Table 4.4.5.13. $\langle j_6 \rangle$ *form factors for rare-earth ions*

Ion	*A*	*a*	*B*	*b*	*C*	*c*	*D*	*e*
Ce^{2+}	−0.1212	7.994	−0.0639	4.024	0.1519	1.096	0.0078	0.0388
Nd^{2+}	−0.1600	8.009	0.0272	4.028	0.1104	1.068	0.0139	0.0363
Nd^{3+}	0.0416	8.014	−0.1261	4.040	0.1400	1.087	0.0102	0.0367
Sm^{2+}	0.1428	6.041	0.0723	2.033	0.0550	0.513	0.0081	0.0450
Sm^{3+}	−0.0944	6.030	−0.0498	2.074	0.1372	0.645	−0.0132	0.0387
Eu^{2+}	−0.1252	6.049	0.0507	2.085	0.0572	0.646	0.0132	0.0403
Eu^{3+}	−0.0817	6.039	−0.0596	2.120	0.1243	0.764	−0.0001	0.0206
Gd^{2+}	−0.1351	5.030	0.0828	2.025	0.0315	0.503	0.0187	0.0453
Gd^{3+}	−0.0662	6.031	−0.0850	2.154	0.1323	0.891	0.0048	0.0371
Th^{2+}	−0.0758	6.032	−0.0540	2.158	0.1199	0.890	0.0051	0.0488
Tb^{3+}	−0.0559	6.031	−0.1020	2.237	0.1264	1.107	0.0167	0.0170
Dy^{2+}	−0.0568	6.032	−0.1003	2.240	0.1401	1.106	0.0109	0.0463
Dy^{3+}	−0.0423	6.038	−0.1248	2.244	0.1359	1.200	0.0188	0.0350
Ho^{2+}	−0.0725	6.045	−0.0318	2.243	0.0738	1.202	0.0252	0.0634
Ho^{3+}	−0.0289	6.050	−0.1545	2.230	0.1550	1.260	0.0177	0.0351
Er^{2+}	0.0648	6.056	−0.0515	2.230	0.0825	1.264	0.0250	0.0409
Er^{3+}	−0.0110	6.061	−0.1954	2.224	0.1818	1.296	0.0149	0.0455
Tm^{2+}	0.0842	4.070	0.0807	0.849	−0.2087	0.039	0.2095	0.0360
Tm^{3+}	0.0727	4.073	0.0243	0.689	3.9459	0.002	−3.9076	0.0502
Yb^{2+}	−0.0739	5.031	0.0140	2.030	0.0351	0.508	0.0174	0.0434
Yb^{3+}	−0.0345	5.007	−0.0677	2.020	0.0985	0.549	−0.0076	0.0359

Table 4.4.5.14. $\langle j_6 \rangle$ *form factors for actinide ions*

Ion	*A*	*a*	*B*	*b*	*C*	*c*	*D*	*e*
U^{3+}	−0.3797	9.953	0.0459	5.038	0.2748	1.607	0.0016	0.0345
U^{4+}	−0.1793	11.896	−0.2269	5.428	0.3291	1.701	0.0030	0.0472
U^{5+}	−0.0399	11.891	−0.3458	5.580	0.3340	1.645	0.0029	0.0444
Np^{3+}	−0.2427	11.844	−0.1129	5.377	0.2848	1.568	0.0022	0.0368
Np^{4+}	−0.2436	9.599	−0.1317	4.101	0.3029	1.545	0.0019	0.0500
Np^{5+}	−0.1157	9.565	−0.2654	4.260	0.3298	1.549	0.0025	0.0495
Np^{6+}	−0.0128	9.569	−0.3611	4.304	0.3419	1.541	0.0032	0.0520
Pu^{3+}	−0.0364	9.572	−0.3181	4.342	0.3210	1.523	0.0041	0.0496
Pu^{4+}	−0.2394	7.837	−0.0785	4.024	0.2643	1.378	0.0012	0.0414
Pu^{5+}	−0.1090	7.819	−0.2243	4.100	0.2947	1.404	0.0015	0.0477
Pu^{6+}	−0.0001	7.820	−0.3354	4.144	0.3097	1.403	0.0020	0.0513
Am^{2+}	−0.3176	7.864	0.0771	4.161	0.2194	1.339	0.0018	0.0374
Am^{3+}	−0.3159	6.982	0.0682	3.995	0.2141	1.188	−0.0015	0.0281
Am^{4+}	−0.1787	7.880	−0.1274	4.090	0.2565	1.315	0.0017	0.0419
Am^{5+}	−0.0927	6.073	−0.2227	3.784	0.2916	1.372	0.0026	0.0485
Am^{6+}	0.0152	6.079	−0.3549	3.861	0.3125	1.403	0.0036	0.0732
Am^{7+}	0.1292	6.082	−0.4689	3.879	0.3234	1.393	0.0042	0.0475

in which $U(r)$ is the radial wavefunction for the unpaired electrons in the atom, k is the length of the scattering vector, and $j_l(kr)$ is the lth-order spherical Bessel function.

Tables 4.4.5.1–4.4.5.8 give the coefficients in an analytical approximation to the $\langle j_0 \rangle$ magnetic form factors for the 3d and 4d transition series, the 4f electrons of rare-earth ions, and the 5f electrons of some actinide ions. The approximation has the form used by Forsyth & Wells (1959) but allowing three instead of two exponential terms:

$$\langle j_0(s) \rangle = A\exp(-as^2) + B\exp(-bs^2) + C\exp(-cs^2) + D, \quad (4.4.5.2)$$

where s is the value of $(\sin\theta)/\lambda$ in Å^{-1}.

Tables 4.4.5.9–4.4.5.14 give coefficients in the approximation used by Lisher & Forsyth (1971) to the $\langle j_2 \rangle$, $\langle j_4 \rangle$, and $\langle j_6 \rangle$ form factors for the same series of atoms and ions, again using three rather than two exponential terms, *viz* for $l \neq 0$:

$$\langle j_l(s) \rangle = As^2\exp(-as^2) + Bs^2\exp(-bs^2) + Cs^2\exp(-cs^2) + Ds^2. \quad (4.4.5.3)$$

For the transition-metal series, the coefficients of the approximation have been obtained by fitting to form factors calculated from the Hartree–Fock wavefunctions given by Clementi & Roetti (1974) in terms of Slater-type functions in the form

$$U(r) = \sum_{nj} N_{nl}\, r^2 A_{nlj} \exp(-a_{nlj}\, r) \quad (4.4.5.4)$$

references