Transformation to normal modes for helium potentials using prolate spheroidal coordinates

λ	$\begin{pmatrix} s_1 \\ s_2 \\ s_3 \end{pmatrix}$	$\begin{pmatrix} \omega_1^2 \\ \omega_2^2 \\ \omega_3^2 \end{pmatrix}$	$\lvert T'_{11}\rvert,\ \lvert T'_{21}\rvert,\ \lvert T'_{31}\rvert$	$\lvert T'_{12}\rvert,\ \lvert T'_{22}\rvert,\ \lvert T'_{32}\rvert$	$\lvert T'_{13}\rvert,\ \lvert T'_{23}\rvert,\ \lvert T'_{33}\rvert$
0.1	-0.03348 - 0.24337*I	1366.8 + 576.3*I	0.2503	0.1032	0.00660
	0.4846 + 0.5955*I	-741.6 + 395.4*I	0.397	0.02108	0.1520
	-0.2589 + 0.4367*I	-271.28 - 99.05*I	0.889	0.0402	0.0915
0.2	-0.00477 - 0.27577*I	820.6 + 94.2*I	0.2856	0.1281	0.00647
	0.6051 + 0.6175*I	-234.1 + 419.8*I	0.382	0.01990	0.1838
	-0.3674 + 0.4019*I	-149.49 - 12.48*I	0.858	0.0355	0.0876
0.3	0.02911 - 0.30448*I	517.8 - 71.0*I	0.3138	0.1500	0.01011
	0.7053 + 0.6314*I	-20.90 + 320.60*I	0.364	0.01794	0.2157
	-0.4481 + 0.3693*I	-80.17 + 18.57*I	0.864	0.0353	0.0864
0.4	0.07048 - 0.33065*I	324.58 - 122.14*I	0.341	0.1717	0.01796
	0.8018 + 0.6392*I	72.17 + 218.41*I	0.341	0.01730	0.2518
	-0.5150 + 0.3354*I	-37.91 + 24.42*I	0.889	0.0367	0.0852
0.5	0.12315 - 0.35368*I	197.59 - 122.86*I	0.370	0.1949	0.03047
	0.9043 + 0.6393*I	106.01 + 135.56*I	0.3098	0.02046	0.2945
	-0.5724 + 0.2983*I	-13.233 + 19.392*I	0.928	0.0386	0.0822
0.6	0.19486 - 0.36964*I	114.99 - 100.24*I	0.405	0.2216	0.0502
	1.0252 + 0.6272*I	110.16 + 74.97*I	0.2642	0.02900	0.347
	-0.6216 + 0.2553*I	-0.942 + 10.797*I	0.982	0.0401	0.0750
0.7	0.3036 - 0.3609*I	100.92 + 33.89*I	0.1996	0.0428	0.411
	1.1933 + 0.5862*I	63.30 - 66.52*I	0.461	0.2552	0.0839
	-0.6604 + 0.1998*I	2.4386 + 2.9332*I	1.050	0.0409	0.0606
0.8	0.4934 - 0.1694*I	87.54 + 5.61*I	0.1131	0.0581	0.475
	1.5980 + 0.3340*I	32.738 - 17.529*I	0.634	0.2859	0.1477
	-0.6633 + 0.0805*I	0.15402 - 0.27477*I	1.022	0.0466	0.02803
0.9	2.0359	67.30	0.0613	0.2299	1.517
	1.1322	61.68	0.1076	1.327	0.2744
	-0.8861	0.008943	1.	0.00349	0.002793

Footnote. Here, we used variables $s_1 = r_1$, $s_2 = (r_2 + r_3)/r_1$, $s_3 = (r_2 - r_3)/r_1$. Normal coordinates are: $q_i = \sum_j T_{ij}\Delta r_j = \sum_j T'_{ij}\Delta s_j$, where $T'_{ij} = \sum_k T_{ik} R_{kj}$, $R_{kj} = \partial r_k / \partial s_j$.