DIRECT ELASTIC BREAKUP OF LIGHT IONS IN INTERMEDIATE ENERGY COLLISIONS

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The breakup of light ion projectiles under the influence of the Coulomb and strong fields of heavy nuclei in intermediate energy collisions is a subject of increasing interest, both experimentally and theoretically. Among the several physical processes of interest in the breakup collisions is, e.g., the possibility of extracting information about radiative capture reactions of astrophysical relevance. To that aim one should be able to separate the contributions from different multipolarities to the breakup.

We study the process $a + A \longrightarrow A^* + b + x$, where A^* represents a slightly excited target. We use the prior form for the reaction mechanism and we show that the breakup amplitude can be written as

$$T(\mathbf{q}, \mathbf{Q}) = \sum_{LM} T_{LM}^{elast.}(\mathbf{Q})\; T_{LM}^{exc.}(\mathbf{q}) ,$$

where LM denotes the different multipolarities contributing to the amplitude. The elastic amplitude $T_{LM}^{elast.}$ depends on the c.m. momentum transfer $\mathbf{Q}$ to the projectile and contains both refractive and diffractive effects, while the excitation amplitude $T_{LM}^{exc.}$ depends on the momentum transfer $\mathbf{q}$ to the relative motion of the fragments b and x.

These amplitudes were calculated using the soft spheres model of Karol with Glauber wavefunctions for the elastic channel. Since the calculation was performed in the laboratory frame of reference, we accounted for Lorentz contraction effects by modifying the initial bound state of the projectile. This allows us to use our results in intermediate energy collisions where retardation effects become increasingly more important.

Numerical calculations were performed to deduce the amplitudes and they enable us to show how to disentangle the contributions from different multipolarities. We also show how the strong and Coulomb interactions interfere in the differential and total cross sections.