Microscopic Approach to Alpha-Nucleus Optical Potentials at Astrophysically Relevant Energies*

Helmut Leeb[1]
[1] Atominstitut of the Austrian Universities, Vienna University of Technology, Wiedner Hauptstrasse 8-10, 1040 Vienna, Austria.

Several nuclear reactions involving α-particles play an important role in nucleosynthesis, in particular in the p-process. However, frequently these reactions are not accessible to experiment and therefore one relies on calculated cross section values. One important ingredient in such calculations are optical potentials in the entrance and the exit channels. Usually phenomenological optical potentials are used, which are adjusted to reproduce the elastic scattering between the collision partners. However, in reactions relevant for nuclear astrophysics the interesting energy range for α-nucleus scattering is well below the Coulomb barrier and experimental data for the determination of the optical potential are not available. Therefore, the α-nucleus optical potentials are usually obtained at the required energy via extrapolations from higher energies, which results in large uncertainties.

In this contribution we revive and extend the nuclear structure approach for α-nucleus optical potentials, originally proposed by N. Vinh Mauh [1]. Following the procedures by Leeb and Osterfeld [2] we reformulate the problem and implement it numerically. Especially, we focus on the evaluation of the imaginary part, which should be almost complete in the low energy regime. We include the nuclear structure explicitly via the amplitudes in RPA. For the real part we use a standard cluster approach and take the non-locality of the resulting optical potential consistently into account. The method is applied to evaluate α-nucleus optical potentials at astrophysically relevant energies. In this first phase we limit ourselves to closed-shell nuclei, whose excitations are well described within RPA. The usefulness of the approach as well as possible extensions will be discussed at several examples.

* This work, supported by the EC under the Contract of Association between EURATOM and the Austrian Academy of Sciences, was carried out within the framework of EFDA. The views and opinions expressed herein do not necessarily reflect those of EC.

[1] N. Vinh Mauh, Phys. Lett. **71B**, 5 (1977).
[2] H. Leeb and F. Osterfeld, Phys. Rev. C **32**, 789 (1985).