AGS formalism in the form of singular and non-singular set of coupled integral equations

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Due to the demerits lying with DWBA & Faddeev approach ,Alt Grassberger and Sandhas found out the solutions for few body problems which is written in the equation form as

$$U_{\alpha\beta} = (1-\delta_{\alpha\beta})(z-H_0) + \sum_{\gamma=1}^{3}(1-\delta_{\alpha\gamma})T_\gamma(z)G_0(z)U_{\gamma\beta}(z)$$

Where $T_\gamma(z)$ is the two-body transition operator in three-body space defined by the Lippmann-Schweinger equation. $\delta_{\alpha\beta}$ is the Kronecker delta function

H_0 is the free Hamiltonian. $G_0(z)$ is the the resolvant operator.

The on shell solutions of one dimensional AGS equation with singular kernel is

$$T_{\alpha\beta}(q_\alpha q_\beta' \beta_\alpha\beta_\beta{:}J) = K_{\alpha\beta}(q_\alpha q_\beta' \beta_\alpha\beta_\beta{:}J) + \sum_{k\beta k}\int K_{ik}(q_\alpha q_\beta' \beta_\alpha\beta_\beta{:}J)\,\tau_k^{n_k}(z-u_k^2)T_{\gamma\beta}(q_\alpha q_\beta' \beta_\gamma\beta_\beta{:}J)u_k^2\mathrm{d}u_k$$

Following Kowalski and Sasakawa

$$T_{\alpha\beta}(q_\alpha Q_\beta' \beta_\alpha\beta_\beta{:}J) = \Gamma_{\alpha\beta}(q_\alpha Q_\beta' \beta_\alpha\beta_\beta{:}J) + \sum_{k\beta k}\int K_{\alpha k}(q_\alpha Q_\beta' \beta_\beta\beta_k{:}J)I_{\alpha k\beta k}u_k^2\mathrm{d}u_k$$

Where $\Gamma_{\alpha\beta}(q_\alpha Q_\beta' \beta_\alpha\beta_\beta{:}J)$ is the one dimensional coupled integral equation and $I_{\alpha k\beta k}$ is a square matrix having both real and imaginary parts.The on shell condition is satisfied here.

$$I_{k\beta k,\beta\beta_k}^{R} + iI_{k\beta k,\beta\beta_k}^{Im} = d_{k\beta k,\beta\beta_k}^{R} + id_{k\beta k,\beta\beta_k}^{Im}$$

Where

$$I_{k\beta k,\beta\beta_k}^{R} = P\int N_k^2\,\frac{\Gamma_{k\beta}(q_k Q_\beta' \beta_k\beta_\beta{:}J)}{(E-u_k^2+\epsilon_{\beta k})}\frac{(Q_k^2+1)}{(u_k^2+1)}u_k^2\mathrm{d}u_k$$

and

$$d_{k\beta k,\beta\beta_k}^{Im} = -\frac{\pi N_k^2 Q_k}{2}\Gamma_{k\beta}(q_k Q_\beta' \beta_k\beta_\beta{:}J)$$

The T-, I- and d- matrix can be written in real and imaginary components.

$$\begin{pmatrix} d^R-1 & -d^{Im} \\ d^{Im} & d^R-1 \end{pmatrix}\begin{pmatrix} I^R \\ I^{Im} \end{pmatrix} = \begin{pmatrix} d^R \\ d^{Im} \end{pmatrix}$$

The AGS equation in one dimensional form contains some singularities.These can be solved by applying Doleschall's methods.So far we have solved the equation for 135X135 square matrix depending on the value of J.For higher value of angular momentum and the higher state the square matrix is considered to be of higher order.Similarly the special weights and points calculated here N=15 can be raised.

Conclusions

The set of coupled integral equations free from singularities mainly used for calculation of cross sections in direct as well as for indirect transfer reactions.We have calculated the reaction cross section for stripping and α-cluster cases given in the references.Our future plan is to do works on dipole and quadrapole transitions for applications to agritural,robotics and industrial societies.

References:

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