Contribution ID: **15** Type: **Theory**

R-matrix calculations for Nuclear Data Evaluation with GECCCOS

Friday 23 February 2024 11:15 (15 minutes)

A new versatile module to perform R-matrix based multi-channel reaction calculations within GECCCOS (GEneral Coupled-Channel COde System) has been developed by the nuclear data group at TU-Wien especially for light nuclear systems. At present light nuclear systems bear challenges for nuclear data evaluation, especially at low energies. The sharp resonances in cross sections at low energies can only be described in a phenomenological way via R-matrix theory by fitting the corresponding resonance parameters to reproduce available experimental data. These R-matrix analyses of experimental data yield consistent reaction cross sections. However, the predictive power as well as the physics interpretation of these analyses are limited.
The GECCCOS R-matrix module aims to provide a development platform for reaction calculations within light nuclear systems to create new methods or improve and extend existing ones. Conventional methods as potential based computational R-matrix calculations using the Lagrange Mesh technique were implemented as well as the phenomenological R-matrix analyses of reaction data. In addition it is used as a development platform for non-standard extensions of R-matrix theory such as Reduced R-matrix theory and the Hybrid R-matrix.
After a successful calculation the complete S-matrix (collision matrix) as well as observables for unpolarized beams, angle-differential cross sections, excitation functions and, if existing, angle-integrated cross sections are returned. In case of phenomenological R-matrix analyses a separate module automatically assembles calculated and available experimental data, performs necessary conversions of units and frames of reference and calculates chi2 values for a fitting process.
This contribution aims to give a brief insight into current code developments of the nuclear data group at TU-Wien as well as present challenges regarding the description of reactions in light nuclear systems.

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Session Classification: Talks