$$S(R_f) = \int_0^{R_{match}} K_{fi}(R_f, R_i) u(R_i) dR_i$$

$$K_{fi}(R_f,R_i)$$

$$D_{fi} = R_f - R_i$$

$$K'_{fi}(R_f,D_{fi})$$

$$\ell_f + \ell_i$$



A(m'M':mM;L)

$$k = f'/f$$

$$0.05 < Re(S_{el}) < 0.95$$

$$K_{fi}(R_f,D_{fi})$$

$$((G-iF)-S.(G+iF)).i/2$$

 $f(m'M': mM; \theta)$

 $\exp i(\sigma_L - \sigma_0)$

 $(-i\delta(k))$

exp(

 $\sin(\delta(k)) \exp(-i\delta(k))$

 $k \exp(-i\delta(k))$

 $k \sin(\delta(k)) \exp(-i\delta(k))$

 $\hbar^2/(m_{\pi}^2c^2)$

$$j(j+1) - l(l+1) - s(s+1) = 2\mathbf{l.s}$$

int(J)



$$Mn(Ek) = \langle I'||Ek||I\rangle/(\sqrt{2I+1}\langle IKk0|I'K\rangle)$$
.

$$Mn(Ek) = \langle k||Ek||0\rangle$$

$$Mn(Ek) = Q_0 \sqrt{5/16\pi}$$

 $3 Z \beta_k R^k$

 4π

Mn(Ek) =

$$i^{I-I'+|I-I'|} \langle I'||Ek||I\rangle$$

$$\pm\sqrt{(2I+1)\ B(Ek,I\to I')}\ ,$$

$$Q_2 = \sqrt{16\pi/5} (2I+1)^{-1/2} \langle II20|II\rangle \langle I||E2||I\rangle.$$

$$M(Ek) = Mn(Ek) (-1)^{[I-I'+|I-I'|]/2} \sqrt{2I+1} \langle IKk0|I'K\rangle$$

$$\beta_k \times R$$

$$B(Ek, 0 \rightarrow k)$$

< IB|M(Ek)|IA>

$$RDEF(k, I \rightarrow I')$$

$$DEF(k)(-1)^{[I-I'+|I-I'|]/2}\sqrt{2I+1} \langle IKk0|I'K\rangle$$

$$M(Ek)*4\pi/[3ZR^{k-1}]$$

$$F(r) = M(Ek) e^{2} \frac{\sqrt{4\pi}}{(2k+1)} r^{-k-1}$$

$$F(r) = -DEF(k) \frac{1}{\sqrt{4\pi}} \frac{dU(r)}{dr}$$

$$(-1)^{[I-I'+|I-I'|]/2}$$

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|L_n, (SN, J_{core})S; J_{com}\rangle
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|(LN,SN)Jn,J_{core};J_{com}\rangle
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$$|L_{nn}, (\ell, S_{12})j_{12}; J_{12}\rangle$$

$$|(L_{nn},\ell)L_t,(S_{12},J_{core})S_t;J_{com}\rangle$$

$$|(.5,.5)T,T_{core};T_{com}\rangle$$

$$(L_{nn}, (\ell, S_{12})j_{12})J_{12}, J_{core}; J_{com})$$

$$(.5,.5)T$$
, T_{core} ; T_{com}

1 r

$$(l_n,SN)JN,K$$

$$K = K_{com} - K_{core}$$

$$u(R) = \langle u_{12}(r)|U(r,R) \rangle$$

$$U(r,R)\times$$

$$|(l_1,s_1)j_1,(l_2,s_2)j_2;J_{12},T\rangle$$

$$(l_1, s_1)j_1$$

$$(l_2, s_2) j_2$$

$$(r_1, r_2)$$

$$u_1(r_1) \times u_2(r_2)$$

$$u_1(r)u_2(R)$$

$$L_{nn}, ((\ell, (s_1, s_2)S_{12})j_{12}; J_{12}, T)$$

Г π

$$\sqrt{(D/D_0-1)/k^2}$$

 $\langle c|c+$

$$\langle c|c+p=t'$$

$$(\ell, s) j, J_{core}; J_{com}$$









$$k \propto \sqrt{E}$$

$$\Gamma = 2\gamma^2 P$$

$$P_{\mathrm{leff}}(E-\mathtt{energy})/P_{\mathrm{leff}}(e_{\mathrm{pole}}-\mathtt{energy})$$

$$\mathbf{S}([\ell,s_p]s_t,s_t)$$

$$(F_{\lambda_1}G_{\lambda_2})_{\lambda\mu} = \sum_{\mu_1\mu_2} \langle \lambda_1\mu_1, \lambda_2\mu_2 | \lambda\mu \rangle F_{\lambda_1\mu_1}G_{\lambda_2\mu_2} ,$$

$$F_{s_t} = [\ell, s_p] s_t$$

 $(F_{\lambda}G_{\lambda})_{00} = (2\lambda + 1)^{-1/2} \sum_{\lambda} (-1)^{\lambda - \mu} F_{\lambda\mu}G_{\lambda - \mu}.$

$$(-1)^{\lambda}(2\lambda+1)^{-1/2}$$

$$\langle j_f m_f | \hat{O}_{\lambda\mu} | J_i m_i \rangle = (2j_f + 1)^{-1/2} \langle j_i m_i, \lambda\mu | j_f m_f \rangle \langle j_f | | \hat{O}_{\lambda} | | j_i \rangle.$$

$$\mathbf{S}(\ell) = Y_{\ell}(\hat{\mathbf{R}})$$

$$\langle L' \parallel Y_{\ell} \parallel L \rangle = \frac{\hat{\ell}\hat{L}}{\sqrt{4\pi}} \langle L0, \ell0 | L'0 \rangle$$

$$\mathbf{S}(\ell) = \ell$$

$$\langle L' \parallel \ell_{\lambda} \parallel L \rangle = \delta_{LL'} (-1)^{\lambda} \sqrt{2\lambda + 1} \sqrt{L(L+1)(2L+1)}$$
.

$$\ell \equiv \mathtt{LTR} = 1$$

*

. .

$$\langle (LI_p)J, I_t; J_TM_T | \mathbf{S}([\ell, s_p]s_t, s_t) | (L'I'_p)J', I'_t; J_TM_T \rangle.$$

$$= (-1)^{s_t + J_T + J' + I_t} \left\{ \begin{array}{ccc} J' & I'_t & J_T \\ I_t & J & s_t \end{array} \right\} \hat{IJ'} \left\{ \begin{array}{ccc} L' & I'_p & J' \\ \ell & s_p & s_t \\ L & I_p & J \end{array} \right\} \ \langle L' \parallel \mathbf{S}(\ell) \parallel L \rangle$$

$$\langle I_p || s_p || I'_p \rangle \langle I_t || s_t || I'_t \rangle$$

 \times

$$\langle I_p||s_p||I'_p\rangle\langle I_t||s_t||I'_t\rangle$$

$$\langle I_p || s_p = 0 || I_p \rangle = \hat{I}_p$$

$$((2I_t'+1)(2I_t+1))^{1/4}$$

$$\langle I_t || s_t = 0 || I_t \rangle = \hat{I}_t$$