TALENT Course 6: Theory for exploring nuclear reaction experiments
Outline project proposal

Project name: R-matrix study of the ^{18}F(α,p)^{21}Ne reaction

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Project outline and aims:

The cosmic origin of fluorine is uncertain. Asymptotic Giant Branch (AGB) stars are thought to be one of the main sites for the production of this element, but models of these stars do not produce enough ^{19}F to match observations. The ^{18}F(α,p)^{21}Ne reaction is thought to be important in predicting the amount of ^{19}F produced in AGB stars. Currently, the cross section for this reaction, measured by H. Y. Lee *et al.*, has a high upper limit due to oxygen contamination of the target. An R-matrix analysis of the data set was performed and published. Another experiment has been carried out at TRIUMF laboratory in Canada using an independent method to put tighter constraints on this cross section. The aim of this project will be to reproduce the R-Matrix analysis carried out by H. Y. Lee *et al.* and then to do an R-Matrix fit to the new data, taken at TRIUMF, when the analysis is complete.

Methodology:

Azure will be used to carry out an R-Matrix fit to the data published by H. Y. Lee *et al.* and the energies and widths of the resonances compared. In time an R-Matrix fit will also be made to the data taken at TRIUMF.

Key references:

1. Lee, H. Y. *et al.*, Phys. Rev. C **80**, 025805 (2009)
2. Azuma, R. E. *et al.* Phys. Rev. C **81**, 045805 (2010)
3. Karakas, A. I., *et al.,* The Astrophysical Journal **676**, 1254-1261 (2008)
4. Karakas, A. I., Mon. Not. R. Astron. Soc **403**, 1413-1425 (2010)
5. Lucatello, S., *et al.,* ApJ **729**, 40 (2011)
6. Recio-Blanco, A., *et al.,* A&A **538**, A117 (2012)