

V SUPPLEMENTARY MATERIAL

Figure captions

FIG. 11: Energies of the spin-orbit coupling states under cubic, tetragonal, and orthorombic fields. The energy of the cube with $d(\text{Bi-O})=2.55 \text{ \AA}$ is taken as reference. The insets zoom the region of small $S_2(e_g \theta)$ and $S_3(e_g \epsilon)$ distortions between -0.072 and $+0.072 \text{ \AA}$ and between 19710 and 19930 cm^{-1} to reveal the almost perfect mexican hat of the $G_u \otimes e_g$ Jahn-Teller coupling, which is isomorphous to the standard $E \otimes e$ Jahn-Teller coupling [Reference 38].

FIG. 12: Energies of the spin-orbit coupling states in D_4 , D_{2d} and D_2 fields. The energy of the cube with $d(\text{Bi-O})=2.55 \text{ \AA}$ is taken as reference.

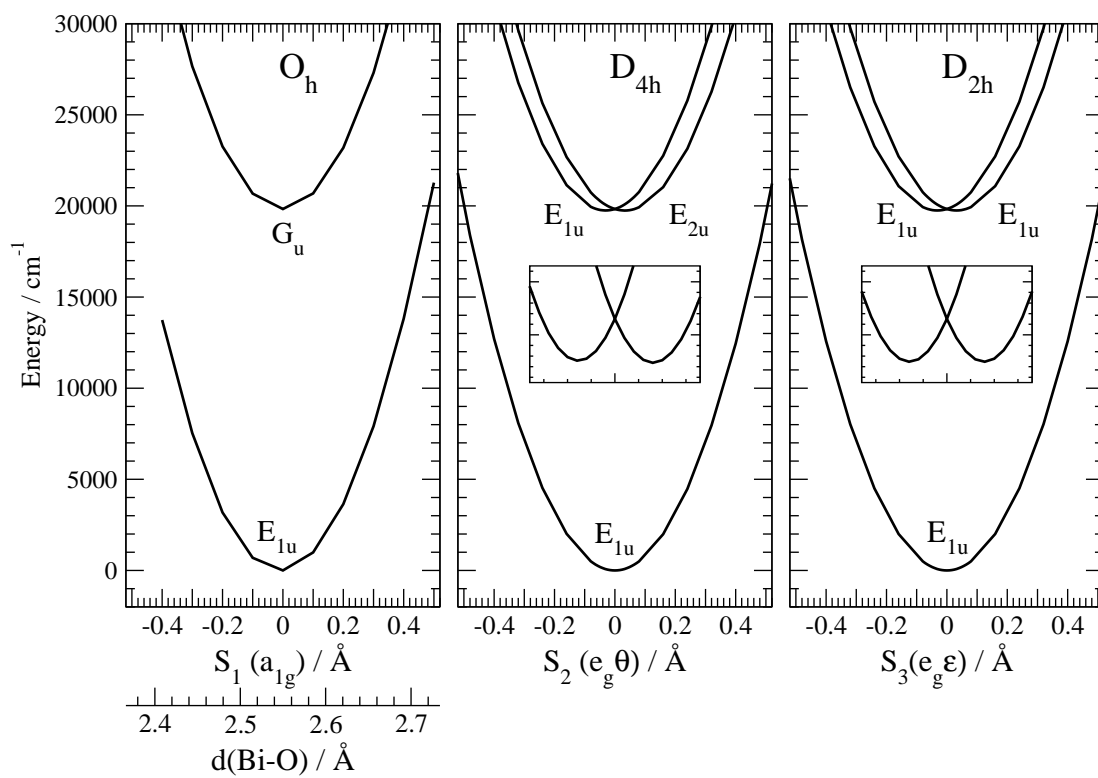


Figure 11. Seijo and Barandiarán

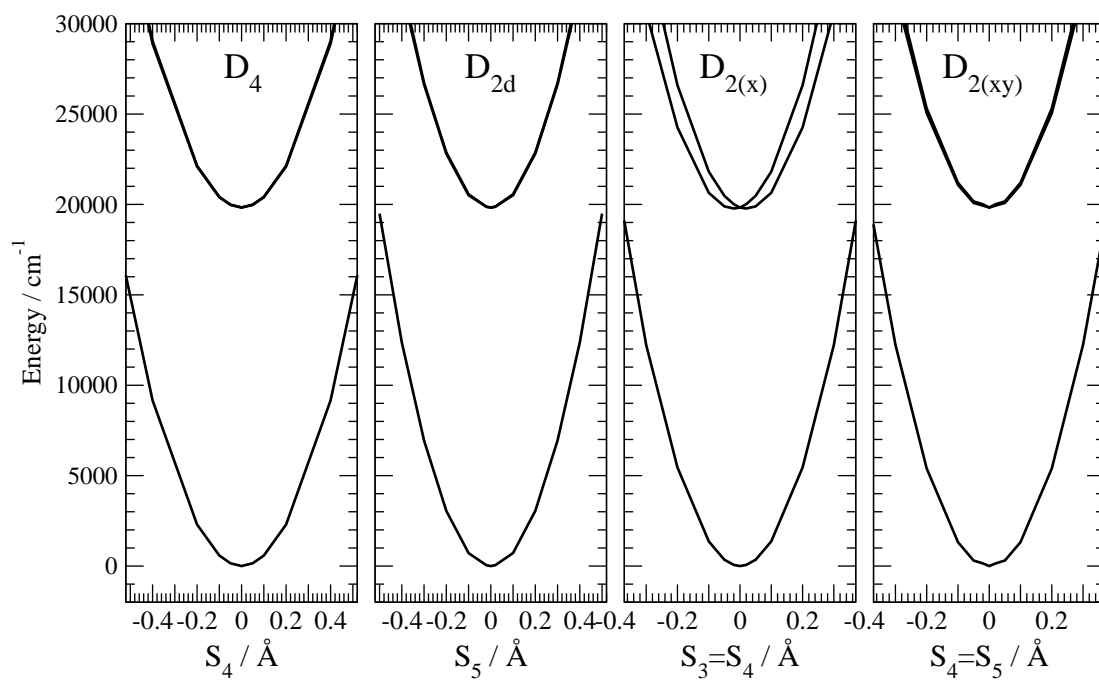


Figure 12. Seijo and Barandiarán