

The Inverse-Oslo method

Thursday 24 May 2018 14:45 (20 minutes)

The recent measurement of the Neutron Star Merger event by LIGO [1] and subsequent optical measurements have revealed that Neutron star mergers are probably one of the primary sites for the r-process of nucleosynthesis [2]. An important source of uncertainty in the r-process models is the nuclear data input [3], especially important is the neutron capture cross-section which is directly observable for only a handful of nuclei close to stability.

The Oslo Method provides an alternative, indirect route to constrain the neutron capture cross-sections by providing the nuclear level density (NLD) and γ -ray strength function (γ SF) which are important in Hauser-Feshbach calculations. The method requires experiments where the γ -ray distribution is measured as a function of excitation energy. This has been achieved for several years with transfer reactions with light ion beams, eg. p,d, ^3He , α , at the Oslo Cyclotron Laboratory and more recently in β -decay experiments [4]. A new class of experiments have recently joined the 'Oslo Method family', namely the inverse kinematics experiment. The NLD and γ SF of ^{87}Kr was successfully extracted from a experiment with a ^{86}Kr beam hitting a deuterated polyethylene target at iThemba LABS in early 2015. With the addition of inverse kinematics we are now able to probe the NLD and γ SF of virtually any nuclei that can be accelerated in the lab. The γ SF and NLD of ^{87}Kr will be presented together with Hauser-Feshbach calculations of the neutron capture cross-section of ^{86}Kr .

New developments are also happening at the Oslo Cyclotron Laboratory with the implementation of the Oslo SCintillator ARray (OSCAR), consisting of 30 large volume $\text{LaBr}_3(\text{Ce})$ detectors (3.5x8"). OSCAR is a substantial upgrade from the old CACTUS array (NaI-detectors) both in terms of improved energy and time resolution and efficiency. To compliment the new array, we have replaced the old analog data acquisition system to a new state-of-the-art digital system consisting of seven Pixie-16 digitizers (2 x 500 MHz, 5 x 250 MHz), allowing for much higher throughput. The new array will allow for new innovations in experimental techniques that could allow for extraction of NLD & γ SF above the neutron separation energy and discrimination between neutron and γ -rays.

[1]: B. P. Abbott *et al.*, Phys. Rev. Lett. **119**, 161101 (2017)

[2]: E. Pian *et al.*, Nature **551**, 67-70 (2017)

[3]: M. R. Mumpower *et al.*, Prog. Part. Nucl. Phys. **86**, 86 (2016)

[4]: A. Spyrou *et al.*, Phys. Rev. Lett. **113**, 232502 (2014)

Primary author: Mr INGEBERG, Vetle Wegner (University of Oslo (NO))

Presenter: Mr INGEBERG, Vetle Wegner (University of Oslo (NO))

Session Classification: session 10