

DIFFERENT LEVELS OF QUANTIZATION FUNCTIONS OF GOOD SYMMETRY

$$H = \underbrace{-\frac{\hbar^2}{2\mu} \sum_{i=1}^N \nabla_i^2 - \sum_{i=1}^N \frac{Ze}{r_i}}_{\sum_i h(i)} + \sum_{i < j}^N \frac{e^2}{r_{ij}} \quad H_1$$

PHYSICAL REALITY

IMPOSSIBLE TO SEPARATE COORDINATES

CENTRAL FIELD APPROXIMATION

$$H = -\frac{\hbar^2}{2\mu} \sum_{i=1}^N \nabla_i^2 + \sum_i U(r_i)$$

nL FOR EACH ELECTRON

(n₁l₁)(n₂l₂)... (n_Nl_N)
ELECTRONIC CONFIGURATION *

$$U(r_i) = U(r_i) - \frac{Ze}{r_i}$$

$\hat{S}_1, \hat{S}_2, \hat{L}, \hat{L}_z$

SPIN-ORBITALS $\Rightarrow$

SLATER DETERMINANT

$$|n s m_s l m_l\rangle$$

$$+ \sum_{i < j}^N \frac{e^2}{r_{ij}} - \sum_i U(r_i)$$

"ELECTRON CORRELATION"

$$\hat{S}^2, \hat{S}_z, \hat{L}^2, \hat{L}_z$$

LINEAR COMB.

SPECTROSCOPIC TERMS

$$|s S m_s L m_L\rangle: 2S+1, L$$

(2L+1)(2S+1) DEG.

LINEAR COMB.

LEVELS FOR SANDL:

$$|s J m_J\rangle \equiv |s S L J m_J\rangle$$

(2J+1) DEG.

MATRIX ELEM.

H₂

$$+ \sum_i \xi_i(r) \vec{S}_i \cdot \vec{L}_i$$

SPIN-ORBIT INTERACTION (WEAK)

$$\hat{J}^2, \hat{J}_z$$

$$\det \{s m_s l m_l\} \xrightarrow[\text{COMBIN.}]{\text{LINEAR}} |s S m_s L m_L\rangle \xrightarrow[\text{COMBIN.}]{\text{LINEAR}} |s S L J m_J\rangle$$

"DEEPEST QUANT."

SMALLEST DIMENSION OF SECULAR DETERM. IT BREAKS UP

TRANSFORMATION

* Eu³⁺: 1s² 2s² 2p⁶ 3s² 3p⁶ 3d¹⁰ 4s² 4p⁶ 4d¹⁰ 5s² 5p⁶ 4f⁶

CLOSED SHELLS: OCCUPATION OF ALL QUANTUM NUMBERS OF SPATIAL AND SPIN ORIENTATION

EQUIVALENT OUTSIDE C.S.

det: $| \overset{+}{3} \overset{-}{3} \overset{+}{2} \overset{-}{2} \overset{+}{1} \overset{-}{1} |, | \overset{+}{3} \overset{+}{2} \overset{+}{1} \overset{+}{0} \overset{+}{-1} \overset{+}{-2} | \dots$ n=4 l=3
m_l = -3, -2, ..., 3