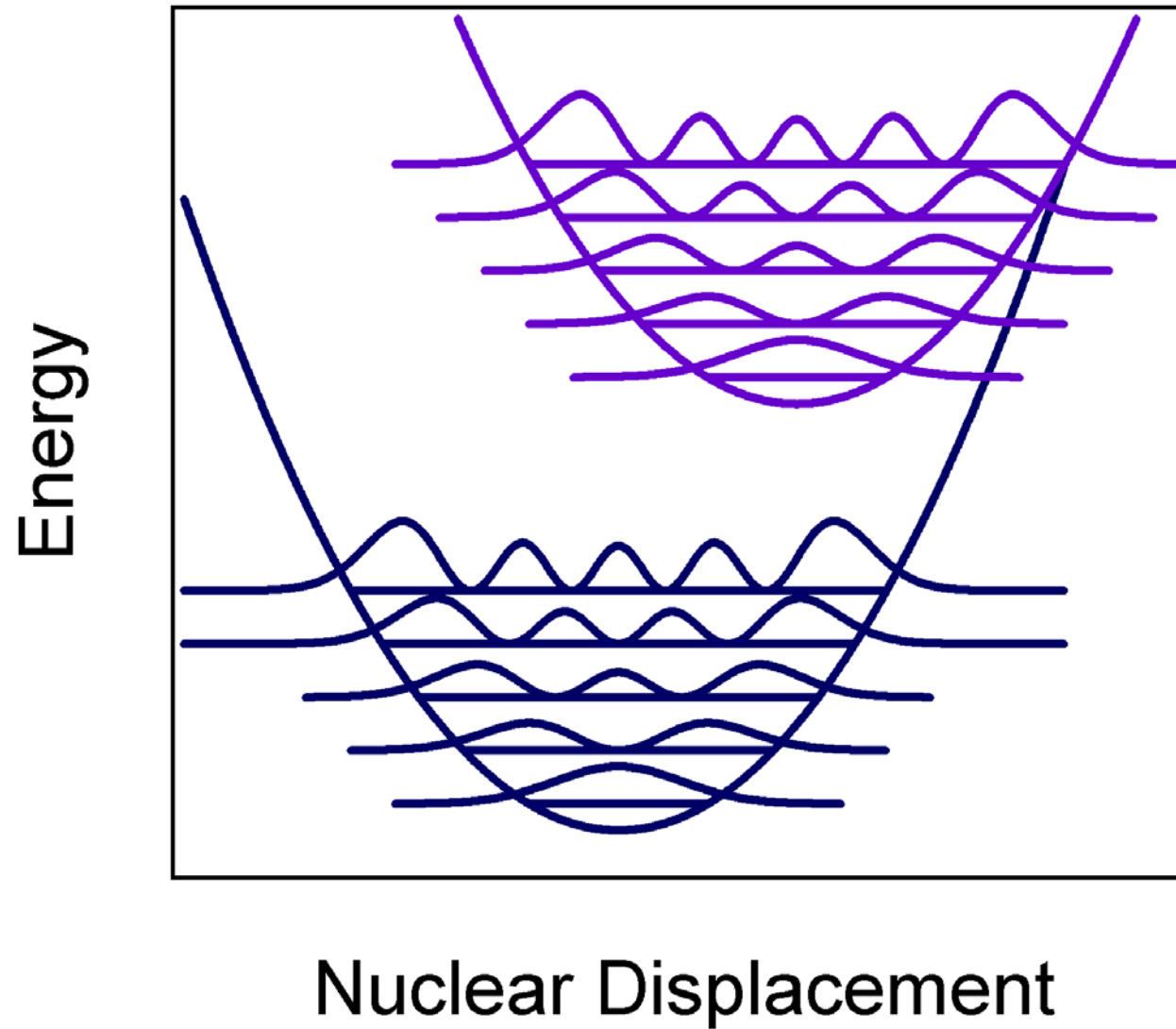


# Franck-Condon factor



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We can use a  $T = 0$  K approximation to calculate the Franck-Condon factor. In this approximation the molecules are in their electronic and vibrational ground state. Therefore, the FC transitions are from  $0 \rightarrow 0'$ ,  $0 \rightarrow 1'$ ,  $0 \rightarrow 2'$ , etc. The formula for this approximation is given by:

$$FC = \sum_{n=0'}^{\infty} \frac{S^n e^{-S}}{n!} \delta(\omega - \omega_{0-0'} - n\omega_{vib})$$

Calculate the “stick spectrum” by making a table showing the relative magnitude of the first 5 vibrational lines above  $0-0'$ . You are given the following information.

$$\begin{aligned}\omega_{0-0'} &= 41,000 \text{ cm}^{-1} \\ \omega_{vib} &= 900 \text{ cm}^{-1} \\ S &= 0.4\end{aligned}$$