TABLE II: The leading relativistic corrections $\mathcal{E}^{(4)}_\infty$ and $\mathcal{E}^{(4)}_M$ for helium-like atoms and their $1/Z$-expansion coefficients. The analytical results for the coefficient c_1 for $\mathcal{E}^{(4)}_\infty$ were taken from Ref. [29] for the 1^1S, 2^3S, 2^3P_0, and 2^3P_2 states. For the other states, this coefficient was evaluated numerically to high accuracy in this work by the same method as in Ref. [29]. The c_0 coefficient of $\mathcal{E}^{(4)}_M$ for the S states originates from the one-electron recoil effect and is well known from the hydrogen theory. For the P states, it contains also the two-electron contribution, which was derived in Ref. [36]. The remaining $1/Z$-expansion coefficients were obtained by fitting the numerical data for $\mathcal{E}^{(4)}_\infty$ and $\mathcal{E}^{(4)}_M$. Atomic units are used.

Z	1^1S	2^1S	2^3S	2^1P_1	2^3P_0	2^3P_1	2^3P_2
$\mathcal{E}^{(4)}_\infty/Z^4$							
2	−0.121 984 67	−0.127 135 46	−0.135 279 87	−0.127 501 60	−0.118 042 52	−0.123 316 23	−0.123 729 58
3	−0.145 794 73	−0.131 881 23	−0.142 840 30	−0.130 953 91	−0.121 128 29	−0.126 601 86	−0.124 410 72
4	−0.163 263 53	−0.136 297 75	−0.147 356 68	−0.133 229 53	−0.126 667 74	−0.130 512 05	−0.125 569 23
5	−0.176 048 64	−0.139 882 98	−0.150 310 08	−0.134 786 60	−0.131 522 71	−0.133 708 51	−0.126 557 82
6	−0.185 674 19	−0.142 737 56	−0.152 383 24	−0.135 917 90	−0.135 444 97	−0.136 216 54	−0.127 342 75
7	−0.193 138 21	−0.145 028 97	−0.153 916 10	−0.136 778 46	−0.138 596 36	−0.138 199 25	−0.127 965 82
8	−0.199 077 87	−0.146 895 44	−0.155 094 63	−0.137 455 97	−0.141 156 38	−0.139 793 29	−0.128 467 48
9	−0.203 909 05	−0.148 439 23	−0.156 028 56	−0.138 003 71	−0.143 266 17	−0.141 097 57	−0.128 878 10
10	−0.207 911 70	−0.149 734 47	−0.156 786 71	−0.138 455 96	−0.145 029 86	−0.142 182 11	−0.129 219 51
11	−0.211 280 06	−0.150 835 16	−0.157 414 35	−0.138 835 82	−0.146 523 58	−0.143 096 91	−0.129 507 41
12	−0.214 152 65	−0.151 781 23	−0.157 942 44	−0.139 159 46	−0.147 803 54	−0.143 878 26	−0.129 753 21
$1/Z$ expansion coefficients							
c_0	−1/4	−21/128	−21/128	−55/384	−21/128	−59/384	−17/128
c_1	0.480 139 61	0.169 478 18	0.076 935 23	0.055 403 03	0.219 768 22	0.130 428 76	0.040 638 72
c_2	−0.636 506 86	−0.281 858 62	−0.042 775 47	−0.090 632 15	−0.303 523 35	−0.162 129 41	−0.047 315 68
c_3	0.456 314 23	0.202 919 21	0.010 473 95	0.156 412 39	0.091 746 25	0.042 468 90	0.002 244 38
c_4	−0.171 179 61	−0.042 542 10	−0.004 460 83	−0.178 042 53	−0.008 844 33	−0.004 319 44	−0.000 236 51
c_5	0.018 587 49	0.018 861 71	−0.001 566 73	0.059 068 31	0.015 552 82	0.007 698 46	0.003 691 05
$\mathcal{E}^{(4)}_M/(Z^4\,m/M)$							
2	−0.134 960 7	−0.004 351 6	0.005 574 1	−0.003 655 3	0.015 596 8	0.016 677 1	0.012 760 7
3	−0.123 759 2	−0.001 616 1	0.011 426 9	−0.008 574 4	0.026 148 2	0.026 855 2	0.019 248 5
4	−0.107 627 1	0.002 303 9	0.015 288 3	−0.012 139 6	0.032 666 5	0.032 185 5	0.021 650 8
5	−0.093 784 1	0.005 792 4	0.017 933 4	−0.014 451 6	0.037 580 2	0.035 768 1	0.022 926 5
6	−0.082 625 7	0.008 672 2	0.019 840 8	−0.015 970 4	0.041 407 7	0.038 388 7	0.023 736 9
7	−0.073 647 0	0.011 026 9	0.021 276 3	−0.017 005 1	0.044 450 5	0.040 395 3	0.024 304 7
8	−0.066 337 0	0.012 965 9	0.022 393 8	−0.017 736 6	0.046 915 2	0.041 981 4	0.024 727 6
9	−0.060 299 1	0.014 581 1	0.023 287 6	−0.018 271 0	0.048 946 2	0.043 266 3	0.025 056 1
10	−0.055 241 6	0.015 943 0	0.024 018 4	−0.018 672 8	0.050 645 5	0.044 328 0	0.025 319 3
11	−0.050 950 5	0.017 104 5	0.024 626 8	−0.018 982 2	0.052 086 4	0.045 219 7	0.025 535 1
12	−0.047 267 8	0.018 105 5	0.025 141 1	−0.019 225 6	0.053 322 8	0.045 979 1	0.025 715 5
$1/Z$ expansion coefficients							
c_0	0	1/32	1/32	−0.020 744 7	0.069 205 9	0.055 392 0	0.027 764 2
c_1	−0.645 040 2	−0.182 643 4	−0.078 412 4	0.002 583 0	−0.217 113 6	−0.125 397 2	−0.025 605 0
c_2	0.972 372 8	0.314 800 3	0.062 834 3	0.220 104 6	0.332 302 1	0.157 607 0	0.015 453 2
c_3	−0.460 091 9	−0.188 443 6	−0.018 866 9	−0.387 495 1	−0.152 038 8	−0.096 226 5	−0.036 663 9
c_4	−0.040 368 0	−0.048 228 2	0.000 413 8	−0.046 282 4	−0.252 878 4	−0.030 160 4	−0.017 642 5