(0) | -2.180995548664(-1) |
| 71 | 3.409671332988(0) | 1.032153983302(-3) | 3.410703486972(0) | -2.410703486972(-1) |
| 72 | 3.680643927712(0) | 1.186040204745(-3) | 3.681829967916(0) | -2.681829967916(-1) |
| 73 | 4.005258306909(0) | 1.373060613215(-3) | 4.006631367522(0) | -3.006631367522(-1) |
| 74 | 4.401131500737(0) | 1.604199621333(-3) | 4.402735700359(0) | -3.402735700359(-1) |

(continued on next page)

Table 7 (continued)

| Z | χ_p'/χ | χ_p''/χ | χ_p/χ | χ_a/χ |
|-----|---------------------|---------------------|---------------------|--------------------|
| 75 | 4.894551758568(0) | 1.895851432736(-3) | 4.896447610001(0) | -3.896447610001(0) |
| 76 | 5.526562311605(0) | 2.273615762295(-3) | 5.528835927367(0) | -4.528835927367(0) |
| 77 | 6.365003292059(0) | 2.779810923526(-3) | 6.367783102983(0) | -5.367783102983(0) |
| 78 | 7.530647419671(0) | 3.489780192220(-3) | 7.534137199863(0) | -6.534137199863(0) |
| 79 | 9.261337538834(0) | 4.551907997779(-3) | 9.265889446831(0) | -8.265889446831(0) |
| 80 | 1.209920969349(1) | 6.304430716637(-3) | 1.210551412420(1) | -1.110551412420(1) |
| 81 | 1.760617665400(1) | 9.721835754284(-3) | 1.761589848975(1) | -1.661589848975(1) |
| 82 | 3.289028999084(1) | 1.923891532091(-2) | 3.290952890616(1) | -3.190952890616(1) |
| 83 | 2.898450604463(2) | 1.795369150753(-1) | 2.900245973614(2) | -2.890245973614(2) |
| 84 | -4.152394463689(1) | -2.722806286723(-2) | -4.155117269975(1) | 4.255117269975(1) |
| 85 | -1.915199734972(1) | -1.329008661386(-2) | -1.916528743634(1) | 2.016528743634(1) |
| 86 | -1.235090741805(1) | -9.067416099186(-3) | -1.235997483415(1) | 1.335997483415(1) |
| 87 | -9.061144349677(0) | -7.035972137870(-3) | -9.068180321815(0) | 1.006818032182(1) |
| 88 | -7.121192729985(0) | -5.847171310916(-3) | -7.127039901296(0) | 8.127039901296(0) |
| 89 | -5.841578338239(0) | -5.070855720959(-3) | -5.846649193960(0) | 6.846649193960(0) |
| 90 | -4.934061195408(0) | -4.527203211559(-3) | -4.938588398620(0) | 5.938588398620(0) |
| 91 | -4.256835493988(0) | -4.127754469965(-3) | -4.260963248458(0) | 5.260963248458(0) |
| 92 | -3.732017568645(0) | -3.823932793390(-3) | -3.735841501439(0) | 4.735841501439(0) |
| 93 | -3.313275295163(0) | -3.586847723032(-3) | -3.316862142887(0) | 4.316862142887(0) |
| 94 | -2.971319563758(0) | -3.398243054525(-3) | -2.974717806813(0) | 3.974717806813(0) |
| 95 | -2.686727285246(0) | -3.246019089135(-3) | -2.689973304335(0) | 3.689973304335(0) |
| 96 | -2.446109392762(0) | -3.121841876026(-3) | -2.449231234638(0) | 3.449231234638(0) |
| 97 | -2.239936091785(0) | -3.019786439832(-3) | -2.242955878224(0) | 3.242955878224(0) |
| 98 | -2.061239397720(0) | -2.935527367204(-3) | -2.064174925087(0) | 3.064174925087(0) |
| 99 | -1.904806087965(0) | -2.865835378490(-3) | -1.907671923343(0) | 2.907671923343(0) |
| 100 | -1.766657617806(0) | -2.808252950347(-3) | -1.769465870756(0) | 2.769465870756(0) |
| 101 | -1.643704611618(0) | -2.760878870152(-3) | -1.646465490488(0) | 2.646465490488(0) |
| 102 | -1.533511179186(0) | -2.722221325414(-3) | -1.536233400511(0) | 2.536233400511(0) |
| 103 | -1.434130371491(0) | -2.691095393696(-3) | -1.436821466885(0) | 2.436821466885(0) |
| 104 | -1.343986916634(0) | -2.666550049194(-3) | -1.346653466683(0) | 2.346653466683(0) |
| 105 | -1.261792102323(0) | -2.647815246677(-3) | -1.264439917570(0) | 2.264439917570(0) |
| 106 | -1.186480963787(0) | -2.634262945951(-3) | -1.189115226732(0) | 2.189115226732(0) |
| 107 | -1.117165233001(0) | -2.625377997748(-3) | -1.119790610999(0) | 2.119790610999(0) |
| 108 | -1.053097609082(0) | -2.620736125284(-3) | -1.055718345208(0) | 2.055718345208(0) |
| 109 | -9.936442815525(-1) | -2.619987092665(-3) | -9.962642686452(-1) | 1.996264268645(0) |
| 110 | -9.382635503441(-1) | -2.622841721480(-3) | -9.408863920655(-1) | 1.940886392066(0) |
| 111 | -8.864890037166(-1) | -2.629061803564(-3) | -8.891180655201(-1) | 1.889118065520(0) |
| 112 | -8.379161396849(-1) | -2.638452224477(-3) | -8.405545919093(-1) | 1.840554591909(0) |
| 113 | -7.921916125626(-1) | -2.650854799221(-3) | -7.948424673618(-1) | 1.794842467362(0) |
| 114 | -7.490044951745(-1) | -2.666143455021(-3) | -7.516706386295(-1) | 1.751670638629(0) |
| 115 | -7.080790962306(-1) | -2.684220492683(-3) | -7.107633167233(-1) | 1.710763316723(0) |
| 116 | -6.691689791509(-1) | -2.705013729605(-3) | -6.718739928805(-1) | 1.671873992880(0) |
| 117 | -6.320519051672(-1) | -2.728474381757(-3) | -6.347803795489(-1) | 1.634780379549(0) |
| 118 | -5.965254776907(-1) | -2.754575584400(-3) | -5.992800532751(-1) | 1.599280053275(0) |
| 119 | -5.624033017826(-1) | -2.783311485950(-3) | -5.651866132686(-1) | 1.565186613269(0) |
| 120 | -5.295114950352(-1) | -2.814696879364(-3) | -5.323261919145(-1) | 1.532326191915(0) |
| 121 | -4.976853953634(-1) | -2.848767363284(-3) | -5.005341627267(-1) | 1.500534162727(0) |
| 122 | -4.667663063032(-1) | -2.885580053275(-3) | -4.696518863564(-1) | 1.469651886356(0) |
| 123 | -4.365980981248(-1) | -2.925214894294(-3) | -4.395233130191(-1) | 1.439523313019(0) |
| 124 | -4.070234363472(-1) | -2.967776661822(-3) | -4.099912130090(-1) | 1.409991213009(0) |
| 125 | -3.778793245380(-1) | -3.013397784112(-3) | -3.808927223221(-1) | 1.380892722322(0) |
| 126 | -3.489915000274(-1) | -3.062242175583(-3) | -3.520537422030(-1) | 1.352053742203(0) |
| 127 | -3.201669600310(-1) | -3.114510345242(-3) | -3.232814703762(-1) | 1.323281470376(0) |
| 128 | -2.911834226800(-1) | -3.170446134546(-3) | -2.943538688145(-1) | 1.294353868815(0) |
| 129 | -2.617736333516(-1) | -3.230345533383(-3) | -2.650039788850(-1) | 1.265003978885(0) |
| 130 | -2.316006391063(-1) | -3.294568058949(-3) | -2.348952071652(-1) | 1.234895207165(0) |
| 131 | -2.002163177508(-1) | -3.363550928200(-3) | -2.035798686790(-1) | 1.203579868679(0) |
| 132 | -1.669864394197(-1) | -3.437824857330(-3) | -1.704242642770(-1) | 1.170424264277(0) |
| 133 | -1.309417458694(-1) | -3.518024432938(-3) | -1.344597703023(-1) | 1.134459770302(0) |
| 134 | -9.044072560657(-2) | -3.604860545725(-3) | -9.404558615230(-2) | 1.094045586152(0) |
| 135 | -4.223910494149(-2) | -3.698891582177(-3) | -4.593799652366(-2) | 1.045937996524(0) |
| 136 | 2.217192671317(-2) | -3.798941107278(-3) | 1.837298560589(-2) | 9.816270143941(-1) |
| 137 | 1.684185240126(-1) | -3.864164853417(-3) | 1.645543591592(-1) | 8.354456408408(-1) |



Table 8
Relative dia- and paramagnetic contributions to magnetizabilities of hydrogenlike atoms in the excited state $3p_{3/2}$ ($\mu = \pm 1/2$), obtained with $\alpha^{-1} = 137.035999084$ (CODATA 2018).

| Z | χ_p'/χ | χ_p''/χ | χ_p/χ | χ_d/χ |
|----|--------------------|----------------------|--------------------|--------------------|
| 1 | 9.998935059903(-1) | -1.969099978383(-11) | 9.998935059706(-1) | 1.064904294175(-4) |
| 2 | 9.995741283149(-1) | -3.149884254279(-10) | 9.995741279999(-1) | 4.258720001011(-4) |
| 3 | 9.990421797506(-1) | -1.594059199900(-9) | 9.990421781565(-1) | 9.578218434576(-4) |
| 4 | 9.982981806447(-1) | -5.035496331069(-9) | 9.982981756092(-1) | 1.701824390823(-3) |
| 5 | 9.973428574987(-1) | -1.228580039128(-8) | 9.973428452129(-1) | 2.657154787112(-3) |
| 6 | 9.961771409956(-1) | -2.545587206515(-8) | 9.961771155397(-1) | 3.822884460282(-3) |
| 7 | 9.948021634795(-1) | -4.711653406994(-8) | 9.948021163629(-1) | 5.197883637071(-3) |
| 8 | 9.932192559002(-1) | -8.029310573965(-8) | 9.932191756071(-1) | 6.780824392859(-3) |
| 9 | 9.914299442380(-1) | -1.284590583716(-7) | 9.914298157790(-1) | 8.570184221010(-3) |
| 10 | 9.894359454241(-1) | -1.955287840287(-7) | 9.894357498954(-1) | 1.056425010465(-2) |
| 11 | 9.872391627779(-1) | -2.858495148368(-7) | 9.872388769284(-1) | 1.276112307158(-2) |
| 12 | 9.848416809814(-1) | -4.041924338881(-7) | 9.848412767890(-1) | 1.515872321103(-2) |
| 13 | 9.822457606143(-1) | -5.557430226256(-7) | 9.822452048713(-1) | 1.775479512869(-2) |
| 14 | 9.794538322755(-1) | -7.460906930220(-7) | 9.794530861848(-1) | 2.054691381519(-2) |
| 15 | 9.764684903166(-1) | -9.812177559596(-7) | 9.764675090988(-1) | 2.353249090116(-2) |
| 16 | 9.732924862170(-1) | -1.267487779938(-6) | 9.732912187292(-1) | 2.670878127081(-2) |
| 17 | 9.699287216285(-1) | -1.611633396596(-6) | 9.699271099951(-1) | 3.007289000495(-2) |
| 18 | 9.663802411207(-1) | -2.020743611483(-6) | 9.663782203770(-1) | 3.362177962295(-2) |
| 19 | 9.626502246577(-1) | -2.502250680112(-6) | 9.626477224070(-1) | 3.735227759298(-2) |
| 20 | 9.587419798380(-1) | -3.063916610489(-6) | 9.587389159213(-1) | 4.126108407866(-2) |
| 21 | 9.546589339288(-1) | -3.713819354131(-6) | 9.546552201094(-1) | 4.534477989057(-2) |
| 22 | 9.504046257284(-1) | -4.460338747981(-6) | 9.504001653897(-1) | 4.959983461033(-2) |
| 23 | 9.459826972868(-1) | -5.312142269695(-6) | 9.459773851445(-1) | 5.402261485548(-2) |
| 24 | 9.413968855173(-1) | -6.278170668459(-6) | 9.413906073466(-1) | 5.860939265336(-2) |
| 25 | 9.366510137306(-1) | -7.367623532820(-6) | 9.366436461071(-1) | 6.335635389291(-2) |
| 26 | 9.317489831213(-1) | -8.589944856086(-6) | 9.317403931765(-1) | 6.825960682354(-2) |
| 27 | 9.266947642372(-1) | -9.954808658526(-6) | 9.266848094285(-1) | 7.331519057146(-2) |
| 28 | 9.214923884602(-1) | -1.147210472409(-5) | 9.214809163555(-1) | 7.851908364447(-2) |
| 29 | 9.161459395720(-1) | -1.315192450750(-5) | 9.161327876025(-1) | 8.386721239752(-2) |
| 30 | 9.106595451150(-1) | -1.500454726567(-5) | 9.106445405677(-1) | 8.935545943229(-2) |
| 31 | 9.050373685207(-1) | -1.704042646497(-5) | 9.050203280942(-1) | 9.497967190581(-2) |
| 32 | 8.992836004525(-1) | -1.927017651360(-5) | 8.992643302760(-1) | 1.007356697240(-1) |
| 33 | 8.934024509616(-1) | -2.170455986585(-5) | 8.933807464018(-1) | 1.066192535982(-1) |
| 34 | 8.873981415309(-1) | -2.435447454213(-5) | 8.873737870564(-1) | 1.126262129436(-1) |
| 35 | 8.812748973414(-1) | -2.723094210612(-5) | 8.812476663993(-1) | 1.187523336007(-1) |
| 36 | 8.750369397336(-1) | -3.034509613760(-5) | 8.750065946375(-1) | 1.249934053625(-1) |
| 37 | 8.686884788793(-1) | -3.370817123643(-5) | 8.686547707080(-1) | 1.313452292920(-1) |
| 38 | 8.622373066777(-1) | -3.733149259067(-5) | 8.621963751851(-1) | 1.378036248149(-1) |
| 39 | 8.556767898887(-1) | -4.122646613880(-5) | 8.556355634226(-1) | 1.443644365774(-1) |
| 40 | 8.490218635124(-1) | -4.540456935321(-5) | 8.489764589431(-1) | 1.510235410569(-1) |
| 41 | 8.422730244254(-1) | -4.987734266965(-5) | 8.422231470827(-1) | 1.577768529173(-1) |
| 42 | 8.354343252790(-1) | -5.465638158448(-5) | 8.353796688974(-1) | 1.646203311026(-1) |
| 43 | 8.285097686665(-1) | -5.975332943925(-5) | 8.284500153371(-1) | 1.71549846629(-1) |
| 44 | 8.215033015619(-1) | -6.517987090964(-5) | 8.214381216910(-1) | 1.785618783090(-1) |
| 45 | 8.144188100326(-1) | -7.094772621381(-5) | 8.143478623064(-1) | 1.856521376936(-1) |
| 46 | 8.072601142274(-1) | -7.706864605280(-5) | 8.071830455814(-1) | 1.928169544186(-1) |
| 47 | 8.000309636379(-1) | -8.355440729416(-5) | 7.999474092306(-1) | 2.000525907694(-1) |
| 48 | 7.927350326321(-1) | -9.041680940804(-5) | 7.926446158227(-1) | 2.073553841773(-1) |
| 49 | 7.853759162556(-1) | -9.766767166360(-5) | 7.852782485840(-1) | 2.147217514160(-1) |
| 50 | 7.779571262973(-1) | -1.053188310923(-4) | 7.778518074662(-1) | 2.221481925338(-1) |
| 51 | 7.704820876108(-1) | -1.133821412238(-4) | 7.703687054696(-1) | 2.296312945304(-1) |
| 52 | 7.629541346882(-1) | -1.218694715990(-4) | 7.628322652166(-1) | 2.371677347834(-1) |
| 53 | 7.553765084739(-1) | -1.307927080649(-4) | 7.552457157658(-1) | 2.447542842342(-1) |
| 54 | 7.477523534132(-1) | -1.401637538546(-4) | 7.476121896593(-1) | 2.523878103407(-1) |
| 55 | 7.400847147222(-1) | -1.499945314572(-4) | 7.399347201908(-1) | 2.600652798092(-1) |
| 56 | 7.323765358708(-1) | -1.602969852810(-4) | 7.322162388855(-1) | 2.677837611145(-1) |
| 57 | 7.246306562645(-1) | -1.710830851153(-4) | 7.244595731794(-1) | 2.755404268206(-1) |
| 58 | 7.168498091150(-1) | -1.823648303964(-4) | 7.166674442846(-1) | 2.833325557154(-1) |
| 59 | 7.090366194833(-1) | -1.941542552839(-4) | 7.088424652281(-1) | 2.911575347719(-1) |
| 60 | 7.011936024847(-1) | -2.064634345560(-4) | 7.009871390501(-1) | 2.990128609499(-1) |
| 61 | 6.933231616373(-1) | -2.193044903335(-4) | 6.931038571470(-1) | 3.068961428530(-1) |
| 62 | 6.854275873423(-1) | -2.326895996452(-4) | 6.851948977426(-1) | 3.148051022574(-1) |
| 63 | 6.775090554766(-1) | -2.466310028478(-4) | 6.772624244737(-1) | 3.227375755263(-1) |
| 64 | 6.695696260846(-1) | -2.611410129198(-4) | 6.693084850717(-1) | 3.306915149283(-1) |
| 65 | 6.616112421487(-1) | -2.762320256482(-4) | 6.613350101230(-1) | 3.386649898770(-1) |
| 66 | 6.536357284224(-1) | -2.919165307344(-4) | 6.533438118916(-1) | 3.466561881084(-1) |
| 67 | 6.456447903072(-1) | -3.082071238470(-4) | 6.453365831834(-1) | 3.546634168166(-1) |
| 68 | 6.376400127355(-1) | -3.251165196553(-4) | 6.373148962338(-1) | 3.626851037662(-1) |
| 69 | 6.296228591642(-1) | -3.426575658833(-4) | 6.292802015983(-1) | 3.707197984017(-1) |
| 70 | 6.215946702827(-1) | -3.608432584289(-4) | 6.212338270243(-1) | 3.787661729757(-1) |
| 71 | 6.135566630399(-1) | -3.796867575998(-4) | 6.131769762823(-1) | 3.868230237177(-1) |
| 72 | 6.055099293387(-1) | -3.992014055268(-4) | 6.051107279331(-1) | 3.948892720669(-1) |
| 73 | 5.974554347510(-1) | -4.194007448214(-4) | 5.970360340062(-1) | 4.029639659938(-1) |
| 74 | 5.893940171016(-1) | -4.402985385560(-4) | 5.889537185630(-1) | 4.110462814370(-1) |

(continued on next page)

Table 8 (continued)

| Z | χ_p'/X | χ_p''/X | χ_p/X | χ_d/X |
|-----|---------------------|---------------------|---------------------|--------------------|
| 75 | 5.813263849093(-1) | -4.619087916542(-4) | 5.808644761177(-1) | 4.191355238823(-1) |
| 76 | 5.732531156590(-1) | -4.842457737927(-4) | 5.727688698852(-1) | 4.272311301148(-1) |
| 77 | 5.651746538689(-1) | -5.073240439271(-4) | 5.646673298249(-1) | 4.353326701751(-1) |
| 78 | 5.570913089218(-1) | -5.311584765714(-4) | 5.565601504453(-1) | 4.434398495547(-1) |
| 79 | 5.490032526216(-1) | -5.557642899766(-4) | 5.484474883316(-1) | 4.515525116684(-1) |
| 80 | 5.409105164336(-1) | -5.811570763749(-4) | 5.403293593572(-1) | 4.596706406428(-1) |
| 81 | 5.328129883664(-1) | -6.073528344758(-4) | 5.322056355319(-1) | 4.677943644681(-1) |
| 82 | 5.247104094437(-1) | -6.343680044269(-4) | 5.240760414393(-1) | 4.759239585607(-1) |
| 83 | 5.166023697134(-1) | -6.622195054816(-4) | 5.159401502080(-1) | 4.840598497920(-1) |
| 84 | 5.084883037330(-1) | -6.909247766458(-4) | 5.077973789563(-1) | 4.922026210437(-1) |
| 85 | 5.003674854638(-1) | -7.205018206156(-4) | 4.996469836432(-1) | 5.003530163568(-1) |
| 86 | 4.922390224989(-1) | -7.509692513602(-4) | 4.914880532475(-1) | 5.085119467525(-1) |
| 87 | 4.841018495388(-1) | -7.823463457541(-4) | 4.833195031930(-1) | 5.166804968070(-1) |
| 88 | 4.759547210192(-1) | -8.146530997182(-4) | 4.751400679195(-1) | 5.248599320805(-1) |
| 89 | 4.677962027809(-1) | -8.479102894004(-4) | 4.669482924915(-1) | 5.330517075085(-1) |
| 90 | 4.596246626575(-1) | -8.821395379988(-4) | 4.587425231195(-1) | 5.412574768805(-1) |
| 91 | 4.514382598369(-1) | -9.173633889245(-4) | 4.505208964480(-1) | 5.494791035520(-1) |
| 92 | 4.432349328344(-1) | -9.536053861058(-4) | 4.422813274483(-1) | 5.577186725517(-1) |
| 93 | 4.350123858856(-1) | -9.908901623621(-4) | 4.340214957232(-1) | 5.659785042768(-1) |
| 94 | 4.267680735409(-1) | -1.029243536920(-3) | 4.257388300039(-1) | 5.742611699961(-1) |
| 95 | 4.184991832065(-1) | -1.068692623323(-3) | 4.174304905832(-1) | 5.825695094168(-1) |
| 96 | 4.102026153338(-1) | -1.109265949190(-3) | 4.090933493846(-1) | 5.909066506154(-1) |
| 97 | 4.018749609074(-1) | -1.150993589531(-3) | 4.007239673178(-1) | 5.992760326822(-1) |
| 98 | 3.935124758228(-1) | -1.193907315617(-3) | 3.923185685072(-1) | 6.076814314928(-1) |
| 99 | 3.851110516673(-1) | -1.238040761777(-3) | 3.838730109055(-1) | 6.161269890945(-1) |
| 100 | 3.766661823279(-1) | -1.283429612906(-3) | 3.753827527150(-1) | 6.246172472850(-1) |
| 101 | 3.681729257417(-1) | -1.330111816021(-3) | 3.668428139256(-1) | 6.331571860744(-1) |
| 102 | 3.596258599647(-1) | -1.378127819826(-3) | 3.582477321449(-1) | 6.417522678551(-1) |
| 103 | 3.510190325714(-1) | -1.427520847064(-3) | 3.495915117243(-1) | 6.504084882757(-1) |
| 104 | 3.423459021874(-1) | -1.478337205392(-3) | 3.408675649821(-1) | 6.591324350179(-1) |
| 105 | 3.335992707015(-1) | -1.530626643753(-3) | 3.320686440578(-1) | 6.679313559422(-1) |
| 106 | 3.247712043756(-1) | -1.584442762752(-3) | 3.231867616129(-1) | 6.768132383871(-1) |
| 107 | 3.158529416650(-1) | -1.639843489436(-3) | 3.142130981755(-1) | 6.857869018245(-1) |
| 108 | 3.068347850369(-1) | -1.696891629370(-3) | 3.051378934075(-1) | 6.948621065925(-1) |
| 109 | 2.977059734094(-1) | -1.75655511970(-3) | 2.959503178974(-1) | 7.040496821026(-1) |
| 110 | 2.884545309677(-1) | -1.816209749114(-3) | 2.866383212186(-1) | 7.133616787814(-1) |
| 111 | 2.790670869939(-1) | -1.878636132251(-3) | 2.771884508617(-1) | 7.228115491383(-1) |
| 112 | 2.695286598666(-1) | -1.943024700081(-3) | 2.675856351665(-1) | 7.324143648335(-1) |
| 113 | 2.598223964281(-1) | -2.009475017937(-3) | 2.578129214102(-1) | 7.421870785898(-1) |
| 114 | 2.499292552907(-1) | -2.078097722125(-3) | 2.478511575686(-1) | 7.521488424314(-1) |
| 115 | 2.398276190872(-1) | -2.149016398835(-3) | 2.376786026884(-1) | 7.623213973116(-1) |
| 116 | 2.294928157883(-1) | -2.222369889704(-3) | 2.272704458986(-1) | 7.727295541014(-1) |
| 117 | 2.188965224092(-1) | -2.298315147147(-3) | 2.165982072620(-1) | 7.834017927380(-1) |
| 118 | 2.080060148505(-1) | -2.377030806365(-3) | 2.056289840442(-1) | 7.943710159558(-1) |
| 119 | 1.967832138999(-1) | -2.458721703337(-3) | 1.943244921966(-1) | 8.056755078034(-1) |
| 120 | 1.851834574399(-1) | -2.543624658871(-3) | 1.826398327811(-1) | 8.173601672189(-1) |
| 121 | 1.731538992698(-1) | -2.632015983053(-3) | 1.705218832868(-1) | 8.294781167132(-1) |
| 122 | 1.606313900510(-1) | -2.724221357301(-3) | 1.579071686937(-1) | 8.420928313063(-1) |
| 123 | 1.475396263145(-1) | -2.820629064806(-3) | 1.447189972497(-1) | 8.552810027503(-1) |
| 124 | 1.337852428513(-1) | -2.921708037504(-3) | 1.308635348138(-1) | 8.691364651862(-1) |
| 125 | 1.192523427654(-1) | -3.028032999625(-3) | 1.162243097658(-1) | 8.837756902342(-1) |
| 126 | 1.037946532671(-1) | -3.140320357654(-3) | 1.006543329095(-1) | 8.993456670905(-1) |
| 127 | 8.722395744540(-2) | -3.259480886428(-3) | 8.396447655897(-2) | 9.160335234410(-1) |
| 128 | 6.929246523596(-2) | -3.386699654078(-3) | 6.590576558188(-2) | 9.340942344181(-1) |
| 129 | 4.966487951558(-2) | -3.523562095547(-3) | 4.614131742004(-2) | 9.538586825800(-1) |
| 130 | 2.787199312993(-2) | -3.672262501830(-3) | 2.419973062810(-2) | 9.758002693719(-1) |
| 131 | 3.228965097977(-3) | -3.835969556978(-3) | -6.070044590018(-4) | 1.000607004459(0) |
| 132 | -2.531973459458(-2) | -4.019516741836(-3) | -2.933925133642(-2) | 1.029339251336(0) |
| 133 | -5.952497508721(-2) | -4.230841264939(-3) | -6.375581635215(-2) | 1.063755816352(0) |
| 134 | -1.026130990650(-1) | -4.484425577337(-3) | -1.070975246424(-1) | 1.107097524642(0) |
| 135 | -1.615989092121(-1) | -4.811450651504(-3) | -1.664103598636(-1) | 1.166410359864(0) |
| 136 | -2.573059862123(-1) | -5.303540614025(-3) | -2.626095268263(-1) | 1.262609526826(0) |
| 137 | -6.008226480409(-1) | -6.876112744859(-3) | -6.076987607858(-1) | 1.607698760786(0) |



Table 9
Relative dia- and paramagnetic contributions to magnetizabilities of hydrogenlike atoms in the excited state $3p_{3/2}$ ($\mu = \pm 3/2$), obtained with $\alpha^{-1} = 137.035999084$ (CODATA 2018).

| Z | χ_p'/χ | χ_p''/χ | χ_p/χ | χ_d/χ |
|----|----------------------|---------------------|---------------------|-------------------|
| 1 | -5.772405534338(-14) | -1.109415527070(-6) | -1.109415584794(-6) | 1.000001109416(0) |
| 2 | -9.236103450508(-13) | -4.437809809691(-6) | -4.437810733302(-6) | 1.000004437811(0) |
| 3 | -4.675992202825(-12) | -9.985626002215(-6) | -9.985630678208(-6) | 1.000009985631(0) |
| 4 | -1.477939515995(-11) | -1.775360286231(-5) | -1.775361764170(-5) | 1.000017753618(0) |
| 5 | -3.608549225643(-11) | -2.774277500170(-5) | -2.774281108719(-5) | 1.000027742811(0) |
| 6 | -7.483444217389(-11) | -3.995447323742(-5) | -3.995454807186(-5) | 1.000039954548(0) |
| 7 | -1.386566108883(-10) | -5.439032504387(-5) | -5.439046370048(-5) | 1.000054390464(0) |
| 8 | -2.365746777408(-10) | -7.105225510583(-5) | -7.105249168051(-5) | 1.000071052492(0) |
| 9 | -3.790061270275(-10) | -8.994248597299(-5) | -8.994286497912(-5) | 1.000089942865(0) |
| 10 | -5.777661264084(-10) | -1.110635388163(-4) | -1.110641165824(-4) | 1.000111064117(0) |
| 11 | -8.460707936441(-10) | -1.344182342864(-4) | -1.344190803572(-4) | 1.000134419080(0) |
| 12 | -1.198540853368(-9) | -1.600096934757(-4) | -1.600108920166(-4) | 1.000160010892(0) |
| 13 | -1.651205685812(-9) | -1.878413389829(-4) | -1.878429901886(-4) | 1.000187842990(0) |
| 14 | -2.221507769614(-9) | -2.179168960827(-4) | -2.179191175904(-4) | 1.000217919118(0) |
| 15 | -2.928307521035(-9) | -2.502403939999(-4) | -2.502433223074(-4) | 1.000250243322(0) |
| 16 | -3.791888532141(-9) | -2.848161672899(-4) | -2.848199591784(-4) | 1.000284819959(0) |
| 17 | -4.833963210706(-9) | -3.216488573254(-4) | -3.216536912886(-4) | 1.000321653691(0) |
| 18 | -6.077678824823(-9) | -3.607434138912(-4) | -3.607494915701(-4) | 1.000360749492(0) |
| 19 | -7.547623955408(-9) | -4.021050968877(-4) | -4.021126445117(-4) | 1.000402112645(0) |
| 20 | -9.269835360034(-9) | -4.457394781444(-4) | -4.457487479798(-4) | 1.000445748748(0) |
| 21 | -1.127180525173(-8) | -4.916524433444(-4) | -4.916637151496(-4) | 1.000491663715(0) |
| 22 | -1.358248899665(-8) | -5.398501940616(-4) | -5.398637765506(-4) | 1.000539863777(0) |
| 23 | -1.623231323463(-8) | -5.903392499115(-4) | -5.903554822247(-4) | 1.000590355482(0) |
| 24 | -1.925318442716(-8) | -6.431264508174(-4) | -6.431457040018(-4) | 1.000643145704(0) |
| 25 | -2.267849783713(-8) | -6.982189593932(-4) | -6.982416378910(-4) | 1.000698241638(0) |
| 26 | -2.654314694541(-8) | -7.556242634447(-4) | -7.556508065917(-4) | 1.000755650807(0) |
| 27 | -3.088353330910(-8) | -8.153501785913(-4) | -8.153810621247(-4) | 1.000815381062(0) |
| 28 | -3.573757686706(-8) | -8.774048510089(-4) | -8.774405885858(-4) | 1.000877440589(0) |
| 29 | -4.114472669808(-8) | -9.417967602972(-4) | -9.418379050239(-4) | 1.000941837905(0) |
| 30 | -4.714597223770(-8) | -1.008534722472(-3) | -1.008581868445(-3) | 1.001008581868(0) |
| 31 | -5.378385495969(-8) | -1.077627893088(-3) | -1.077681676943(-3) | 1.001077681677(0) |
| 32 | -6.110248052875(-8) | -1.149085770485(-3) | -1.149146872965(-3) | 1.001149146873(0) |
| 33 | -6.914753143097(-8) | -1.222918199174(-3) | -1.222987346705(-3) | 1.001222987347(0) |
| 34 | -7.796628008908(-8) | -1.299135373354(-3) | -1.299213339634(-3) | 1.001299213340(0) |
| 35 | -8.760760246986(-8) | -1.377747840567(-3) | -1.377835448170(-3) | 1.001377835448(0) |
| 36 | -9.812192919107(-8) | -1.458766505489(-3) | -1.458864627481(-3) | 1.001458864627(0) |
| 37 | -1.095615751360(-7) | -1.542202633868(-3) | -1.542312195443(-3) | 1.001542312195(0) |
| 38 | -1.219801245839(-7) | -1.628067856607(-3) | -1.628189836731(-3) | 1.001628189837(0) |
| 39 | -1.354330768641(-7) | -1.716374173989(-3) | -1.716509607065(-3) | 1.001716509607(0) |
| 40 | -1.499775475444(-7) | -1.807133960060(-3) | -1.807283937608(-3) | 1.001807283938(0) |
| 41 | -1.656723481603(-7) | -1.900359967165(-3) | -1.900525639513(-3) | 1.001900525640(0) |
| 42 | -1.825780034975(-7) | -1.996065330634(-3) | -1.996247908638(-3) | 1.001996247909(0) |
| 43 | -2.007567694354(-7) | -2.094263573641(-3) | -2.094464330411(-3) | 1.002094464330(0) |
| 44 | -2.202726513634(-7) | -2.194968612217(-3) | -2.195188884868(-3) | 1.002195188885(0) |
| 45 | -2.411914231788(-7) | -2.298194760433(-3) | -2.298435951857(-3) | 1.002298435952(0) |
| 46 | -2.635806468802(-7) | -2.403956735765(-3) | -2.404220316412(-3) | 1.002404220316(0) |
| 47 | -2.875096927652(-7) | -2.512269664617(-3) | -2.512557174310(-3) | 1.002512557174(0) |
| 48 | -3.130497602453(-7) | -2.623149088040(-3) | -2.623462137800(-3) | 1.002623462138(0) |
| 49 | -3.402738992913(-7) | -2.736610967626(-3) | -2.736951241525(-3) | 1.002736951242(0) |
| 50 | -3.692570325197(-7) | -2.852671691596(-3) | -2.853040948629(-3) | 1.002853040949(0) |
| 51 | -4.000759779364(-7) | -2.971348081077(-3) | -2.971748157055(-3) | 1.002971748157(0) |
| 52 | -4.328094723479(-7) | -3.092657396581(-3) | -3.093090206054(-3) | 1.003093090206(0) |
| 53 | -4.675381954574(-7) | -3.216617344683(-3) | -3.217084882879(-3) | 1.003217084883(0) |
| 54 | -5.043447946583(-7) | -3.343246084912(-3) | -3.343750429707(-3) | 1.003343750430(0) |
| 55 | -5.433139105413(-7) | -3.472562236853(-3) | -3.473105550763(-3) | 1.003473105551(0) |
| 56 | -5.845322031308(-7) | -3.604584887466(-3) | -3.605169419669(-3) | 1.003605169420(0) |
| 57 | -6.280883788663(-7) | -3.739333598639(-3) | -3.739961687018(-3) | 1.003739961687(0) |
| 58 | -6.740732183463(-7) | -3.876828414958(-3) | -3.877502488177(-3) | 1.003877502488(0) |
| 59 | -7.225796048522(-7) | -4.017089871728(-3) | -4.017812451333(-3) | 1.004017812451(0) |
| 60 | -7.737025536698(-7) | -4.160139003229(-3) | -4.160912705783(-3) | 1.004160912706(0) |
| 61 | -8.275392422268(-7) | -4.305997351226(-3) | -4.306824890469(-3) | 1.004306824890(0) |
| 62 | -8.841890410672(-7) | -4.454686973736(-3) | -4.455571162777(-3) | 1.004455711627(0) |
| 63 | -9.437535456805(-7) | -4.606230454057(-3) | -4.607174207603(-3) | 1.004607174208(0) |
| 64 | -1.006336609208(-6) | -4.760650910077(-3) | -4.761657246686(-3) | 1.004761657247(0) |
| 65 | -1.072044376049(-6) | -4.917972003850(-3) | -4.919044048226(-3) | 1.004919044048(0) |
| 66 | -1.140985316381(-6) | -5.078217951474(-3) | -5.079358936791(-3) | 1.005079358937(0) |
| 67 | -1.213270261632(-6) | -5.241413533256(-3) | -5.242626803517(-3) | 1.005242626804(0) |
| 68 | -1.289012440914(-6) | -5.407584104181(-3) | -5.408873116622(-3) | 1.005408873117(0) |
| 69 | -1.368327518447(-6) | -5.576755604708(-3) | -5.578123932226(-3) | 1.005578123932(0) |
| 70 | -1.451333632006(-6) | -5.748954571871(-3) | -5.750405905503(-3) | 1.005750405906(0) |
| 71 | -1.538151432405(-6) | -5.924208150728(-3) | -5.925746302160(-3) | 1.005925746302(0) |
| 72 | -1.628904124059(-6) | -6.102544106147(-3) | -6.104173010271(-3) | 1.006104173010(0) |
| 73 | -1.723717506633(-6) | -6.283990834947(-3) | -6.285714552453(-3) | 1.006285714552(0) |
| 74 | -1.822720017836(-6) | -6.468577378401(-3) | -6.470400098419(-3) | 1.006470400098(0) |

(continued on next page)

Table 9 (continued)

| Z | χ_p'/X | χ_p''/X | χ_p/X | χ_a/X |
|-----|---------------------|---------------------|---------------------|-------------------|
| 75 | -1.926042777358(-6) | -6.656333435121(-3) | -6.658259477898(-3) | 1.006658259478(0) |
| 76 | -2.033819632006(-6) | -6.847289374325(-3) | -6.849323193957(-3) | 1.006849323194(0) |
| 77 | -2.146187202062(-6) | -7.041476249510(-3) | -7.043622436712(-3) | 1.007043622437(0) |
| 78 | -2.263284928889(-6) | -7.238925812528(-3) | -7.241189097457(-3) | 1.007241189097(0) |
| 79 | -2.385255123844(-6) | -7.439670528101(-3) | -7.442055783225(-3) | 1.007442055783(0) |
| 80 | -2.512243018499(-6) | -7.643743588764(-3) | -7.646255831782(-3) | 1.007646255832(0) |
| 81 | -2.644396816242(-6) | -7.851178930268(-3) | -7.853823327084(-3) | 1.007853823327(0) |
| 82 | -2.781867745274(-6) | -8.062011247453(-3) | -8.064793115199(-3) | 1.008064793115(0) |
| 83 | -2.924810113050(-6) | -8.276276010601(-3) | -8.279200820714(-3) | 1.008279200821(0) |
| 84 | -3.073381362209(-6) | -8.494009482290(-3) | -8.497082863652(-3) | 1.008497082864(0) |
| 85 | -3.227742128030(-6) | -8.715248734767(-3) | -8.718476476895(-3) | 1.008718476477(0) |
| 86 | -3.388056297461(-6) | -8.940031667856(-3) | -8.943419724154(-3) | 1.008943419724(0) |
| 87 | -3.554491069768(-6) | -9.168397027414(-3) | -9.171951518484(-3) | 1.009171951518(0) |
| 88 | -3.727217018855(-6) | -9.400384424362(-3) | -9.404111641381(-3) | 1.009404111641(0) |
| 89 | -3.906408157299(-6) | -9.636034354306(-3) | -9.639940762463(-3) | 1.009639940762(0) |
| 90 | -4.092242002157(-6) | -9.875388217766(-3) | -9.879480459768(-3) | 1.009879480460(0) |
| 91 | -4.284899642597(-6) | -1.011848834105(-2) | -1.012277324069(-2) | 1.010122773241(0) |
| 92 | -4.484565809405(-6) | -1.036537799774(-2) | -1.036986256355(-2) | 1.010369862564(0) |
| 93 | -4.691428946437(-6) | -1.061610143095(-2) | -1.062079285990(-2) | 1.010620792860(0) |
| 94 | -4.905681284063(-6) | -1.087070387616(-2) | -1.087560955744(-2) | 1.010875609557(0) |
| 95 | -5.127518914677(-6) | -1.112923158486(-2) | -1.113435910377(-2) | 1.011134359104(0) |
| 96 | -5.357141870324(-6) | -1.139173184894(-2) | -1.139708899081(-2) | 1.011397088991(0) |
| 97 | -5.594754202535(-6) | -1.165825302584(-2) | -1.166384778004(-2) | 1.011663847780(0) |
| 98 | -5.840564064408(-6) | -1.192884456450(-2) | -1.193468512857(-2) | 1.011934685129(0) |
| 99 | -6.094783795041(-6) | -1.220355703217(-2) | -1.220965181597(-2) | 1.012209651816(0) |
| 100 | -6.357630006368(-6) | -1.248244214208(-2) | -1.248879977209(-2) | 1.012488799772(0) |
| 101 | -6.629323672486(-6) | -1.276555278200(-2) | -1.277218210567(-2) | 1.012772182106(0) |
| 102 | -6.910090221563(-6) | -1.305294304376(-2) | -1.305985313398(-2) | 1.013059853134(0) |
| 103 | -7.200159630394(-6) | -1.334466825370(-2) | -1.335186841333(-2) | 1.013351868413(0) |
| 104 | -7.499766521712(-6) | -1.364078500416(-2) | -1.364828477068(-2) | 1.013648284771(0) |
| 105 | -7.809150264337(-6) | -1.394135118600(-2) | -1.394916033627(-2) | 1.013949160336(0) |
| 106 | -8.128555076252(-6) | -1.424642602220(-2) | -1.425455457728(-2) | 1.014254554577(0) |
| 107 | -8.458230130731(-6) | -1.455607010259(-2) | -1.456452833272(-2) | 1.014564528333(0) |
| 108 | -8.798429665589(-6) | -1.487034541974(-2) | -1.487914384941(-2) | 1.014879143849(0) |
| 109 | -9.149413095694(-6) | -1.518931540609(-2) | -1.519846481919(-2) | 1.015198464819(0) |
| 110 | -9.511445128832(-6) | -1.551304497231(-2) | -1.552255641744(-2) | 1.015522556417(0) |
| 111 | -9.884795885054(-6) | -1.584160054698(-2) | -1.585148534287(-2) | 1.015851485343(0) |
| 112 | -1.026974101963(-5) | -1.617505011765(-2) | -1.618531985867(-2) | 1.016185319859(0) |
| 113 | -1.066656184972(-5) | -1.651346327329(-2) | -1.652412983514(-2) | 1.016524129835(0) |
| 114 | -1.107554548492(-5) | -1.685691124826(-2) | -1.686798679374(-2) | 1.016867986794(0) |
| 115 | -1.149698496182(-5) | -1.720546696774(-2) | -1.721696395270(-2) | 1.017216963953(0) |
| 116 | -1.193117938268(-5) | -1.755920509486(-2) | -1.757113627424(-2) | 1.017571136274(0) |
| 117 | -1.237843405843(-5) | -1.791820207938(-2) | -1.793058051344(-2) | 1.017930580513(0) |
| 118 | -1.283906065615(-5) | -1.828253620820(-2) | -1.829537526886(-2) | 1.018295375269(0) |
| 119 | -1.331337735109(-5) | -1.865228765762(-2) | -1.866560103497(-2) | 1.018665601035(0) |
| 120 | -1.380170898360(-5) | -1.902753854745(-2) | -1.904134025643(-2) | 1.019041340256(0) |
| 121 | -1.430438722099(-5) | -1.940837299719(-2) | -1.942267738441(-2) | 1.019422677384(0) |
| 122 | -1.482175072449(-5) | -1.979487718411(-2) | -1.980969893484(-2) | 1.019809698935(0) |
| 123 | -1.535414532169(-5) | -2.018713940358(-2) | -2.020249354890(-2) | 1.020202493549(0) |
| 124 | -1.590192418447(-5) | -2.058525013152(-2) | -2.060115205570(-2) | 1.020601152056(0) |
| 125 | -1.646544801277(-5) | -2.098930208925(-2) | -2.100576753726(-2) | 1.021005767537(0) |
| 126 | -1.704508522431(-5) | -2.139939031069(-2) | -2.141643539591(-2) | 1.021416435396(0) |
| 127 | -1.764121215062(-5) | -2.181561221212(-2) | -2.183325342428(-2) | 1.021833253424(0) |
| 128 | -1.825421323955(-5) | -2.223806766459(-2) | -2.225632187783(-2) | 1.022256321878(0) |
| 129 | -1.888448126454(-5) | -2.266685906900(-2) | -2.268574355026(-2) | 1.022685743550(0) |
| 130 | -1.953241754088(-5) | -2.310209143414(-2) | -2.312162385169(-2) | 1.023121623852(0) |
| 131 | -2.019843214936(-5) | -2.354387245774(-2) | -2.356407088989(-2) | 1.023564070890(0) |
| 132 | -2.088294416747(-5) | -2.399231261054(-2) | -2.401319555471(-2) | 1.024013195555(0) |
| 133 | -2.158638190859(-5) | -2.444752522379(-2) | -2.446911160570(-2) | 1.024469111606(0) |
| 134 | -2.230918316937(-5) | -2.490962658010(-2) | -2.493193576327(-2) | 1.024931935763(0) |
| 135 | -2.305179548577(-5) | -2.537873600792(-2) | -2.540178780341(-2) | 1.025401787803(0) |
| 136 | -2.381467639804(-5) | -2.585497597973(-2) | -2.587879065613(-2) | 1.025878790656(0) |
| 137 | -2.459829372508(-5) | -2.633847221425(-2) | -2.636307050797(-2) | 1.026363070508(0) |



Table 10

Relative dia- and paramagnetic contributions to magnetizabilities of hydrogenlike atoms in the excited state $3d_{3/2}$ ($\mu = \pm 1/2$), obtained with $\alpha^{-1} = 137.035999084$ (CODATA 2018).

| Z | χ_p'/χ | χ_p''/χ | χ_p/χ | χ_d/χ |
|----|-------------------|---------------------|-------------------|---------------------|
| 1 | 1.000023010333(0) | 3.646856262095(-12) | 1.000023010336(0) | -2.301033632634(-5) |
| 2 | 1.000092047189(0) | 5.835517425949(-11) | 1.000092047247(0) | -9.204724717665(-5) |
| 3 | 1.000207128146(0) | 2.954692662098(-10) | 1.000207128442(0) | -2.071284419574(-4) |
| 4 | 1.000368282515(0) | 9.340332576674(-10) | 1.000368283449(0) | -3.682834489926(-4) |
| 5 | 1.000575551354(0) | 2.280996693449(-9) | 1.000575553635(0) | -5.755536345099(-4) |
| 6 | 1.000828987498(0) | 4.731502782621(-9) | 1.000828992229(0) | -8.289922292520(-4) |
| 7 | 1.001128655593(0) | 8.769259680222(-9) | 1.001128664363(0) | -1.128664362748(-3) |
| 8 | 1.001474632138(0) | 1.496699531841(-8) | 1.001474647105(0) | -1.474647105281(-3) |
| 9 | 1.001867005531(0) | 2.398699641577(-8) | 1.001867029518(0) | -1.867029517612(-3) |
| 10 | 1.002305876127(0) | 3.658173241097(-8) | 1.002305912709(0) | -2.305912708504(-3) |
| 11 | 1.002791356306(0) | 5.359456518575(-8) | 1.002791409900(0) | -2.791409900133(-3) |
| 12 | 1.003323570541(0) | 7.596054556292(-8) | 1.003323646501(0) | -3.323646501460(-3) |
| 13 | 1.003902655482(0) | 1.047072976881(-7) | 1.003902760190(0) | -3.902760189637(-3) |
| 14 | 1.004528760044(0) | 1.409559925281(-7) | 1.004528901000(0) | -4.528900999576(-3) |
| 15 | 1.005202045499(0) | 1.859224118481(-7) | 1.005202231422(0) | -5.202231421763(-3) |
| 16 | 1.005922685590(0) | 2.409181041581(-7) | 1.005922926508(0) | -5.922926508451(-3) |
| 17 | 1.006690866637(0) | 3.073516342542(-7) | 1.006691173988(0) | -6.691173988357(-3) |
| 18 | 1.007506787660(0) | 3.867299281172(-7) | 1.007507174390(0) | -7.507174390006(-3) |
| 19 | 1.008370660514(0) | 4.806597150715(-7) | 1.008371141174(0) | -8.371141173876(-3) |
| 20 | 1.009282710024(0) | 5.908490692501(-7) | 1.009283300874(0) | -9.283300873502(-3) |
| 21 | 1.010243174137(0) | 7.191090525662(-7) | 1.010243893246(0) | -1.024389324572(-2) |
| 22 | 1.011252304075(0) | 8.673554615371(-7) | 1.011253171430(0) | -1.125317143024(-2) |
| 23 | 1.012310364508(0) | 1.037610680475(-6) | 1.012311402119(0) | -1.231140211873(-2) |
| 24 | 1.013417633728(0) | 1.232005643714(-6) | 1.013418865734(0) | -1.341886573367(-2) |
| 25 | 1.014574403835(0) | 1.452781909719(-6) | 1.014575856617(0) | -1.457585661715(-2) |
| 26 | 1.015780980936(0) | 1.702293850099(-6) | 1.015782683230(0) | -1.578268322985(-2) |
| 27 | 1.017037685350(0) | 1.983010956726(-6) | 1.017039668361(0) | -1.703966836056(-2) |
| 28 | 1.018344851826(0) | 2.297520270346(-6) | 1.018347149346(0) | -1.834714934634(-2) |
| 29 | 1.019702829775(0) | 2.648528934288(-6) | 1.019705478304(0) | -1.970547830375(-2) |
| 30 | 1.021111983505(0) | 3.038866877055(-6) | 1.021115022371(0) | -2.111502237138(-2) |
| 31 | 1.022572692474(0) | 3.471489627814(-6) | 1.022576163964(0) | -2.257616396405(-2) |
| 32 | 1.024085351558(0) | 3.949481269011(-6) | 1.024089301039(0) | -2.408930103890(-2) |
| 33 | 1.025650371316(0) | 4.476057530591(-6) | 1.025654847374(0) | -2.565484737392(-2) |
| 34 | 1.027268178290(0) | 5.054569030521(-6) | 1.027273232859(0) | -2.727323285905(-2) |
| 35 | 1.028939215296(0) | 5.688504666592(-6) | 1.028944903800(0) | -2.894490380047(-2) |
| 36 | 1.030663941743(0) | 6.381495164716(-6) | 1.030670323238(0) | -3.067032323835(-2) |
| 37 | 1.032442833962(0) | 7.137316789241(-6) | 1.032449971279(0) | -3.244997127852(-2) |
| 38 | 1.034276385543(0) | 7.959895221079(-6) | 1.034284345439(0) | -3.428434543858(-2) |
| 39 | 1.036165107699(0) | 8.853309609745(-6) | 1.036173961009(0) | -3.617396100881(-2) |
| 40 | 1.038109529632(0) | 9.821796805740(-6) | 1.038119351429(0) | -3.811935142856(-2) |
| 41 | 1.040110198923(0) | 1.086975578004(-5) | 1.040121068678(0) | -4.012106867841(-2) |
| 42 | 1.042167681937(0) | 1.200175223781(-5) | 1.042179683689(0) | -4.217968368893(-2) |
| 43 | 1.044282564243(0) | 1.322252343377(-5) | 1.044295786766(0) | -4.429578676641(-2) |
| 44 | 1.046455451053(0) | 1.453698319722(-5) | 1.046469988036(0) | -4.646998803628(-2) |
| 45 | 1.048686967678(0) | 1.595022717479(-5) | 1.048702917905(0) | -4.870291790479(-2) |
| 46 | 1.050977760002(0) | 1.746753829987(-5) | 1.050995227540(0) | -5.099522753982(-2) |
| 47 | 1.053328494979(0) | 1.909439249769(-5) | 1.053347589371(0) | -5.334758937118(-2) |
| 48 | 1.055739861147(0) | 2.083646463578(-5) | 1.055760697612(0) | -5.576069761161(-2) |
| 49 | 1.058212569164(0) | 2.269963472987(-5) | 1.058235268799(0) | -5.823526879880(-2) |
| 50 | 1.060747352365(0) | 2.468999441608(-5) | 1.060772042360(0) | -6.0772042360(-2) |
| 51 | 1.063344967343(0) | 2.681385370032(-5) | 1.063371781197(0) | -6.337178119719(-2) |
| 52 | 1.066006194554(0) | 2.907774799703(-5) | 1.066035272302(0) | -6.603527230199(-2) |
| 53 | 1.068731838942(0) | 3.148844546948(-5) | 1.068763327388(0) | -6.876332738751(-2) |
| 54 | 1.071522730597(0) | 3.405295468472(-5) | 1.071556783552(0) | -7.155678355191(-2) |
| 55 | 1.074379725434(0) | 3.677853259713(-5) | 1.074416503967(0) | -7.441650396655(-2) |
| 56 | 1.077303705900(0) | 3.967269287480(-5) | 1.077343378592(0) | -7.734337859250(-2) |
| 57 | 1.080295581712(0) | 4.274321458429(-5) | 1.080338324926(0) | -8.033832492617(-2) |
| 58 | 1.083356290624(0) | 4.599815124960(-5) | 1.083402288775(0) | -8.340228877548(-2) |
| 59 | 1.086486799227(0) | 4.944584030250(-5) | 1.086536245068(0) | -8.653624506762(-2) |
| 60 | 1.089688103777(0) | 5.309491294194(-5) | 1.089741198690(0) | -8.974119868998(-2) |
| 61 | 1.092961231061(0) | 5.695430442145(-5) | 1.093018185366(0) | -9.301818536557(-2) |
| 62 | 1.096307239300(0) | 6.103326478428(-5) | 1.096368272564(0) | -9.636827256446(-2) |
| 63 | 1.099727219083(0) | 6.534137006734(-5) | 1.099792560453(0) | -9.979256045290(-2) |
| 64 | 1.10322294348(0) | 6.988853399578(-5) | 1.103292182882(0) | -1.032921828817(-1) |
| 65 | 1.106793623396(0) | 7.468502019180(-5) | 1.106868308416(0) | -1.068683084159(-1) |
| 66 | 1.110442399952(0) | 7.974145492198(-5) | 1.110522141407(0) | -1.105221414071(-1) |
| 67 | 1.114169854270(0) | 8.506884040922(-5) | 1.114254923111(0) | -1.142549231107(-1) |
| 68 | 1.117977254282(0) | 9.067856873666(-5) | 1.118067932851(0) | -1.180679328508(-1) |
| 69 | 1.121865906797(0) | 9.658243637242(-5) | 1.121962489233(0) | -1.219624892334(-1) |
| 70 | 1.125837158753(0) | 1.027926593459(-4) | 1.125939951412(0) | -1.259399514120(-1) |
| 71 | 1.129892398517(0) | 1.093218891077(-4) | 1.130001720406(0) | -1.300017204060(-1) |
| 72 | 1.134033057248(0) | 1.161832291076(-4) | 1.134149240477(0) | -1.341492404771(-1) |
| 73 | 1.138260610312(0) | 1.233902521264(-4) | 1.138384000564(0) | -1.383840005638(-1) |
| 74 | 1.142576578760(0) | 1.309570184002(-4) | 1.142707535778(0) | -1.427075357784(-1) |

(continued on next page)

Table 10 (continued)

| Z | χ_p'/χ | χ_p''/χ | χ_p/χ | χ_d/χ |
|-----|-------------------|--------------------|--------------------|---------------------|
| 75 | 1.146982530875(0) | 1.388980945770(-4) | 1.147121428970(0) | -1.471214289697(-1) |
| 76 | 1.151480083780(0) | 1.472285735491(-4) | 1.151627312353(0) | -1.516273123531(-1) |
| 77 | 1.156070905118(0) | 1.559640952064(-4) | 1.156226869213(0) | -1.562268692132(-1) |
| 78 | 1.160756714814(0) | 1.651208681577(-4) | 1.160921835682(0) | -1.609218356819(-1) |
| 79 | 1.165539286903(0) | 1.747156924731(-4) | 1.165714002595(0) | -1.657140025950(-1) |
| 80 | 1.170420451450(0) | 1.847659834988(-4) | 1.170605217433(0) | -1.706052174331(-1) |
| 81 | 1.175402096552(0) | 1.952897968032(-4) | 1.175597386349(0) | -1.755973863486(-1) |
| 82 | 1.180486170432(0) | 2.063058543152(-4) | 1.180692476287(0) | -1.806924762866(-1) |
| 83 | 1.185674683629(0) | 2.178335717178(-4) | 1.185892517201(0) | -1.858925172006(-1) |
| 84 | 1.190969711285(0) | 2.298930871662(-4) | 1.191199604372(0) | -1.911996043721(-1) |
| 85 | 1.196373395544(0) | 2.425052914040(-4) | 1.196615900836(0) | -1.966159008359(-1) |
| 86 | 1.201887948060(0) | 2.556918593526(-4) | 1.202143639920(0) | -2.021436399197(-1) |
| 87 | 1.207515652619(0) | 2.694752832579(-4) | 1.207785127902(0) | -2.077851279024(-1) |
| 88 | 1.213258867890(0) | 2.838789074810(-4) | 1.213542746798(0) | -2.135427467977(-1) |
| 89 | 1.219120030306(0) | 2.989269650251(-4) | 1.219418957271(0) | -2.194189572710(-1) |
| 90 | 1.225101657080(0) | 3.146446158991(-4) | 1.225416301696(0) | -2.254163016959(-1) |
| 91 | 1.231206349370(0) | 3.310579874213(-4) | 1.231537407358(0) | -2.315374073576(-1) |
| 92 | 1.237436795597(0) | 3.481942165780(-4) | 1.237784989813(0) | -2.377849898134(-1) |
| 93 | 1.243795774923(0) | 3.660814945538(-4) | 1.244161856417(0) | -2.441618564173(-1) |
| 94 | 1.250286160905(0) | 3.847491135639(-4) | 1.250670910019(0) | -2.506709100186(-1) |
| 95 | 1.256910925329(0) | 4.042275161229(-4) | 1.257315152845(0) | -2.573151528450(-1) |
| 96 | 1.263673142233(0) | 4.245483468965(-4) | 1.264097690580(0) | -2.640976905803(-1) |
| 97 | 1.270575992142(0) | 4.457445072905(-4) | 1.271021736649(0) | -2.710217366490(-1) |
| 98 | 1.277622766505(0) | 4.678502129445(-4) | 1.278090616718(0) | -2.780906167178(-1) |
| 99 | 1.284816872376(0) | 4.909010543060(-4) | 1.285307773430(0) | -2.853077734302(-1) |
| 100 | 1.292161837325(0) | 5.149340604766(-4) | 1.292676771385(0) | -2.926767713852(-1) |
| 101 | 1.299661314610(0) | 5.399877665318(-4) | 1.300201302377(0) | -3.002013023767(-1) |
| 102 | 1.307319088624(0) | 5.661022845333(-4) | 1.307885190908(0) | -3.078851909084(-1) |
| 103 | 1.315139080623(0) | 5.933193784663(-4) | 1.315732400002(0) | -3.157324000019(-1) |
| 104 | 1.323125354773(0) | 6.216825433519(-4) | 1.323747037316(0) | -3.237470373160(-1) |
| 105 | 1.331282124508(0) | 6.512370888027(-4) | 1.331933361597(0) | -3.319333615966(-1) |
| 106 | 1.339613759250(0) | 6.820302273090(-4) | 1.340295789477(0) | -3.402957894775(-1) |
| 107 | 1.348124791488(0) | 7.141111675656(-4) | 1.348838902656(0) | -3.488389026558(-1) |
| 108 | 1.356819924251(0) | 7.475312131696(-4) | 1.357567455465(0) | -3.575674554646(-1) |
| 109 | 1.365704039002(0) | 7.823438670473(-4) | 1.366486382870(0) | -3.664863828700(-1) |
| 110 | 1.374782203974(0) | 8.186049419937(-4) | 1.375600808916(0) | -3.756008089163(-1) |
| 111 | 1.384059682982(0) | 8.563726777373(-4) | 1.384916055659(0) | -3.849160556593(-1) |
| 112 | 1.393541944738(0) | 8.957078649755(-4) | 1.394437652603(0) | -3.944376526028(-1) |
| 113 | 1.403234672713(0) | 9.366739768600(-4) | 1.404171346689(0) | -4.041713466894(-1) |
| 114 | 1.413143775563(0) | 9.793373084481(-4) | 1.414123112872(0) | -4.141231128719(-1) |
| 115 | 1.423275398185(0) | 1.023767124677(-3) | 1.424299165309(0) | -4.242991653094(-1) |
| 116 | 1.433635933410(0) | 1.070035817464(-3) | 1.434705969228(0) | -4.347059692278(-1) |
| 117 | 1.444232034420(0) | 1.118219072576(-3) | 1.445350253493(0) | -4.453502534929(-1) |
| 118 | 1.455070627896(0) | 1.168396046977(-3) | 1.456239023943(0) | -4.562390239429(-1) |
| 119 | 1.466158927976(0) | 1.220649557397(-3) | 1.467379577533(0) | -4.673795775329(-1) |
| 120 | 1.477504451066(0) | 1.275066280948(-3) | 1.478779517347(0) | -4.787795173474(-1) |
| 121 | 1.489115031570(0) | 1.331736968662(-3) | 1.490446768539(0) | -4.904467685390(-1) |
| 122 | 1.500998838582(0) | 1.390756672891(-3) | 1.502389595255(0) | -5.023895952552(-1) |
| 123 | 1.513164393627(0) | 1.452224989589(-3) | 1.514616618617(0) | -5.146166186171(-1) |
| 124 | 1.525620589497(0) | 1.516246316561(-3) | 1.527136835814(0) | -5.271368358139(-1) |
| 125 | 1.538376710248(0) | 1.582930128828(-3) | 1.539959640377(0) | -5.399596403773(-1) |
| 126 | 1.551442452415(0) | 1.652391272293(-3) | 1.553094843687(0) | -5.530948436872(-1) |
| 127 | 1.564827947472(0) | 1.724750276963(-3) | 1.566552697749(0) | -5.665526977490(-1) |
| 128 | 1.578543785549(0) | 1.800133690861(-3) | 1.580343919240(0) | -5.803439192398(-1) |
| 129 | 1.592601040312(0) | 1.878674435656(-3) | 1.594479714748(0) | -5.944797147477(-1) |
| 130 | 1.607011294781(0) | 1.960512184482(-3) | 1.608971806966(0) | -6.089718069656(-1) |
| 131 | 1.621786667486(0) | 2.045793761238(-3) | 1.623832461248(0) | -6.238324612477(-1) |
| 132 | 1.636939837535(0) | 2.134673557599(-3) | 1.639074511092(0) | -6.390745110923(-1) |
| 133 | 1.652484064927(0) | 2.227313955708(-3) | 1.654711378883(0) | -6.547113788828(-1) |
| 134 | 1.668433195569(0) | 2.323885718695(-3) | 1.6707570812875(0) | -6.707570812875(-1) |
| 135 | 1.684801613257(0) | 2.424568209556(-3) | 1.687226181466(0) | -6.872261814661(-1) |
| 136 | 1.701603939118(0) | 2.529548695599(-3) | 1.704133487814(0) | -7.041334878139(-1) |
| 137 | 1.718850208709(0) | 2.639004946810(-3) | 1.721489213656(0) | -7.214892136557(-1) |



Table 11

Relative dia- and paramagnetic contributions to magnetizabilities of hydrogenlike atoms in the excited state $3d_{3/2}$ ($\mu = \pm 3/2$), obtained with $\alpha^{-1} = 137.035999084$ (CODATA 2018).

| Z | χ_p'/χ | χ_p''/χ | χ_p/χ | χ_d/χ |
|----|-------------------|---------------------|-------------------|---------------------|
| 1 | 1.000051774697(0) | 4.923397564896(-11) | 1.000051774746(0) | -5.177474592480(-5) |
| 2 | 1.000207129350(0) | 7.878855052924(-10) | 1.000207130138(0) | -2.071301381949(-4) |
| 3 | 1.000466155696(0) | 3.989868098027(-9) | 1.000466159686(0) | -4.661596863418(-4) |
| 4 | 1.000829006778(0) | 1.261525631864(-8) | 1.000829019393(0) | -8.290193931917(-4) |
| 5 | 1.001295897170(0) | 3.081562453750(-8) | 1.001295927986(0) | -1.295927985720(-3) |
| 6 | 1.001867103298(0) | 6.394154258041(-8) | 1.001867167239(0) | -1.867167239136(-3) |
| 7 | 1.002542963843(0) | 1.185522497928(-7) | 1.002543082395(0) | -2.543082395093(-3) |
| 8 | 1.003323880248(0) | 2.024275353440(-7) | 1.003324082675(0) | -3.324082675178(-3) |
| 9 | 1.004210317309(0) | 3.245818590348(-7) | 1.004210641891(0) | -4.210641891100(-3) |
| 10 | 1.005202803873(0) | 4.952807534595(-7) | 1.005203299153(0) | -5.203299153290(-3) |
| 11 | 1.006301933620(0) | 7.260595551516(-7) | 1.006302659680(0) | -6.302659679865(-3) |
| 12 | 1.007508365964(0) | 1.029744519332(-6) | 1.007509395708(0) | -7.509395708244(-3) |
| 13 | 1.008822827036(0) | 1.420476380122(-6) | 1.008824247512(0) | -8.824247511978(-3) |
| 14 | 1.010246110789(0) | 1.913736425597(-6) | 1.010248024526(0) | -1.024802452567(-2) |
| 15 | 1.011779080206(0) | 2.526375164927(-6) | 1.011781606581(0) | -1.178160658121(-2) |
| 16 | 1.013422668615(0) | 3.276643673023(-6) | 1.013425945259(0) | -1.3425945259(-2) |
| 17 | 1.015177881129(0) | 4.184227706739(-6) | 1.015182065357(0) | -1.518206535685(-2) |
| 18 | 1.017045796200(0) | 5.270284695717(-6) | 1.017051066485(0) | -1.705106648471(-2) |
| 19 | 1.019027567300(0) | 6.557483720511(-6) | 1.019034124783(0) | -1.903412478328(-2) |
| 20 | 1.021124424730(0) | 8.070048600704(-6) | 1.021132494778(0) | -2.113249477829(-2) |
| 21 | 1.023337677568(0) | 9.833804226425(-6) | 1.023347511372(0) | -2.334751137196(-2) |
| 22 | 1.025668715753(0) | 1.187622627799(-5) | 1.025680591979(0) | -2.5680591979(-2) |
| 23 | 1.028119012318(0) | 1.422649449047(-5) | 1.028133238813(0) | -2.813323881296(-2) |
| 24 | 1.030690125782(0) | 1.691554963285(-5) | 1.030707041332(0) | -3.070704133171(-2) |
| 25 | 1.033383702692(0) | 1.997615438502(-5) | 1.033403678847(0) | -3.340367884657(-2) |
| 26 | 1.036201480348(0) | 2.344295831078(-5) | 1.036224923306(0) | -3.622492330649(-2) |
| 27 | 1.039145289697(0) | 2.735256714034(-5) | 1.039172642264(0) | -3.917264226408(-2) |
| 28 | 1.042217058417(0) | 3.174361659294(-5) | 1.042248802034(0) | -4.224880203386(-2) |
| 29 | 1.045418814202(0) | 3.665685098804(-5) | 1.045455471053(0) | -4.545547105270(-2) |
| 30 | 1.048752688247(0) | 4.213520691316(-5) | 1.048794823454(0) | -4.879482345385(-2) |
| 31 | 1.052220918964(0) | 4.822390223690(-5) | 1.052269142866(0) | -5.226914286610(-2) |
| 32 | 1.05582585921(0) | 5.497053077882(-5) | 1.055880826451(0) | -5.588082645137(-2) |
| 33 | 1.059569964031(0) | 6.242516297128(-5) | 1.059632389194(0) | -5.963238919426(-2) |
| 34 | 1.063455828006(0) | 7.064045287540(-5) | 1.063526468459(0) | -6.352646845874(-2) |
| 35 | 1.067486157076(0) | 7.967175194077(-5) | 1.067565828828(0) | -6.756582882798(-2) |
| 36 | 1.071663790015(0) | 8.957722992990(-5) | 1.071753367245(0) | -7.175336724474(-2) |
| 37 | 1.075991700468(0) | 1.004180034610(-4) | 1.076092118471(0) | -7.609211847109(-2) |
| 38 | 1.080473002615(0) | 1.122582726589(-4) | 1.080585260888(0) | -8.058526088766(-2) |
| 39 | 1.085110957188(0) | 1.251654664428(-4) | 1.085236122654(0) | -8.523612265423(-2) |
| 40 | 1.089908977858(0) | 1.392103970226(-4) | 1.090048188255(0) | -9.004818825531(-2) |
| 41 | 1.094870638032(0) | 1.544674242195(-4) | 1.095025105456(0) | -9.502510545615(-2) |
| 42 | 1.099999678066(0) | 1.710146302805(-4) | 1.100170692697(0) | -1.001706926967(-1) |
| 43 | 1.105300012947(0) | 1.889340059064(-4) | 1.105488946953(0) | -1.105488946953(-1) |
| 44 | 1.110775740452(0) | 2.083116482764(-4) | 1.110984052100(0) | -1.109840521000(-1) |
| 45 | 1.116431149834(0) | 2.292379719154(-4) | 1.116660387806(0) | -1.166603878063(-1) |
| 46 | 1.122270731072(0) | 2.518079333205(-4) | 1.122522539005(0) | -1.225225390051(-1) |
| 47 | 1.128299184706(0) | 2.761212703436(-4) | 1.128575305976(0) | -1.285753059763(-1) |
| 48 | 1.134521432331(0) | 3.022827574081(-4) | 1.134823715089(0) | -1.348237150885(-1) |
| 49 | 1.140942627769(0) | 3.304024777341(-4) | 1.141273030246(0) | -1.412730302463(-1) |
| 50 | 1.147568168983(0) | 3.605961138463(-4) | 1.147928765097(0) | -1.479287650973(-1) |
| 51 | 1.154403710798(0) | 3.929852577525(-4) | 1.154796696056(0) | -1.547966960559(-1) |
| 52 | 1.161455178462(0) | 4.276977423021(-4) | 1.161882876205(0) | -1.618828762046(-1) |
| 53 | 1.168728782146(0) | 4.648679953705(-4) | 1.169193650142(0) | -1.691936501418(-1) |
| 54 | 1.176231032432(0) | 5.046374186639(-4) | 1.176735669850(0) | -1.767356698504(-1) |
| 55 | 1.183968756872(0) | 5.471547931033(-4) | 1.184515911666(0) | -1.845159116656(-1) |
| 56 | 1.191949117720(0) | 5.925767129281(-4) | 1.192541694433(0) | -1.925416944334(-1) |
| 57 | 1.200179630902(0) | 6.410680508602(-4) | 1.200820698953(0) | -2.008206989532(-1) |
| 58 | 1.208668186352(0) | 6.928024568896(-4) | 1.209360988808(0) | -2.093609888085(-1) |
| 59 | 1.217423069818(0) | 7.479628934899(-4) | 1.218171032712(0) | -2.181710327116(-1) |
| 60 | 1.226452986260(0) | 8.067422103430(-4) | 1.227259728470(0) | -2.272597284701(-1) |
| 61 | 1.235767084972(0) | 8.693437619529(-4) | 1.236636428733(0) | -2.366364287335(-1) |
| 62 | 1.245374986589(0) | 9.359820718673(-4) | 1.246310968660(0) | -2.463109686604(-1) |
| 63 | 1.255286812133(0) | 1.006883547594(-3) | 1.256293695680(0) | -2.562936956805(-1) |
| 64 | 1.265513214282(0) | 1.082287250719(-3) | 1.266595501533(0) | -2.665955015325(-1) |
| 65 | 1.276065411059(0) | 1.162445727198(-3) | 1.277227856787(0) | -2.772278567865(-1) |
| 66 | 1.286955222169(0) | 1.247625903301(-3) | 1.288202848072(0) | -2.882028480724(-1) |
| 67 | 1.298195108213(0) | 1.338110053285(-3) | 1.299533218266(0) | -2.995332182662(-1) |
| 68 | 1.309798213064(0) | 1.434196845510(-3) | 1.311232409910(0) | -3.112324099917(-1) |
| 69 | 1.321778409694(0) | 1.536202474432(-3) | 1.323314612169(0) | -3.233146121686(-1) |
| 70 | 1.334150349783(0) | 1.644461886752(-3) | 1.335794811670(0) | -3.357948116696(-1) |
| 71 | 1.346929517482(0) | 1.759330110891(-3) | 1.348688847593(0) | -3.486888475929(-1) |
| 72 | 1.360132287741(0) | 1.881183700014(-3) | 1.362013471441(0) | -3.620134714410(-1) |
| 73 | 1.373775989650(0) | 2.010422300006(-3) | 1.375786411950(0) | -3.757864119504(-1) |
| 74 | 1.387878975315(0) | 2.147470355095(-3) | 1.390026445670(0) | -3.900264456697(-1) |

(continued on next page)

Table 11 (continued)

| Z | χ_p'/χ | χ_p''/χ | χ_p/χ | χ_d/χ |
|-----|-------------------|--------------------|-------------------|---------------------|
| 75 | 1.402460694822(0) | 2.292778965355(-3) | 1.404753473787(0) | -4.047534737873(-1) |
| 76 | 1.417541777951(0) | 2.446827912008(-3) | 1.419988605863(0) | -4.199886058627(-1) |
| 77 | 1.433144123326(0) | 2.610127868354(-3) | 1.435754251194(0) | -4.357542511944(-1) |
| 78 | 1.449290995832(0) | 2.783222816415(-3) | 1.452074218648(0) | -4.520742186480(-1) |
| 79 | 1.466007133179(0) | 2.966692691830(-3) | 1.468973825871(0) | -4.689738258706(-1) |
| 80 | 1.483318862655(0) | 3.161156282459(-3) | 1.486480018937(0) | -4.864800189373(-1) |
| 81 | 1.501254229198(0) | 3.367274409416(-3) | 1.504621503607(0) | -5.046215036074(-1) |
| 82 | 1.519843136104(0) | 3.585753423043(-3) | 1.523428889527(0) | -5.234288895268(-1) |
| 83 | 1.539117499837(0) | 3.817349050658(-3) | 1.542934848888(0) | -5.429348488881(-1) |
| 84 | 1.559111420629(0) | 4.062870637957(-3) | 1.563174291267(0) | -5.631742912671(-1) |
| 85 | 1.579861370760(0) | 4.323185831695(-3) | 1.584184556591(0) | -5.841845565914(-1) |
| 86 | 1.601406402715(0) | 4.599225757997(-3) | 1.606005628473(0) | -6.060056284727(-1) |
| 87 | 1.623788379693(0) | 4.891990758423(-3) | 1.628680370451(0) | -6.286803704511(-1) |
| 88 | 1.647052231321(0) | 5.202556754978(-3) | 1.652254788075(0) | -6.522547880755(-1) |
| 89 | 1.671246237848(0) | 5.532082325811(-3) | 1.676778320174(0) | -6.767783201742(-1) |
| 90 | 1.696422346594(0) | 5.881816585722(-3) | 1.702304163179(0) | -7.023041631792(-1) |
| 91 | 1.722636524983(0) | 6.253107980132(-3) | 1.728889632963(0) | -7.288896329634(-1) |
| 92 | 1.749949155231(0) | 6.647414118197(-3) | 1.756596569349(0) | -7.565965693494(-1) |
| 93 | 1.778425476488(0) | 7.066312790987(-3) | 1.785491789279(0) | -7.854917892786(-1) |
| 94 | 1.808136081261(0) | 7.511514344441(-3) | 1.815647595606(0) | -8.156475956056(-1) |
| 95 | 1.839157474045(0) | 7.984875605238(-3) | 1.847142349650(0) | -8.471423496501(-1) |
| 96 | 1.871572701431(0) | 8.488415591486(-3) | 1.880061117022(0) | -8.800611170220(-1) |
| 97 | 1.905472064619(0) | 9.024333280590(-3) | 1.914496397900(0) | -9.144963979000(-1) |
| 98 | 1.940953927172(0) | 9.595027755174(-3) | 1.950548954927(0) | -9.505489549269(-1) |
| 99 | 1.978125633194(0) | 1.020312110646(-2) | 1.988328754300(0) | -9.883287543003(-1) |
| 100 | 2.017104553974(0) | 1.085148454524(-2) | 2.027956038519(0) | -1.027956038519(0) |
| 101 | 2.058019284542(0) | 1.154326825659(-2) | 2.069562552799(0) | -1.069562552799(0) |
| 102 | 2.101011015815(0) | 1.228193563933(-2) | 2.113292951454(0) | -1.113292951454(0) |
| 103 | 2.146235113134(0) | 1.307130269982(-2) | 2.159306415834(0) | -1.159306415834(0) |
| 104 | 2.193862938351(0) | 1.391558352803(-2) | 2.207778521879(0) | -1.207778521879(0) |
| 105 | 2.244083960455(0) | 1.481944297963(-2) | 2.258903403434(0) | -1.258903403434(0) |
| 106 | 2.297108209485(0) | 1.578805793174(-2) | 2.312896267417(0) | -1.312896267417(0) |
| 107 | 2.353169140691(0) | 1.682718878464(-2) | 2.369996329476(0) | -1.369996329476(0) |
| 108 | 2.412526991242(0) | 1.794326326537(-2) | 2.430470254507(0) | -1.430470254507(0) |
| 109 | 2.475472731219(0) | 1.914347507421(-2) | 2.494616206293(0) | -1.494616206293(0) |
| 110 | 2.542332735385(0) | 2.043590053354(-2) | 2.562768635918(0) | -1.562768635918(0) |
| 111 | 2.613474333914(0) | 2.182963719064(-2) | 2.635303971104(0) | -1.635303971104(0) |
| 112 | 2.689312441294(0) | 2.333496934972(-2) | 2.712647410644(0) | -1.712647410644(0) |
| 113 | 2.770317515875(0) | 2.496356684019(-2) | 2.795281082715(0) | -1.795281082715(0) |
| 114 | 2.857025172473(0) | 2.672872507417(-2) | 2.883753897547(0) | -1.883753897547(0) |
| 115 | 2.950047862936(0) | 2.864565675678(-2) | 2.978693519693(0) | -1.978693519693(0) |
| 116 | 3.050089162975(0) | 3.073184869544(-2) | 3.080821011670(0) | -2.080821011670(0) |
| 117 | 3.157961369923(0) | 3.300750130959(-2) | 3.190968871232(0) | -2.190968871232(0) |
| 118 | 3.274607342570(0) | 3.549607409929(-2) | 3.310103416669(0) | -2.310103416669(0) |
| 119 | 3.401127826022(0) | 3.822496811975(-2) | 3.439352794142(0) | -2.439352794142(0) |
| 120 | 3.538815938920(0) | 4.122638735947(-2) | 3.580042326279(0) | -2.580042326279(0) |
| 121 | 3.689201113376(0) | 4.453843623133(-2) | 3.733739549607(0) | -2.733739549607(0) |
| 122 | 3.854105655062(0) | 4.820653229487(-2) | 3.902312187357(0) | -2.902312187357(0) |
| 123 | 4.035718364836(0) | 5.228524514904(-2) | 4.088003609985(0) | -3.088003609985(0) |
| 124 | 4.236691544215(0) | 5.684071941774(-2) | 4.293532263633(0) | -3.293532263633(0) |
| 125 | 4.460270534118(0) | 6.195391036752(-2) | 4.522244444486(0) | -3.522244444486(0) |
| 126 | 4.710469269876(0) | 6.772496894350(-2) | 4.778194238819(0) | -3.778194238819(0) |
| 127 | 4.992312123462(0) | 7.427928256317(-2) | 5.066591406025(0) | -4.066591406025(0) |
| 128 | 5.312173194704(0) | 8.177595004444(-2) | 5.393949144748(0) | -4.393949144748(0) |
| 129 | 5.678262160420(0) | 9.041991733960(-2) | 5.768682077760(0) | -4.768682077760(0) |
| 130 | 6.101336268306(0) | 1.004797620410(-1) | 6.201816030346(0) | -5.201816030346(0) |
| 131 | 6.595771609328(0) | 1.123144521511(-1) | 6.708086061479(0) | -5.708086061479(0) |
| 132 | 7.181224601473(0) | 1.264148474915(-1) | 7.307639448964(0) | -6.307639448964(0) |
| 133 | 7.885301411233(0) | 1.434703779636(-1) | 8.028771789197(0) | -7.028771789197(0) |
| 134 | 8.748028929348(0) | 1.644807220762(-1) | 8.912509651424(0) | -7.912509651424(0) |
| 135 | 9.829725557824(0) | 1.909524079344(-1) | 1.002067796576(1) | -9.020677965758(0) |
| 136 | 1.122572569995(1) | 2.252666100070(-1) | 1.145099230996(1) | -1.045099230996(1) |
| 137 | 1.309610272444(1) | 2.714215865072(-1) | 1.336752431095(1) | -1.236752431095(1) |



Table 12

Relative dia- and paramagnetic contributions to magnetizabilities of hydrogenlike atoms in the excited state $3d_{5/2}$ ($\mu = \pm 1/2$), obtained with $\alpha^{-1} = 137.035\,999\,084$ (CODATA 2018).

| Z | χ_p'/χ | χ_p''/χ | χ_p/χ | χ_d/χ |
|----|--------------------|----------------------|--------------------|---------------------|
| 1 | 9.999778123338(-1) | -5.470044859032(-12) | 9.999778123283(-1) | 2.218767171571(-5) |
| 2 | 9.999112541123(-1) | -8.751743071904(-11) | 9.999112540248(-1) | 8.874597524229(-5) |
| 3 | 9.998003396644(-1) | -4.430292641491(-10) | 9.998003392213(-1) | 1.996607786658(-4) |
| 4 | 9.996450928614(-1) | -1.400068598827(-9) | 9.996450914614(-1) | 3.549085386192(-4) |
| 5 | 9.994455471027(-1) | -3.417751367396(-9) | 9.994455436850(-1) | 5.544563150050(-4) |
| 6 | 9.992017452945(-1) | -7.086074321391(-9) | 9.992017382084(-1) | 7.982617915864(-4) |
| 7 | 9.989137398233(-1) | -1.312569421413(-8) | 9.989137266976(-1) | 1.086273302424(-3) |
| 8 | 9.985815925235(-1) | -2.238765852793(-8) | 9.985815701359(-1) | 1.418429864130(-3) |
| 9 | 9.982053746392(-1) | -3.585308811298(-8) | 9.982053387861(-1) | 1.794661213908(-3) |
| 10 | 9.977851667795(-1) | -5.463281217068(-8) | 9.977851121467(-1) | 2.214887853336(-3) |
| 11 | 9.973210588691(-1) | -7.996695607898(-8) | 9.973209789021(-1) | 2.679021097850(-3) |
| 12 | 9.968131500926(-1) | -1.132244826212(-7) | 9.968130368681(-1) | 3.186963131872(-3) |
| 13 | 9.962615488332(-1) | -1.559026872426(-7) | 9.962613929305(-1) | 3.738607069530(-3) |
| 14 | 9.956663726057(-1) | -2.096266480226(-7) | 9.956661629791(-1) | 4.333837020902(-3) |
| 15 | 9.950277479849(-1) | -2.761486311080(-7) | 9.950274718363(-1) | 4.972528163727(-3) |
| 16 | 9.943458105270(-1) | -3.573474524177(-7) | 9.943454531795(-1) | 5.654546820483(-3) |
| 17 | 9.936207046870(-1) | -4.552277964833(-7) | 9.936202494592(-1) | 6.379750540789(-3) |
| 18 | 9.928525837305(-1) | -5.719194933497(-7) | 9.928520118110(-1) | 7.147988189013(-3) |
| 19 | 9.920416096397(-1) | -7.096767545157(-7) | 9.920408999630(-1) | 7.959100037020(-3) |
| 20 | 9.911879530154(-1) | -8.708773689483(-7) | 9.911870821380(-1) | 8.812917861952(-3) |
| 21 | 9.902917929729(-1) | -1.058021860258(-6) | 9.902907349511(-1) | 9.709265048945(-3) |
| 22 | 9.893533170339(-1) | -1.273732606172(-6) | 9.893520433013(-1) | 1.064795669869(-2) |
| 23 | 9.883727210132(-1) | -1.520752921497(-6) | 9.883712002603(-1) | 1.162879973969(-2) |
| 24 | 9.873502089009(-1) | -1.801946105803(-6) | 9.873484069548(-1) | 1.265159304520(-2) |
| 25 | 9.862859927399(-1) | -2.120294457110(-6) | 9.862838724454(-1) | 1.371612755457(-2) |
| 26 | 9.851802924992(-1) | -2.478898252910(-6) | 9.851778136010(-1) | 1.482218639903(-2) |
| 27 | 9.840333359429(-1) | -2.880974699886(-6) | 9.840304549682(-1) | 1.596954503175(-2) |
| 28 | 9.828453584949(-1) | -3.329856853739(-6) | 9.828420286380(-1) | 1.715797136196(-2) |
| 29 | 9.816166030994(-1) | -3.828992510571(-6) | 9.816127741069(-1) | 1.838722589311(-2) |
| 30 | 9.803473200782(-1) | -4.381943071312(-6) | 9.803429381351(-1) | 1.9657056186492(-2) |
| 31 | 9.790377669833(-1) | -4.992382380697(-6) | 9.790327746009(-1) | 2.096722539910(-2) |
| 32 | 9.776882084468(-1) | -5.664095542360(-6) | 9.776825443513(-1) | 2.231745564872(-2) |
| 33 | 9.762989160267(-1) | -6.400977711618(-6) | 9.762925150490(-1) | 2.370748495103(-2) |
| 34 | 9.748701680494(-1) | -7.207032867549(-6) | 9.748629610165(-1) | 2.513703898351(-2) |
| 35 | 9.734022494493(-1) | -8.086372566014(-6) | 9.733941630767(-1) | 2.660583692325(-2) |
| 36 | 9.718954516055(-1) | -9.043214675269(-6) | 9.718864083908(-1) | 2.81138160917(-2) |
| 37 | 9.703500721749(-1) | -1.008188209586(-5) | 9.703399902928(-1) | 2.966000970723(-2) |
| 38 | 9.687664149231(-1) | -1.120680146651(-5) | 9.687552081216(-1) | 3.124479187837(-2) |
| 39 | 9.671447895529(-1) | -1.242250185767(-5) | 9.671323670510(-1) | 3.286763294896(-2) |
| 40 | 9.654855115297(-1) | -1.373361345455(-5) | 9.654717779163(-1) | 3.452822038375(-2) |
| 41 | 9.637889019052(-1) | -1.514486623134(-5) | 9.637737570390(-1) | 3.622624296103(-2) |
| 42 | 9.620552871386(-1) | -1.666108861833(-5) | 9.620386260500(-1) | 3.796137395000(-2) |
| 43 | 9.602849989161(-1) | -1.828720616384(-5) | 9.602667117099(-1) | 3.973328829009(-2) |
| 44 | 9.584783739681(-1) | -2.002824019255(-5) | 9.584583457279(-1) | 4.154165427206(-2) |
| 45 | 9.566357538856(-1) | -2.188930646226(-5) | 9.566138645792(-1) | 4.338613542084(-2) |
| 46 | 9.547574849339(-1) | -2.387561382059(-5) | 9.547336093201(-1) | 4.526639067992(-2) |
| 47 | 9.528439178658(-1) | -2.599246286371(-5) | 9.528179254030(-1) | 4.718207459704(-2) |
| 48 | 9.508954077334(-1) | -2.824524459860(-5) | 9.508671624888(-1) | 4.913283751122(-2) |
| 49 | 9.489123136983(-1) | -3.063943911095(-5) | 9.488816742592(-1) | 5.111832574082(-2) |
| 50 | 9.468949988417(-1) | -3.318061424021(-5) | 9.468618182275(-1) | 5.313818177255(-2) |
| 51 | 9.448438299730(-1) | -3.587442426375(-5) | 9.448079555487(-1) | 5.519204445131(-2) |
| 52 | 9.427591774379(-1) | -3.872660859189(-5) | 9.427204508293(-1) | 5.727954917073(-2) |
| 53 | 9.406414149263(-1) | -4.174299047556(-5) | 9.405996719358(-1) | 5.940032806415(-2) |
| 54 | 9.384909192797(-1) | -4.492947572831(-5) | 9.384459898039(-1) | 6.155401019607(-2) |
| 55 | 9.363080702976(-1) | -4.829205146463(-5) | 9.362597782462(-1) | 6.374022175384(-2) |
| 56 | 9.340932505454(-1) | -5.183678485603(-5) | 9.340414137605(-1) | 6.595858623948(-2) |
| 57 | 9.318468451605(-1) | -5.556982190695(-5) | 9.317912753385(-1) | 6.820872466145(-2) |
| 58 | 9.295692416598(-1) | -5.949738625200(-5) | 9.295097442736(-1) | 7.049025572644(-2) |
| 59 | 9.272608297473(-1) | -6.362577797635(-5) | 9.271972039693(-1) | 7.280279603070(-2) |
| 60 | 9.249220011212(-1) | -6.796137246096(-5) | 9.248540397488(-1) | 7.514596025123(-2) |
| 61 | 9.225531492830(-1) | -7.251061925440(-5) | 9.224806386637(-1) | 7.751936133630(-2) |
| 62 | 9.201546693455(-1) | -7.728004097280(-5) | 9.200773893045(-1) | 7.992261069551(-2) |
| 63 | 9.177269578432(-1) | -8.227623222977(-5) | 9.176446816110(-1) | 8.235531838905(-2) |
| 64 | 9.152704125423(-1) | -8.750585859783(-5) | 9.151829066837(-1) | 8.481709331626(-2) |
| 65 | 9.127854322524(-1) | -9.297565560301(-5) | 9.126924565968(-1) | 8.730754340316(-2) |
| 66 | 9.102724166387(-1) | -9.869242775424(-5) | 9.101737242109(-1) | 8.982627578907(-2) |
| 67 | 9.077317660355(-1) | -1.046630476092(-4) | 9.076271029879(-1) | 9.237289701209(-2) |
| 68 | 9.051638812615(-1) | -1.108944548781(-4) | 9.050529868066(-1) | 9.494701319338(-2) |
| 69 | 9.025691634353(-1) | -1.173936555671(-4) | 9.024517697798(-1) | 9.754823022023(-2) |
| 70 | 8.999480137935(-1) | -1.241677211628(-4) | 8.998238460724(-1) | 1.001761539276(-1) |
| 71 | 8.973008335092(-1) | -1.312237878595(-4) | 8.971696097213(-1) | 1.028303902787(-1) |
| 72 | 8.946280235127(-1) | -1.385690558303(-4) | 8.944894544569(-1) | 1.055105455431(-1) |
| 73 | 8.919299843140(-1) | -1.462107885449(-4) | 8.917837735254(-1) | 1.082162264746(-1) |
| 74 | 8.892071158260(-1) | -1.541563121335(-4) | 8.890529595138(-1) | 1.109470404862(-1) |

(continued on next page)

Table 12 (continued)

| Z | χ_p'/X | χ_p''/X | χ_p/X | χ_a/X |
|-----|--------------------|---------------------|--------------------|--------------------|
| 75 | 8.864598171905(-1) | -1.624130147998(-4) | 8.862974041757(-1) | 1.137025958243(-1) |
| 76 | 8.836884866057(-1) | -1.709883462850(-4) | 8.835174982594(-1) | 1.164825017406(-1) |
| 77 | 8.808935211549(-1) | -1.798898173822(-4) | 8.807136313375(-1) | 1.192863686625(-1) |
| 78 | 8.780753166382(-1) | -1.891249995051(-4) | 8.778861916387(-1) | 1.221138083613(-1) |
| 79 | 8.752342674053(-1) | -1.987015243106(-4) | 8.750355658810(-1) | 1.249644341190(-1) |
| 80 | 8.723707661903(-1) | -2.086270833780(-4) | 8.721621391069(-1) | 1.278378608931(-1) |
| 81 | 8.694852039492(-1) | -2.189094279452(-4) | 8.692662945213(-1) | 1.307337054787(-1) |
| 82 | 8.665779696988(-1) | -2.295563687045(-4) | 8.663484133301(-1) | 1.336515866699(-1) |
| 83 | 8.636494503576(-1) | -2.405757756583(-4) | 8.634088745819(-1) | 1.365911254181(-1) |
| 84 | 8.607000305893(-1) | -2.519755780371(-4) | 8.604480550113(-1) | 1.395519449887(-1) |
| 85 | 8.577300926482(-1) | -2.637637642805(-4) | 8.574663288839(-1) | 1.425336711161(-1) |
| 86 | 8.547400162260(-1) | -2.759483820835(-4) | 8.544640678440(-1) | 1.455359321560(-1) |
| 87 | 8.517301783022(-1) | -2.885375385083(-4) | 8.514416407637(-1) | 1.485583592363(-1) |
| 88 | 8.487009529947(-1) | -3.015394001648(-4) | 8.483994135945(-1) | 1.516005864055(-1) |
| 89 | 8.456527114143(-1) | -3.149621934593(-4) | 8.453377492209(-1) | 1.546622507791(-1) |
| 90 | 8.425858215202(-1) | -3.288142049154(-4) | 8.422570073152(-1) | 1.577429926848(-1) |
| 91 | 8.395006479774(-1) | -3.431037815654(-4) | 8.391575441959(-1) | 1.608424558041(-1) |
| 92 | 8.363975520176(-1) | -3.578393314171(-4) | 8.360397126861(-1) | 1.639602873139(-1) |
| 93 | 8.332768912998(-1) | -3.730293239951(-4) | 8.329038619758(-1) | 1.670961380242(-1) |
| 94 | 8.301390197753(-1) | -3.886822909597(-4) | 8.297503374844(-1) | 1.702496625156(-1) |
| 95 | 8.269842875531(-1) | -4.048068268040(-4) | 8.265794807263(-1) | 1.734205192737(-1) |
| 96 | 8.238130407674(-1) | -4.214115896316(-4) | 8.233916291778(-1) | 1.766083708222(-1) |
| 97 | 8.206256214478(-1) | -4.385053020162(-4) | 8.201871161458(-1) | 1.798128838542(-1) |
| 98 | 8.174223673902(-1) | -4.560967519455(-4) | 8.169662706382(-1) | 1.830337293618(-1) |
| 99 | 8.142036120303(-1) | -4.741947938502(-4) | 8.137294172365(-1) | 1.86270582735(-1) |
| 100 | 8.109696843186(-1) | -4.928083497204(-4) | 8.104768759689(-1) | 1.895231240311(-1) |
| 101 | 8.077209085967(-1) | -5.119464103123(-4) | 8.072089621864(-1) | 1.927910378136(-1) |
| 102 | 8.044576044755(-1) | -5.316180364453(-4) | 8.039259864391(-1) | 1.960740135609(-1) |
| 103 | 8.011800867149(-1) | -5.518323603931(-4) | 8.006282543545(-1) | 1.993717456455(-1) |
| 104 | 7.978886651046(-1) | -5.725985873704(-4) | 7.973160665173(-1) | 2.026839334827(-1) |
| 105 | 7.945836443468(-1) | -5.939259971174(-4) | 7.939897183497(-1) | 2.060102816503(-1) |
| 106 | 7.912653239395(-1) | -6.158239455840(-4) | 7.906494999939(-1) | 2.093505000061(-1) |
| 107 | 7.879339980612(-1) | -6.383018667173(-4) | 7.872956961945(-1) | 2.127043038055(-1) |
| 108 | 7.845899554568(-1) | -6.613692743533(-4) | 7.839285861825(-1) | 2.160714138175(-1) |
| 109 | 7.812334793244(-1) | -6.850357642167(-4) | 7.805484435602(-1) | 2.194515564398(-1) |
| 110 | 7.778648472024(-1) | -7.093110160309(-4) | 7.771555361864(-1) | 2.228444638136(-1) |
| 111 | 7.744843308581(-1) | -7.342047957410(-4) | 7.737501260624(-1) | 2.262498739376(-1) |
| 112 | 7.710921961762(-1) | -7.597269578530(-4) | 7.703324692183(-1) | 2.296675307817(-1) |
| 113 | 7.676887030480(-1) | -7.858874478926(-4) | 7.669028156002(-1) | 2.330971843998(-1) |
| 114 | 7.642741052614(-1) | -8.126963049855(-4) | 7.634614089564(-1) | 2.365385910436(-1) |
| 115 | 7.608486503897(-1) | -8.401636645650(-4) | 7.600084867251(-1) | 2.399915132749(-1) |
| 116 | 7.574125796820(-1) | -8.682997612077(-4) | 7.565442799208(-1) | 2.434557200792(-1) |
| 117 | 7.539661279526(-1) | -8.971149316034(-4) | 7.530690130210(-1) | 2.469309869790(-1) |
| 118 | 7.505095234697(-1) | -9.266196176622(-4) | 7.495829038520(-1) | 2.504170961480(-1) |
| 119 | 7.470429878448(-1) | -9.568243697619(-4) | 7.460861634751(-1) | 2.539138365249(-1) |
| 120 | 7.435667359204(-1) | -9.877398501427(-4) | 7.425789960703(-1) | 2.574210039297(-1) |
| 121 | 7.400809756571(-1) | -1.019376836451(-3) | 7.390615988207(-1) | 2.609384011793(-1) |
| 122 | 7.365859080200(-1) | -1.051746225441(-3) | 7.355341617945(-1) | 2.644658382055(-1) |
| 123 | 7.330817268633(-1) | -1.084859036829(-3) | 7.319968678264(-1) | 2.680031321736(-1) |
| 124 | 7.295686188139(-1) | -1.118726417328(-3) | 7.284498923966(-1) | 2.715501076034(-1) |
| 125 | 7.260467631531(-1) | -1.153359644837(-3) | 7.248934035083(-1) | 2.751065964917(-1) |
| 126 | 7.225163316962(-1) | -1.188770132819(-3) | 7.213275615634(-1) | 2.786724384366(-1) |
| 127 | 7.189774886702(-1) | -1.224969434860(-3) | 7.177525192353(-1) | 2.822474807647(-1) |
| 128 | 7.154303905888(-1) | -1.261969249416(-3) | 7.141684213393(-1) | 2.858315786607(-1) |
| 129 | 7.118751861250(-1) | -1.299781424764(-3) | 7.105754047002(-1) | 2.894245952998(-1) |
| 130 | 7.083120159804(-1) | -1.338417964147(-3) | 7.069735980162(-1) | 2.930264019838(-1) |
| 131 | 7.047410127515(-1) | -1.377891031145(-3) | 7.033631217203(-1) | 2.966368782797(-1) |
| 132 | 7.011623007919(-1) | -1.418212955259(-3) | 6.997440878366(-1) | 3.002559121634(-1) |
| 133 | 6.975759960713(-1) | -1.459396237726(-3) | 6.961165998336(-1) | 3.038834001664(-1) |
| 134 | 6.939822060297(-1) | -1.501453557576(-3) | 6.924807524722(-1) | 3.075192475278(-1) |
| 135 | 6.903810294270(-1) | -1.544397777941(-3) | 6.888366316491(-1) | 3.111633683509(-1) |
| 136 | 6.867725561878(-1) | -1.588241952616(-3) | 6.851843142352(-1) | 3.148156857648(-1) |
| 137 | 6.831568672408(-1) | -1.632999332898(-3) | 6.815238679079(-1) | 3.184761320921(-1) |



Table 13

Relative dia- and paramagnetic contributions to magnetizabilities of hydrogenlike atoms in the excited state $3d_{5/2}$ ($\mu = \pm 3/2$), obtained with $\alpha^{-1} = 137.035999084$ (CODATA 2018).

| Z | χ_p'/χ | χ_p''/χ | χ_p/χ | χ_d/χ |
|----|--------------------|----------------------|--------------------|--------------------|
| 1 | 9.99593234278(-1) | -7.384424024217(-11) | 9.99593233540(-1) | 4.067664604819(-5) |
| 2 | 9.998373122583(-1) | -1.181397945739(-9) | 9.998373110769(-1) | 1.626889231329(-4) |
| 3 | 9.996340221108(-1) | -5.979900139531(-9) | 9.996340161309(-1) | 3.659838690606(-4) |
| 4 | 9.993495456119(-1) | -1.889533798419(-8) | 9.993495267166(-1) | 6.504732834170(-4) |
| 5 | 9.989840122861(-1) | -4.611833659430(-8) | 9.989839661677(-1) | 1.016033832271(-3) |
| 6 | 9.985375884040(-1) | -9.559841800281(-8) | 9.985374928056(-1) | 1.462507194440(-3) |
| 7 | 9.980104767876(-1) | -1.770366424555(-7) | 9.980102997510(-1) | 1.989700249013(-3) |
| 8 | 9.974029165729(-1) | -3.018766488943(-7) | 9.974026146963(-1) | 2.597385303703(-3) |
| 9 | 9.967151829305(-1) | -4.832941151174(-7) | 9.967146996364(-1) | 3.285300363569(-3) |
| 10 | 9.959475867452(-1) | -7.361846616651(-7) | 9.959468505605(-1) | 4.053149439505(-3) |
| 11 | 9.951004742544(-1) | -1.077150226953(-6) | 9.950993971041(-1) | 4.900602895851(-3) |
| 12 | 9.941742266476(-1) | -1.524483944561(-6) | 9.941727021636(-1) | 5.827297836383(-3) |
| 13 | 9.931692596257(-1) | -2.098153556862(-6) | 9.931671614721(-1) | 6.832838527860(-3) |
| 14 | 9.920860229232(-1) | -2.819783402340(-6) | 9.920832031398(-1) | 7.916796860235(-3) |
| 15 | 9.909249997924(-1) | -3.712635016985(-6) | 9.909212871574(-1) | 9.078712842571(-3) |
| 16 | 9.896867064528(-1) | -4.801586393061(-6) | 9.896819048664(-1) | 1.031809513361(-2) |
| 17 | 9.883716915040(-1) | -6.113109941288(-6) | 9.883655783941(-1) | 1.163442160590(-2) |
| 18 | 9.869805353068(-1) | -7.675249205130(-6) | 9.869728600576(-1) | 1.302713994236(-2) |
| 19 | 9.855138493305(-1) | -9.517594378283(-6) | 9.855043317361(-1) | 1.449566826392(-2) |
| 20 | 9.839722754695(-1) | -1.167125667878(-5) | 9.839606042128(-1) | 1.603939578717(-2) |
| 21 | 9.823564853311(-1) | -1.416884163528(-5) | 9.823423164895(-1) | 1.765768351053(-2) |
| 22 | 9.806671794937(-1) | -1.704442134290(-5) | 9.806501350724(-1) | 1.934986492700(-2) |
| 23 | 9.789050867394(-1) | -2.033350574803(-5) | 9.788847532337(-1) | 2.111524676630(-2) |
| 24 | 9.770709632606(-1) | -2.407301302270(-5) | 9.770468902476(-1) | 2.295310975239(-2) |
| 25 | 9.751655918433(-1) | -2.830123909100(-5) | 9.751372906042(-1) | 2.486270939578(-2) |
| 26 | 9.731897810282(-1) | -3.305782637070(-5) | 9.731567232018(-1) | 2.684327679817(-2) |
| 27 | 9.711443642512(-1) | -3.838373179482(-5) | 9.711059805194(-1) | 2.889401948058(-2) |
| 28 | 9.690301989652(-1) | -4.432119417822(-5) | 9.689858777710(-1) | 3.101412222897(-2) |
| 29 | 9.668481657443(-1) | -5.091370099526(-5) | 9.667972520433(-1) | 3.320274795674(-2) |
| 30 | 9.645991673725(-1) | -5.820595463504(-5) | 9.645409614179(-1) | 3.545903858209(-2) |
| 31 | 9.622841279191(-1) | -6.624383820076(-5) | 9.622178840809(-1) | 3.778211591911(-2) |
| 32 | 9.599039918002(-1) | -7.507438092012(-5) | 9.598289174193(-1) | 4.017108258068(-2) |
| 33 | 9.574597228315(-1) | -8.474572323353(-5) | 9.573749771083(-1) | 4.262502289171(-2) |
| 34 | 9.549523032704(-1) | -9.530708162660(-5) | 9.548569961888(-1) | 4.514300381119(-2) |
| 35 | 9.523827328518(-1) | -1.068087132730(-4) | 9.522759241385(-1) | 4.772407586147(-2) |
| 36 | 9.497520278174(-1) | -1.193018805531(-4) | 9.496327259369(-1) | 5.036727406312(-2) |
| 37 | 9.470612199415(-1) | -1.328388155140(-4) | 9.469283811260(-1) | 5.307161887399(-2) |
| 38 | 9.443113555535(-1) | -1.474726843331(-4) | 9.441638828692(-1) | 5.583611713084(-2) |
| 39 | 9.415034945597(-1) | -1.632575518504(-4) | 9.413402370078(-1) | 5.865976299218(-2) |
| 40 | 9.386387094655(-1) | -1.802483462297(-4) | 9.384584611193(-1) | 6.154153888075(-2) |
| 41 | 9.357180843995(-1) | -1.985008238097(-4) | 9.355195835757(-1) | 6.448041642427(-2) |
| 42 | 9.327427141410(-1) | -2.180715342043(-4) | 9.325246426068(-1) | 6.747535739317(-2) |
| 43 | 9.297137031519(-1) | -2.390177857096(-4) | 9.294746853662(-1) | 7.052531463376(-2) |
| 44 | 9.266321646153(-1) | -2.613976110732(-4) | 9.263707670043(-1) | 7.362923299574(-2) |
| 45 | 9.234992194810(-1) | -2.852697336812(-4) | 9.232139497474(-1) | 7.678605025265(-2) |
| 46 | 9.203159955201(-1) | -3.106935342139(-4) | 9.200053019859(-1) | 7.999469801414(-2) |
| 47 | 9.170836263890(-1) | -3.377290178225(-4) | 9.167458973712(-1) | 8.325410262885(-2) |
| 48 | 9.138032507052(-1) | -3.664367818743(-4) | 9.134368139233(-1) | 8.656318607670(-2) |
| 49 | 9.104760111345(-1) | -3.968779843135(-4) | 9.100791331502(-1) | 8.992086684980(-2) |
| 50 | 9.071030534921(-1) | -4.291143126833(-4) | 9.066739391794(-1) | 9.332606082056(-2) |
| 51 | 9.036855258574(-1) | -4.632079538498(-4) | 9.032223179036(-1) | 9.677768209642(-2) |
| 52 | 9.002245777044(-1) | -4.992215644709(-4) | 8.997253561399(-1) | 1.002746438601(-1) |
| 53 | 8.967213590480(-1) | -5.372182422462(-4) | 8.961841408057(-1) | 1.038158591943(-1) |
| 54 | 8.931770196071(-1) | -5.772614979861(-4) | 8.925997581092(-1) | 1.074002418908(-1) |
| 55 | 8.895927079861(-1) | -6.194152285327(-4) | 8.889732927575(-1) | 1.110267072425(-1) |
| 56 | 8.859695708733(-1) | -6.637436905657(-4) | 8.853058271828(-1) | 1.146941728172(-1) |
| 57 | 8.823087522605(-1) | -7.103114753215(-4) | 8.815984407852(-1) | 1.184015592148(-1) |
| 58 | 8.786113926802(-1) | -7.591834842556(-4) | 8.778522091959(-1) | 1.221477908041(-1) |
| 59 | 8.748786284644(-1) | -8.104249056709(-4) | 8.740682035587(-1) | 1.259317964413(-1) |
| 60 | 8.71115910236(-1) | -8.641011923380(-4) | 8.702474898312(-1) | 1.297525101688(-1) |
| 61 | 8.673114061470(-1) | -9.202780401265(-4) | 8.663911281069(-1) | 1.336088718931(-1) |
| 62 | 8.634791933245(-1) | -9.790213676695(-4) | 8.625001719569(-1) | 1.374998280431(-1) |
| 63 | 8.596160650899(-1) | -1.040397297075(-3) | 8.585756677929(-1) | 1.414243322071(-1) |
| 64 | 8.557231263872(-1) | -1.104472135703(-3) | 8.546186542514(-1) | 1.453813457486(-1) |
| 65 | 8.518014739581(-1) | -1.171312359022(-3) | 8.506301615991(-1) | 1.493698384009(-1) |
| 66 | 8.478521957535(-1) | -1.240984594551(-3) | 8.466112111589(-1) | 1.533887888411(-1) |
| 67 | 8.438763703661(-1) | -1.313555606905(-3) | 8.425628147592(-1) | 1.574371852408(-1) |
| 68 | 8.398750664870(-1) | -1.389092283949(-3) | 8.384859742030(-1) | 1.615140257970(-1) |
| 69 | 8.358493423840(-1) | -1.467661624061(-3) | 8.343816807600(-1) | 1.656183192400(-1) |
| 70 | 8.318002454039(-1) | -1.549330724525(-3) | 8.302509146793(-1) | 1.697490853207(-1) |
| 71 | 8.277288114959(-1) | -1.634166771037(-3) | 8.260946447249(-1) | 1.739053552751(-1) |
| 72 | 8.236360647595(-1) | -1.722237028344(-3) | 8.219138277312(-1) | 1.780861722688(-1) |
| 73 | 8.195230170130(-1) | -1.813608832008(-3) | 8.177094081810(-1) | 1.822905918190(-1) |
| 74 | 8.153906673855(-1) | -1.908349581294(-3) | 8.134823178042(-1) | 1.865176821958(-1) |

(continued on next page)

Table 13 (continued)

| Z | χ_p'/X | χ_p''/X | χ_p/X | χ_d/X |
|-----|--------------------|---------------------|--------------------|--------------------|
| 75 | 8.112400019308(-1) | -2.006526733189(-3) | 8.092334751976(-1) | 1.907665248024(-1) |
| 76 | 8.070719932626(-1) | -2.108207797538(-3) | 8.049637854651(-1) | 1.950362145349(-1) |
| 77 | 8.028876002120(-1) | -2.213460333301(-3) | 8.006741398787(-1) | 1.993258601213(-1) |
| 78 | 7.986877675058(-1) | -2.322351945929(-3) | 7.963654155598(-1) | 2.036345844402(-1) |
| 79 | 7.944734254656(-1) | -2.434950285841(-3) | 7.920384751798(-1) | 2.079615248202(-1) |
| 80 | 7.902454897283(-1) | -2.551323048015(-3) | 7.876941666803(-1) | 2.123058333197(-1) |
| 81 | 7.860048609858(-1) | -2.671537972668(-3) | 7.833333230131(-1) | 2.166666769869(-1) |
| 82 | 7.817524247450(-1) | -2.795662847029(-3) | 7.789567618980(-1) | 2.210432381020(-1) |
| 83 | 7.774890511076(-1) | -2.923765508198(-3) | 7.745652855994(-1) | 2.254347144006(-1) |
| 84 | 7.732155945676(-1) | -3.055913847069(-3) | 7.701596807205(-1) | 2.298403192795(-1) |
| 85 | 7.689328938287(-1) | -3.192175813334(-3) | 7.657407180154(-1) | 2.342592819846(-1) |
| 86 | 7.646417716388(-1) | -3.332619421528(-3) | 7.613091522172(-1) | 2.386908477828(-1) |
| 87 | 7.603430346421(-1) | -3.477312758136(-3) | 7.568657218839(-1) | 2.431342781161(-1) |
| 88 | 7.560374732486(-1) | -3.626323989732(-3) | 7.524111492589(-1) | 2.475888507411(-1) |
| 89 | 7.517258615201(-1) | -3.779721372150(-3) | 7.479461401479(-1) | 2.520538598521(-1) |
| 90 | 7.474089570710(-1) | -3.937573260680(-3) | 7.434713838104(-1) | 2.565286161896(-1) |
| 91 | 7.430875009868(-1) | -4.099948121273(-3) | 7.389875528655(-1) | 2.610124471345(-1) |
| 92 | 7.387622177550(-1) | -4.266914542758(-3) | 7.344953032122(-1) | 2.655046967878(-1) |
| 93 | 7.344338152123(-1) | -4.438541250043(-3) | 7.299952739623(-1) | 2.700047260377(-1) |
| 94 | 7.301029845047(-1) | -4.614897118320(-3) | 7.254880873864(-1) | 2.745119126136(-1) |
| 95 | 7.257704000608(-1) | -4.796051188245(-3) | 7.209743488725(-1) | 2.790256511275(-1) |
| 96 | 7.214367195783(-1) | -4.982072682087(-3) | 7.164546468962(-1) | 2.835453531038(-1) |
| 97 | 7.171025840223(-1) | -5.173031020856(-3) | 7.119295530015(-1) | 2.880704469985(-1) |
| 98 | 7.127686176357(-1) | -5.368995842390(-3) | 7.073996217933(-1) | 2.926003782067(-1) |
| 99 | 7.084354279594(-1) | -5.570037020397(-3) | 7.028653909390(-1) | 2.971346090610(-1) |
| 100 | 7.041036058650(-1) | -5.776224684454(-3) | 6.983273811806(-1) | 3.016726188194(-1) |
| 101 | 6.997737255955(-1) | -5.987629240957(-3) | 6.937860963546(-1) | 3.062139036454(-1) |
| 102 | 6.954463448167(-1) | -6.204321395021(-3) | 6.892420234217(-1) | 3.107579765783(-1) |
| 103 | 6.911220046768(-1) | -6.426372173320(-3) | 6.846956325035(-1) | 3.153043674965(-1) |
| 104 | 6.868012298747(-1) | -6.653852947880(-3) | 6.801473769268(-1) | 3.198526230732(-1) |
| 105 | 6.824845287361(-1) | -6.886835460817(-3) | 6.755976932753(-1) | 3.244023067247(-1) |
| 106 | 6.781723932964(-1) | -7.125391850025(-3) | 6.710470014463(-1) | 3.289529985537(-1) |
| 107 | 6.738652993909(-1) | -7.369594675813(-3) | 6.664957047151(-1) | 3.335042952849(-1) |
| 108 | 6.695637067514(-1) | -7.619516948501(-3) | 6.619441898029(-1) | 3.380558101971(-1) |
| 109 | 6.652680591075(-1) | -7.875232156976(-3) | 6.573928269505(-1) | 3.426071730495(-1) |
| 110 | 6.609787842943(-1) | -8.136814298221(-3) | 6.528419699961(-1) | 3.471580300039(-1) |
| 111 | 6.566962943643(-1) | -8.404337907816(-3) | 6.482919564565(-1) | 3.517080435435(-1) |
| 112 | 6.524209857035(-1) | -8.677878091428(-3) | 6.437431076121(-1) | 3.562568923879(-1) |
| 113 | 6.481532391517(-1) | -8.957510557307(-3) | 6.391957285943(-1) | 3.608042714057(-1) |
| 114 | 6.438934201252(-1) | -9.243311649782(-3) | 6.346501084754(-1) | 3.653498915246(-1) |
| 115 | 6.396418787437(-1) | -9.535358383797(-3) | 6.301065203599(-1) | 3.698934796401(-1) |
| 116 | 6.353989499582(-1) | -9.833728480485(-3) | 6.255652214778(-1) | 3.74434785222(-1) |
| 117 | 6.311649536820(-1) | -1.013850040381(-2) | 6.210264532782(-1) | 3.789735467218(-1) |
| 118 | 6.269401949222(-1) | -1.044975339827(-2) | 6.164904415239(-1) | 3.835095584761(-1) |
| 119 | 6.227249639127(-1) | -1.076756752778(-2) | 6.119573963849(-1) | 3.880426036151(-1) |
| 120 | 6.185195362484(-1) | -1.109202371557(-2) | 6.074275125328(-1) | 3.925724874672(-1) |
| 121 | 6.143241730182(-1) | -1.142320378535(-2) | 6.029009692329(-1) | 3.970990307671(-1) |
| 122 | 6.101391209394(-1) | -1.176119050361(-2) | 5.983779304358(-1) | 4.016220695642(-1) |
| 123 | 6.059646124901(-1) | -1.210606762315(-2) | 5.938585448669(-1) | 4.061414551331(-1) |
| 124 | 6.018008660412(-1) | -1.245791992789(-2) | 5.893429461133(-1) | 4.106570538867(-1) |
| 125 | 5.976480859872(-1) | -1.281683327892(-2) | 5.848312527083(-1) | 4.151687472917(-1) |
| 126 | 5.935064628746(-1) | -1.318289466195(-2) | 5.803235682127(-1) | 4.196764317873(-1) |
| 127 | 5.893761735285(-1) | -1.355619223609(-2) | 5.758199812924(-1) | 4.241800187076(-1) |
| 128 | 5.852573811760(-1) | -1.393681538407(-2) | 5.713205657919(-1) | 4.286794342081(-1) |
| 129 | 5.811502355675(-1) | -1.432485476393(-2) | 5.668253808036(-1) | 4.331746191964(-1) |
| 130 | 5.770548730936(-1) | -1.472040236223(-2) | 5.623344707314(-1) | 4.376655292686(-1) |
| 131 | 5.729714168992(-1) | -1.512355154888(-2) | 5.578478653503(-1) | 4.421521346497(-1) |
| 132 | 5.688999769922(-1) | -1.553439713354(-2) | 5.533655798586(-1) | 4.466344201414(-1) |
| 133 | 5.648406503490(-1) | -1.595303542379(-2) | 5.488876149252(-1) | 4.511123850748(-1) |
| 134 | 5.607935210143(-1) | -1.637956428506(-2) | 5.444139567292(-1) | 4.555860432708(-1) |
| 135 | 5.567586601950(-1) | -1.681408320237(-2) | 5.399445769927(-1) | 4.600554230073(-1) |
| 136 | 5.527361263501(-1) | -1.725669334406(-2) | 5.354794330060(-1) | 4.645205669940(-1) |
| 137 | 5.487259652723(-1) | -1.770749762746(-2) | 5.310184676448(-1) | 4.689815323552(-1) |



Table 14

Relative dia- and paramagnetic contributions to magnetizabilities of hydrogenlike atoms in the excited state $3d_{5/2}$ ($\mu = \pm 5/2$), obtained with $\alpha^{-1} = 137.035999084$ (CODATA 2018).

| Z | χ_p'/χ | χ_p''/χ | χ_p/χ | χ_d/χ |
|----|----------------------|---------------------|---------------------|-------------------|
| 1 | -3.236280289539(-14) | -3.698043551561(-6) | -3.698043583924(-6) | 1.00003698044(0) |
| 2 | -5.178261931528(-13) | -1.479256807213(-5) | -1.479256858996(-5) | 1.000014792569(0) |
| 3 | -2.621675231832(-12) | -3.328475526576(-5) | -3.328475788744(-5) | 1.000033284758(0) |
| 4 | -8.286585502781(-12) | -5.917657499383(-5) | -5.917658328042(-5) | 1.000059176583(0) |
| 5 | -2.023342416575(-11) | -9.247078580723(-5) | -9.247080604066(-5) | 1.000092470806(0) |
| 6 | -4.196237209107(-11) | -1.331709356918(-4) | -1.331709776541(-4) | 1.000133170978(0) |
| 7 | -7.775436773679(-11) | -1.812813630271(-4) | -1.812814407815(-4) | 1.000181281441(0) |
| 8 | -1.326728736192(-10) | -2.368071977600(-4) | -2.368073304329(-4) | 1.000236807330(0) |
| 9 | -2.125659664182(-10) | -2.997543627921(-4) | -2.997545753581(-4) | 1.000299754575(0) |
| 10 | -3.240687519499(-10) | -3.701295755830(-4) | -3.701298996518(-4) | 1.000370129900(0) |
| 11 | -4.746061064329(-10) | -4.479403499701(-4) | -4.479408245762(-4) | 1.000447940825(0) |
| 12 | -6.723957456662(-10) | -5.331949982045(-4) | -5.331956706002(-4) | 1.000533195671(0) |
| 13 | -9.264516239345(-10) | -6.259026332066(-4) | -6.259035596582(-4) | 1.000625903560(0) |
| 14 | -1.246587664652(-9) | -7.260731710395(-4) | -7.260744176271(-4) | 1.000726074418(0) |
| 15 | -1.643421824951(-9) | -8.337173336041(-4) | -8.337189770259(-4) | 1.000833718977(0) |
| 16 | -2.128380496637(-9) | -9.488466515556(-4) | -9.488487799361(-4) | 1.000948848780(0) |
| 17 | -2.713703246102(-9) | -1.071473467444(-3) | -1.071476181147(-3) | 1.001071476181(0) |
| 18 | -3.412447896042(-9) | -1.201610939077(-3) | -1.201614351525(-3) | 1.001201614352(0) |
| 19 | -4.238495951978(-9) | -1.339273043117(-3) | -1.339277281613(-3) | 1.001339277282(0) |
| 20 | -5.206558376832(-9) | -1.484474578897(-3) | -1.484479785455(-3) | 1.001484479785(0) |
| 21 | -6.332181717001(-9) | -1.637231172472(-3) | -1.637237504653(-3) | 1.001637237505(0) |
| 22 | -7.631754583596(-9) | -1.797559280906(-3) | -1.797566912660(-3) | 1.001797566913(0) |
| 23 | -9.122514492720(-9) | -1.965476196788(-3) | -1.965485319303(-3) | 1.001965485319(0) |
| 24 | -1.082255506891(-8) | -2.141000052990(-3) | -2.141010875545(-3) | 1.002141010876(0) |
| 25 | -1.275083361607(-8) | -2.324149827662(-3) | -2.324162578496(-3) | 1.002324162578(0) |
| 26 | -1.492717906040(-8) | -2.514945349468(-3) | -2.514960276647(-3) | 1.002514960277(0) |
| 27 | -1.737230027029(-8) | -2.713407303072(-3) | -2.713424675372(-3) | 1.002713424675(0) |
| 28 | -2.010779475794(-8) | -2.919557234867(-3) | -2.919577342662(-3) | 1.002919577343(0) |
| 29 | -2.315615776828(-8) | -3.133417558960(-3) | -3.133440715117(-3) | 1.003133440715(0) |
| 30 | -2.654079176049(-8) | -3.355011563402(-3) | -3.355038104194(-3) | 1.003355038104(0) |
| 31 | -3.028601628805(-8) | -3.584363416687(-3) | -3.584393702703(-3) | 1.003584393703(0) |
| 32 | -3.441707828325(-8) | -3.821498174504(-3) | -3.821532591582(-3) | 1.003821532592(0) |
| 33 | -3.896016275252(-8) | -4.066441786753(-3) | -4.066480746915(-3) | 1.004066480747(0) |
| 34 | -4.394240388920(-8) | -4.319221104834(-3) | -4.319265047238(-3) | 1.004319265047(0) |
| 35 | -4.939189661045(-8) | -4.579863889205(-3) | -4.579913281101(-3) | 1.004579913281(0) |
| 36 | -5.533770852559(-8) | -4.848398817214(-3) | -4.848454154923(-3) | 1.004848454155(0) |
| 37 | -6.180989234317(-8) | -5.124855491218(-3) | -5.124917301110(-3) | 1.005124917301(0) |
| 38 | -6.883949872459(-8) | -5.409264446974(-3) | -5.409333286473(-3) | 1.005409332866(0) |
| 39 | -7.645858959216(-8) | -5.701657162336(-3) | -5.701733620926(-3) | 1.005701733621(0) |
| 40 | -8.470025190003(-8) | -6.002066066230(-3) | -6.002150766482(-3) | 1.006002150766(0) |
| 41 | -9.359861187663(-8) | -6.310524547937(-3) | -6.310618146549(-3) | 1.006310618147(0) |
| 42 | -1.031888497475(-7) | -6.627066966677(-3) | -6.627170155527(-3) | 1.006627170156(0) |
| 43 | -1.135072149478(-7) | -6.951728661501(-3) | -6.951842168716(-3) | 1.006951842169(0) |
| 44 | -1.245910418345(-7) | -7.284545961500(-3) | -7.284670552542(-3) | 1.007284670553(0) |
| 45 | -1.364787659078(-7) | -7.625556196329(-3) | -7.625692675095(-3) | 1.007625692675(0) |
| 46 | -1.492099405521(-7) | -7.974797707066(-3) | -7.974946917007(-3) | 1.007974946917(0) |
| 47 | -1.628252543076(-7) | -8.332309857391(-3) | -8.332472682645(-3) | 1.008332472683(0) |
| 48 | -1.773665486842(-7) | -8.698133045113(-3) | -8.698310411662(-3) | 1.008698310412(0) |
| 49 | -1.928768365274(-7) | -9.072308714036(-3) | -9.072501590873(-3) | 1.009072501591(0) |
| 50 | -2.094003209496(-7) | -9.454879366181(-3) | -9.455088766502(-3) | 1.009455088767(0) |
| 51 | -2.269824148398(-7) | -9.845888574359(-3) | -9.846115556774(-3) | 1.009846115557(0) |
| 52 | -2.456697609618(-7) | -1.024538099512(-2) | -1.024562666488(-2) | 1.010245626665(0) |
| 53 | -2.655102526569(-7) | -1.065340238206(-2) | -1.065366789231(-2) | 1.010653667892(0) |
| 54 | -2.865530551633(-7) | -1.106999959952(-2) | -1.107028615258(-2) | 1.011070286153(0) |
| 55 | -3.088486275666(-7) | -1.149522063669(-2) | -1.149552948532(-2) | 1.011495529485(0) |
| 56 | -3.324487453959(-7) | -1.192911462205(-2) | -1.192944707080(-2) | 1.011929447071(0) |
| 57 | -3.574065238811(-7) | -1.237173183829(-2) | -1.237208924482(-2) | 1.012372089245(0) |
| 58 | -3.837764418863(-7) | -1.282312373760(-2) | -1.282350751404(-2) | 1.012823507514(0) |
| 59 | -4.116143665361(-7) | -1.328334295737(-2) | -1.328375457174(-2) | 1.013283754572(0) |
| 60 | -4.409775785512(-7) | -1.375244333639(-2) | -1.375288431397(-2) | 1.013752884314(0) |
| 61 | -4.719247983102(-7) | -1.423047993140(-2) | -1.423095185620(-2) | 1.014230951856(0) |
| 62 | -5.045162126562(-7) | -1.471750903416(-2) | -1.471801355038(-2) | 1.014718013550(0) |
| 63 | -5.388135024661(-7) | -1.521358818898(-2) | -1.521412700248(-2) | 1.015214127002(0) |
| 64 | -5.748798710019(-7) | -1.571877621063(-2) | -1.571935109050(-2) | 1.015719351090(0) |
| 65 | -6.127800730635(-7) | -1.623313320288(-2) | -1.623374598296(-2) | 1.016233745983(0) |
| 66 | -6.525804449631(-7) | -1.675672057744(-2) | -1.675737315789(-2) | 1.016757373158(0) |
| 67 | -6.943489353434(-7) | -1.728960107339(-2) | -1.729029542233(-2) | 1.017290295422(0) |
| 68 | -7.381551368598(-7) | -1.783183877720(-2) | -1.783257693234(-2) | 1.017832576932(0) |
| 69 | -7.840703187499(-7) | -1.838349914324(-2) | -1.838428321356(-2) | 1.018384283214(0) |
| 70 | -8.321674603138(-7) | -1.894464901482(-2) | -1.894548118228(-2) | 1.018945481182(0) |
| 71 | -8.825212853286(-7) | -1.951535664581(-2) | -1.951623916709(-2) | 1.019516239167(0) |
| 72 | -9.352082974217(-7) | -2.009569172284(-2) | -2.009662693114(-2) | 1.020096626931(0) |
| 73 | -9.903068164298(-7) | -2.068572538807(-2) | -2.068671569489(-2) | 1.020686715695(0) |
| 74 | -1.047897015768(-6) | -2.128553026254(-2) | -2.128657815955(-2) | 1.021286578160(0) |

(continued on next page)

Table 14 (continued)

| Z | χ_p'/X | χ_p''/X | χ_p/X | χ_a/X |
|-----|---------------------|---------------------|---------------------|-------------------|
| 75 | -1.108060960841(-6) | -2.189518047014(-2) | -2.189628853110(-2) | 1.021896288531(0) |
| 76 | -1.170882648513(-6) | -2.251475166227(-2) | -2.251592254492(-2) | 1.022515922545(0) |
| 77 | -1.236448047688(-6) | -2.314432104308(-2) | -2.314555749112(-2) | 1.023145557491(0) |
| 78 | -1.304845141001(-6) | -2.378396739536(-2) | -2.378527224050(-2) | 1.023785272240(0) |
| 79 | -1.376163967679(-6) | -2.443377110718(-2) | -2.443514727115(-2) | 1.024435147271(0) |
| 80 | -1.450496667584(-6) | -2.509381419918(-2) | -2.509526469585(-2) | 1.025095264696(0) |
| 81 | -1.527937526489(-6) | -2.576418035258(-2) | -2.576570829010(-2) | 1.025765708290(0) |
| 82 | -1.608583022601(-6) | -2.644495493791(-2) | -2.644656352093(-2) | 1.026446563521(0) |
| 83 | -1.692531874385(-6) | -2.713622504456(-2) | -2.713791757644(-2) | 1.027137917576(0) |
| 84 | -1.779885089720(-6) | -2.783807951102(-2) | -2.783985939611(-2) | 1.027839859396(0) |
| 85 | -1.870746016419(-6) | -2.855060895597(-2) | -2.855247970198(-2) | 1.028552479702(0) |
| 86 | -1.965220394161(-6) | -2.927390581014(-2) | -2.927587103054(-2) | 1.029275871031(0) |
| 87 | -2.063416407874(-6) | -3.000806434911(-2) | -3.001012776551(-2) | 1.030010127766(0) |
| 88 | -2.165444742604(-6) | -3.075318072681(-2) | -3.075534617155(-2) | 1.030755346172(0) |
| 89 | -2.271418639930(-6) | -3.150935301008(-2) | -3.151162442872(-2) | 1.031511624429(0) |
| 90 | -2.381453955948(-6) | -3.227668121401(-2) | -3.227906266797(-2) | 1.032279062668(0) |
| 91 | -2.495669220893(-6) | -3.305526733828(-2) | -3.305776300750(-2) | 1.033057763008(0) |
| 92 | -2.614185700431(-6) | -3.384521540445(-2) | -3.384782959015(-2) | 1.033847829590(0) |
| 93 | -2.737127458683(-6) | -3.464663149423(-2) | -3.464936862169(-2) | 1.034649368622(0) |
| 94 | -2.864621423023(-6) | -3.545962378879(-2) | -3.546248841021(-2) | 1.035462488410(0) |
| 95 | -2.996797450712(-6) | -3.628430260908(-2) | -3.628729940653(-2) | 1.036287299407(0) |
| 96 | -3.133788397416(-6) | -3.712078045727(-2) | -3.712391424567(-2) | 1.037123914246(0) |
| 97 | -3.275730187678(-6) | -3.796917205927(-2) | -3.797244778946(-2) | 1.037972447789(0) |
| 98 | -3.422761887386(-6) | -3.882959440841(-2) | -3.883301717030(-2) | 1.038833017170(0) |
| 99 | -3.575025778314(-6) | -3.970216681025(-2) | -3.970574183603(-2) | 1.039705741836(0) |
| 100 | -3.732667434797(-6) | -4.058701092869(-2) | -4.059074359612(-2) | 1.040590743596(0) |
| 101 | -3.895835802595(-6) | -4.148425083319(-2) | -4.148814666899(-2) | 1.041488146669(0) |
| 102 | -4.064683280038(-6) | -4.239401304743(-2) | -4.239807773071(-2) | 1.042398077731(0) |
| 103 | -4.239365801491(-6) | -4.331642659914(-2) | -4.332066596494(-2) | 1.043320665965(0) |
| 104 | -4.420042923250(-6) | -4.425162307139(-2) | -4.425604311431(-2) | 1.044256043114(0) |
| 105 | -4.606877911912(-6) | -4.519973665524(-2) | -4.520434353316(-2) | 1.045204343533(0) |
| 106 | -4.800037835320(-6) | -4.616090420386(-2) | -4.616570424170(-2) | 1.046165704242(0) |
| 107 | -4.999693656156(-6) | -4.713526528808(-2) | -4.714026498174(-2) | 1.047140264982(0) |
| 108 | -5.206020328270(-6) | -4.812296225354(-2) | -4.812816827387(-2) | 1.048128168274(0) |
| 109 | -5.419196895833(-6) | -4.912414027936(-2) | -4.912955947626(-2) | 1.049129559476(0) |
| 110 | -5.639406595408(-6) | -5.013894743853(-2) | -5.014458684513(-2) | 1.050144586845(0) |
| 111 | -5.866836961024(-6) | -5.116753475986(-2) | -5.117340159682(-2) | 1.051173401597(0) |
| 112 | -6.101679932369(-6) | -5.221005629173(-2) | -5.221615797166(-2) | 1.052216157972(0) |
| 113 | -6.344131966188(-6) | -5.326666916767(-2) | -5.327301329964(-2) | 1.053273013300(0) |
| 114 | -6.594394151007(-6) | -5.433753367369(-2) | -5.434412806784(-2) | 1.054344128068(0) |
| 115 | -6.852672325272(-6) | -5.542281331755(-2) | -5.542966598987(-2) | 1.055429665990(0) |
| 116 | -7.119177199050(-6) | -5.652267490004(-2) | -5.652979407724(-2) | 1.056529794077(0) |
| 117 | -7.394124479371(-6) | -5.763728858824(-2) | -5.764468271271(-2) | 1.057644682713(0) |
| 118 | -7.677734999376(-6) | -5.876682799084(-2) | -5.877450572583(-2) | 1.058774505726(0) |
| 119 | -7.970234851359(-6) | -5.991147023571(-2) | -5.991944047056(-2) | 1.059919440471(0) |
| 120 | -8.271855523874(-6) | -6.107139604965(-2) | -6.107966790517(-2) | 1.061079667905(0) |
| 121 | -8.582834043013(-6) | -6.224678984042(-2) | -6.225537267446(-2) | 1.062255372674(0) |
| 122 | -8.903413118018(-6) | -6.343783978118(-2) | -6.344674319430(-2) | 1.063446743194(0) |
| 123 | -9.233841291376(-6) | -6.464473789744(-2) | -6.465397173874(-2) | 1.064653971739(0) |
| 124 | -9.574373093538(-6) | -6.586768015644(-2) | -6.587725452954(-2) | 1.065877254530(0) |
| 125 | -9.925269202441(-6) | -6.710686655925(-2) | -6.711679182845(-2) | 1.067116791828(0) |
| 126 | -1.028679660799(-5) | -6.836250123554(-2) | -6.837278803215(-2) | 1.068372788032(0) |
| 127 | -1.065922878167(-5) | -6.963479254118(-2) | -6.964545176997(-2) | 1.069645451770(0) |
| 128 | -1.104284585148(-5) | -7.092395315876(-2) | -7.093499600461(-2) | 1.070934996005(0) |
| 129 | -1.143793478241(-5) | -7.223020020104(-2) | -7.224163813582(-2) | 1.072241638136(0) |
| 130 | -1.184478956255(-5) | -7.35537531759(-2) | -7.356560010715(-2) | 1.073565600107(0) |
| 131 | -1.226371139514(-5) | -7.489484480461(-2) | -7.490710851600(-2) | 1.074907108516(0) |
| 132 | -1.269500889680(-5) | -7.625369971805(-2) | -7.626639472695(-2) | 1.076266394727(0) |
| 133 | -1.313899830200(-5) | -7.763055599025(-2) | -7.764369498856(-2) | 1.077643694989(0) |
| 134 | -1.359600367416(-5) | -7.902565455004(-2) | -7.903925055372(-2) | 1.079039250554(0) |
| 135 | -1.406635712360(-5) | -8.043924144661(-2) | -8.045330780373(-2) | 1.080453307804(0) |
| 136 | -1.455039903242(-5) | -8.187156797715(-2) | -8.188611837618(-2) | 1.081886118376(0) |
| 137 | -1.504847828690(-5) | -8.332289081852(-2) | -8.333793929681(-2) | 1.083337939297(0) |



Table 15

Relativistic total magnetizabilities $\chi = \chi_d + \chi_p$ (in the units of $\alpha^2 a_0^3$) for states $1s_{1/2}$, $2s_{1/2}$, $2p_{1/2}$ and $2p_{3/2}$ of selected hydrogenlike ions, obtained with $\alpha^{-1} = 137.035\,999\,139$ (CODATA 2014) [the upper entries] and with $\alpha^{-1} = 137.035\,999\,084$ (CODATA 2018) [the lower entries].

| Z | $1s_{1/2}$ | $2s_{1/2}$ | $2p_{1/2}$ | $2p_{3/2} (\mu = \pm 1/2)$ | $2p_{3/2} (\mu = \pm 3/2)$ |
|-----|------------------------|-------------------------|------------------------|----------------------------|----------------------------|
| 1 | -4.999 644 993 669(-1) | -6.999 722 649 147(+ 0) | 6.676 163 152 752(+ 4) | -6.677 063 123 774(+ 4) | -5.999 861 546 894(+ 0) |
| | -4.999 644 993 668(-1) | -6.999 722 649 147(+ 0) | 6.676 163 147 392(+ 4) | -6.677 063 118 415(+ 4) | -5.999 861 546 894(+ 0) |
| 2 | -1.249 645 001 764(-1) | -1.749 722 649 002(+ 0) | 4.171 164 660 772(+ 3) | -4.173 414 370 995(+ 3) | -1.499 861 548 141(+ 0) |
| | -1.249 645 001 764(-1) | -1.749 722 649 002(+ 0) | 4.171 164 657 423(+ 3) | -4.173 414 367 645(+ 3) | -1.499 861 548 141(+ 0) |
| 5 | -1.996 450 584 458(-2) | -2.797 226 479 764(-1) | 1.065 244 131 032(+ 2) | -1.068 841 233 198(+ 2) | -2.398 615 568 695(-1) |
| | -1.996 450 584 456(-2) | -2.797 226 479 762(-1) | 1.065 244 130 174(+ 2) | -1.068 841 232 340(+ 2) | -2.398 615 568 694(-1) |
| 7 | -1.016 859 395 768(-2) | -1.425 797 896 419(-1) | 2.765 269 415 830(+ 1) | -2.783 607 783 733(+ 1) | -1.223 105 464 382(-1) |
| | -1.016 859 395 765(-2) | -1.425 797 896 417(-1) | 2.765 269 413 598(+ 1) | -2.783 607 781 500(+ 1) | -1.223 105 464 381(-1) |
| 10 | -4.964 526 105 003(-3) | -6.972 264 418 235(-2) | 6.600 466 097 095(+ 0) | -6.690 176 291 750(+ 0) | -5.986 158 805 136(-2) |
| | -4.964 526 104 975(-3) | -6.972 264 418 212(-2) | 6.600 466 091 735(+ 0) | -6.690 176 286 391(+ 0) | -5.986 158 805 125(-2) |
| 20 | -1.214 607 414 490(-3) | -1.722 262 691 678(-2) | 3.983 443 339 545(-1) | -4.205 544 369 778(-1) | -1.486 171 290 440(-2) |
| | -1.214 607 414 461(-3) | -1.722 262 691 655(-2) | 3.983 443 336 197(-1) | -4.205 544 366 428(-1) | -1.486 171 290 429(-2) |
| 40 | -2.774 370 778 562(-4) | -4.097 522 252 752(-3) | 2.149 268 284 498(-2) | -2.682 735 569 862(-2) | -3.612 214 346 049(-3) |
| | -2.774 370 778 284(-4) | -4.097 522 252 529(-3) | 2.149 268 282 421(-2) | -2.682 735 567 761(-2) | -3.612 214 345 939(-3) |
| 50 | -1.651 892 129 562(-4) | -2.522 402 512 753(-3) | 7.818 803 550 735(-3) | -1.112 807 953 802(-2) | -2.262 592 588 983(-3) |
| | -1.651 892 129 288(-4) | -2.522 402 512 530(-3) | 7.818 803 542 322(-3) | -1.112 807 952 938(-2) | -2.262 592 588 874(-3) |
| 80 | -4.446 245 639 716(-5) | -8.150 967 719 944(-4) | 6.338 207 576 445(-4) | -1.746 639 554 569(-3) | -8.017 538 525 544(-4) |
| | -4.446 245 637 172(-5) | -8.150 967 717 686(-4) | 6.338 207 564 971(-4) | -1.746 639 553 181(-3) | -8.017 538 524 477(-4) |
| 100 | -1.749 820 929 318(-5) | -4.191 628 402 646(-4) | 1.023 054 311 643(-4) | -7.040 609 243 754(-4) | -4.658 211 084 276(-4) |
| | -1.749 820 926 981(-5) | -4.191 628 400 323(-4) | 1.023 054 307 897(-4) | -7.040 609 237 467(-4) | -4.658 211 083 234(-4) |
| 120 | -3.838 526 853 900(-6) | -1.990 375 839 852(-4) | -8.557 571 732 907(-6) | -3.048 757 238 860(-4) | -2.844 509 502 864(-4) |
| | -3.838 526 833 771(-6) | -1.990 375 837 283(-4) | -8.557 571 825 120(-6) | -3.048 757 234 863(-4) | -2.844 509 501 855(-4) |
| 130 | 2.099 852 117 594(-7) | -1.184 030 625 960(-4) | -1.633 283 429 506(-5) | -1.847 126 573 331(-4) | -2.239 544 235 860(-4) |
| | 2.099 852 292 247(-7) | -1.184 030 622 847(-4) | -1.633 283 430 363(-5) | -1.847 126 568 800(-4) | -2.239 544 234 870(-4) |
| 137 | 2.154 582 953 028(-6) | -4.903 302 713 912(-5) | -9.398 566 990 645(-6) | -4.903 236 487 356(-5) | -1.894 662 493 029(-4) |
| | 2.154 582 966 618(-6) | -4.903 302 450 115(-5) | -9.398 566 506 191(-6) | -4.903 235 466 649(-5) | -1.894 662 492 054(-4) |