Optical Theorem Formulation of Low Energy Nuclear Reaction

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Optical theorem formulation of low-energy nuclear reaction [1,2] will be described for 2-body and 3-body reactions. Analytical formulae obtained for the cross-section $\sigma(E)$ exhibit explicitly the energy and charge dependences of $\sigma(E)$ and may provide a better physical understanding of anomalous low-energy enhancement of $\sigma(E)$ observed in deuterated metals [3,4] and also in nuclear fusion reactions relevant for the primodal nucleosynthesis and stellar evolution. Application to 3D fusion observed by Kasagi et al. [5] ("Kasagi effect") will be described. Effects of halo nuclear states on the anomalous low-energy enhancement of $\sigma(E)$ are also discussed. The formulation can also be applied to sub-barrier heavy-ion fusion reactions.

1. Y.E. Kim and A.L. Zubarev, Few-Body Systems Supplement 8, 322 (1995).
2. Y.E. Kim et al., Physical Review C 55, 801 (1997).
3. H. Yuki, et al., JETP Lett. 68, 823 (1998).
4. F. Raiola et al., Physics Letters B547, 193 (2002).
5. J. Kasagi et al., J. Phys. Soc. Japan 64, 777 (1995).