Behavior of stationary points for helium potentials in the vicinity of the symmetry-breaking point

λ	r_1	r_2	r_3	ω_1^2	ω_2^2	ω_3^2
0.805	0.5045 - 0.1221*I	0.27174 + 0.01846*I	0.5964 - 0.0917*I	86.9 + 3.8*I	31.52 - 12.10*I	0.0483 - 0.1743*I
0.806	0.5066 - 0.1090*I	0.27321 + 0.01690*I	0.5999 - 0.0816*I	86.7 + 3.3*I	31.28 - 10.69*I	0.0328 - 0.1488*I
0.807	0.5086 - 0.0935*I	0.27482 + 0.01490*I	0.6034 - 0.0697*I	86.6 + 2.8*I	31.03 - 9.08*I	0.0198 - 0.1208*I
0.808	0.5104 - 0.0740*I	0.27658 + 0.01216*I	0.6070 - 0.0549*I	86.5 + 2.2*I	30.79 - 7.11*I	0.0095 - 0.0895*I
0.809	0.5121 - 0.0455*I	0.27855 + 0.00773*I	0.6106 - 0.0335*I	86.3 + 1.3*I	30.53 - 4.32*I	0.0024 - 0.0507*I
0.810	0.5524 0.4748	0.27393 0.28764	0.6427 0.5859	85.1 87.3	33.9 26.64	0.0381 -0.0399
0.811	0.5874 0.4419	0.26995 0.29684	0.6707 0.5653	84.1 88.1	36.7 23.30	0.0642 -0.0641
0.812	0.6120 0.4185	0.26768 0.30547	0.6910 0.5524	83.3 88.5	38.6 20.98	0.0777 -0.0656
0.813	0.6327 0.3970	0.26603 0.31556	0.7083 0.5426	82.7 88.9	40.0 19.04	0.0862 -0.0502
0.814	0.6511 0.3721	0.26473 0.3310	0.7240 0.5345	82.2 89.1	41.1 17.32	0.0919 -0.01772
0.815	0.6681 0.3474 + 0.0248*I	0.26366 0.34745 - 0.02477*I	0.7387 0.5276	81.7 89.3	42.2 15.74	0.0958 0.03412
0.816	0.6841 0.3438 + 0.0389*I	0.26274 0.34384 - 0.03886*I	0.7526 0.5214	81.3 89.5	43.1 14.26	0.0984 0.1091
0.817	0.6993 0.3406 + 0.0480*I	0.26195 0.34058 - 0.04796*I	0.7659 0.5159	80.9 89.7	43.9 12.84	0.1000 0.2129

Footnote. In the interval $\lambda_* < \lambda < \lambda_{**}$, there is a coexistance of a minimum with a saddle point. At $\lambda = \lambda_* \approx 0.809585$, the minimum collides with the saddle point, and for $\lambda < \lambda_*$ they turn into complex stationary points. At $\lambda = \lambda_{**} \approx 0.814389$, which is the symmetry breaking point, the saddle point collides with the symmetric minimum, and for $\lambda > \lambda_{**}$ they turn into a complex stationary point and a symmetric saddle point (the symmetric minimum and the symmetric saddle point are not listed in the table). The asymmetric minimum has regular behavior at $\lambda = \lambda_{**}$.

At $\lambda < \lambda_c \approx 0.810776$, the asymmetric minimum is a local minimum, and it lies up to the symmetric minimum. At $\lambda > \lambda_c$, it becomes an absolute minimum.