EXAMINATION OF THE LIGHT-HEAVY ION REACTIONS USING A NEW COUPLING POTENTIAL

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The light-heavy ion reactions have been extensively studied both theoretically and experimentally and these investigations have resulted in a large body of experimental data and a great number of theoretical models. A number of serious problems have continued to plague the study of these reactions including alpha + nucleus, $^{12}C+^{12}C$, $^{12}C+^{24}Mg$, $^{16}O+^{28}Si$ and similar systems for the last 40 years.

1. The explanation of anomalous large angle scattering data;
2. The reproduction of the oscillatory structure near the Coulomb barrier;
3. The out-of-phase problem between theoretical predictions and experimental data;
4. The consistent description of angular distributions together with resonance and excitation functions data are just some of these problems.

These are long standing problems that have persisted over the years and do represent a challenge calling for a consistent framework to resolve these difficulties within a unified approach. Traditional frameworks have failed to describe these phenomena within a single model and have so far only offered different approaches where these difficulties are investigated separately from one another. We propose a new approach based on the use of a new type of coupling potential in order to address the problems of such reactions in a systematic way over a wide energy range. Not only this new approach improves the simultaneous fits to the data of these diverse observable, achieving this within a unified approach for a number of nuclear systems over wide energy ranges, but it departs for its coupling potential from the standard formulation. This new feature could provide new insights in the dynamics of these reactions. It also leads to new predictions especially concerning resonance phenomena in these systems that could form the basis for some new experimental investigation.