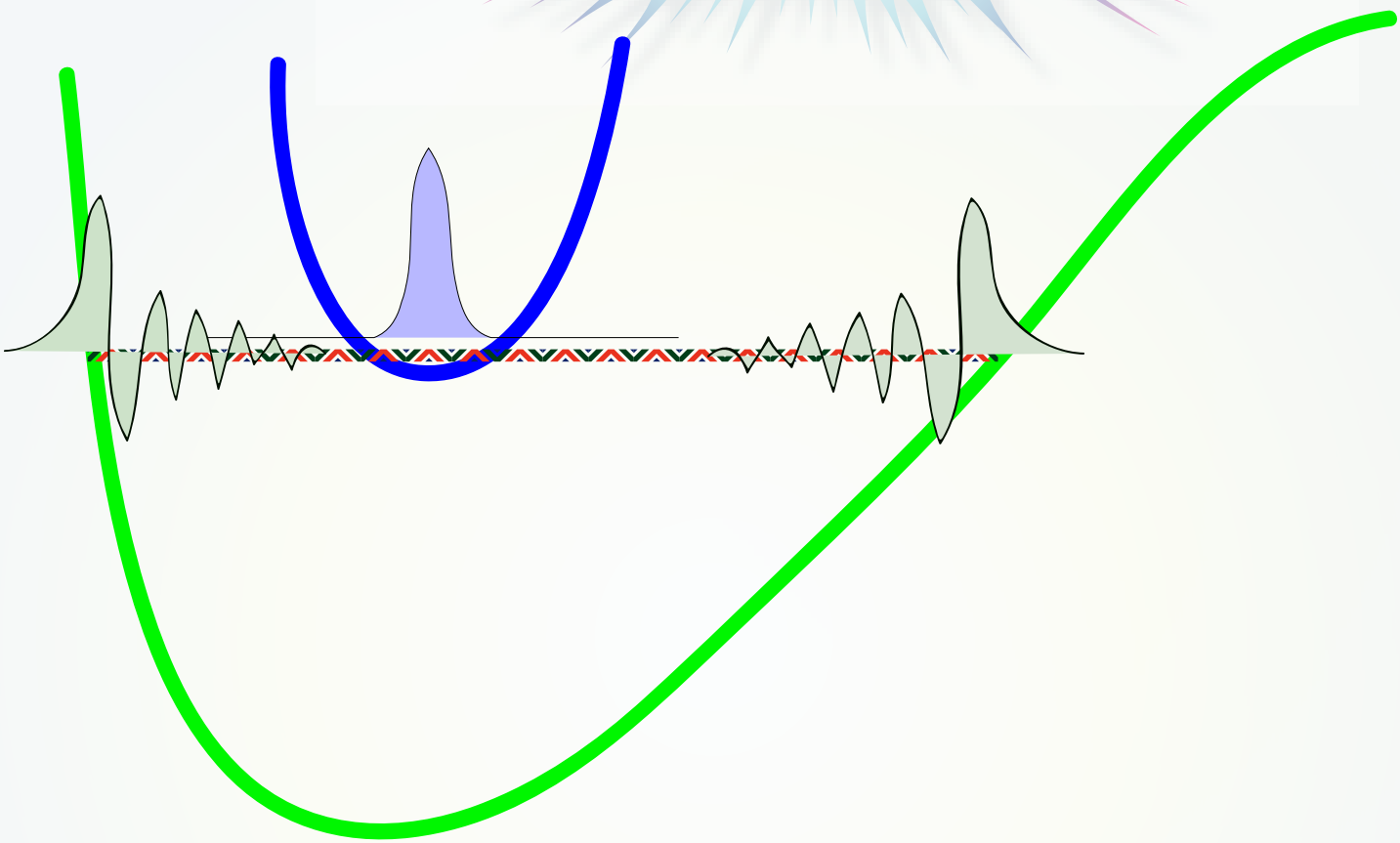
Franck - Condon factor

$$f_n^2 = \left| \int d\vec{q} \psi^{(\mathrm{I})^*}(\vec{q}) \psi_n^{(\mathrm{F})}(\vec{q}) \right|^2$$



Transition rate

$$I(E) = \frac{1}{2\delta} \sum_{E-\delta < E_n < E+\delta} f_n^2$$

Wigner function

$$\rho(\vec{q}, \vec{p}) = (\pi\hbar)^{-N} \int d\vec{\eta}\ e^{-2i\vec{p}\cdot\vec{\eta}} \psi^*(\vec{q} + \vec{\eta}) \psi(\vec{q} - \vec{\eta})$$

F. - C. f. in terms of Wigner functions

$$f_n^2 = (\pi\hbar)^N \int d\vec{q} \int d\vec{p}\, \rho^{(\mathrm{I})}(\vec{q}, \vec{p}) \rho^{(\mathrm{F})}(\vec{q}, \vec{p})$$