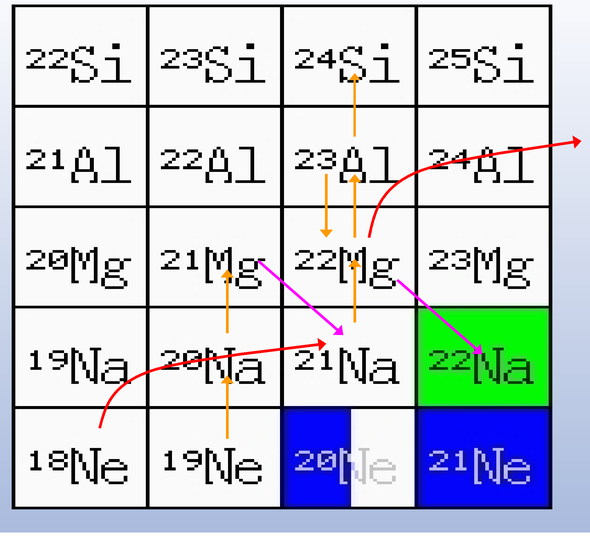
The Joint Institute for Nuclear Astrophysics

Exploring the αp-process Path

S. O'Brien[1], A. Matic[2], G.P.A. Berg[1], K. Hatanaka[3], J. Görres[1], and M. Wiescher[1]

[1]University of Notre Dame, Notre Dame, IN [2]KVI, Groningen, Netherlands [3]RCNP, University of Osaka, Japan

αp reaction network near ^{22}Mg



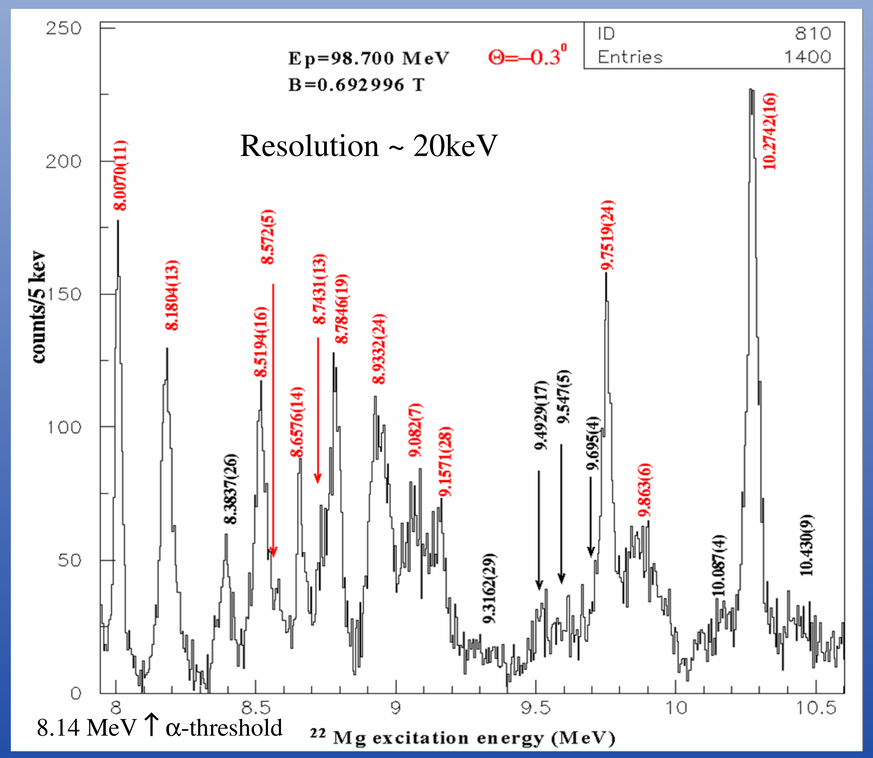
^{22}Mg plays an important role as the compound nucleus in the breakout reactions from the hot CNO cycle and the start of the αp-process. Therefore it is important to know the energy of the resonance levels to high accuracy.

The αp-process determines the structure of light curves observed from type I x-ray bursters. This process, which involves a series of (α,p) and (p,γ) reactions, runs through the neutron deficient nuclei up to mass A≈42, with the exact endpoint being as yet not determined. Several experiments have been performed that are designed to reduce the error in the energy of excited states in nuclei important to the αp-process.

Preliminary (α,^{8}He) experiments at RCNP

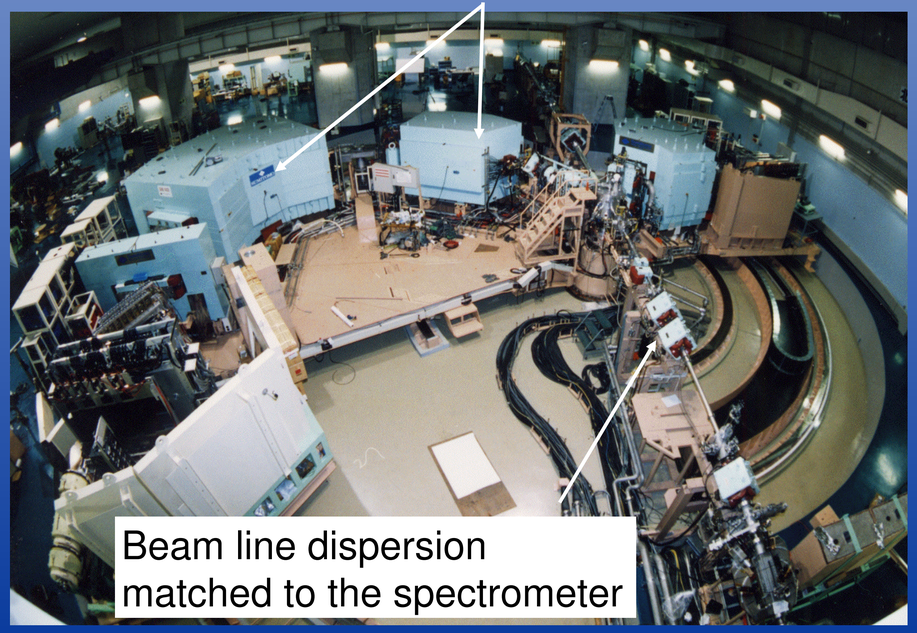
First tests to detect and identify ^{8}He particles following (α,^{8}He) reactions at 0° at RCNP were successful using ^{13}C and ^{28}Si targets. Also, the cross sections of ^{42}Ti and ^{46}Cr for the (α,^{8}He) reaction were determined, and future experiments are planned. These nuclei are important because they mark the end of the αp-process.

^{24}Mg(p,t)^{22}Mg at RCNP

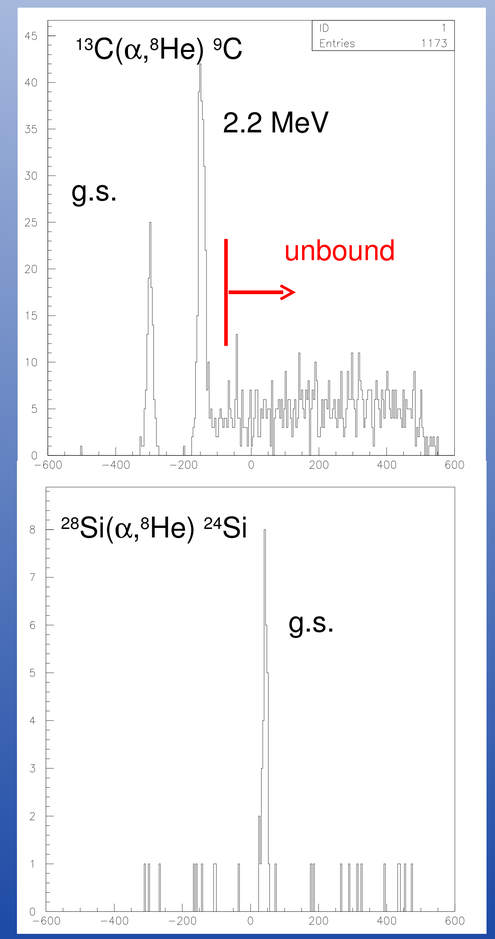


High resolution spectrometer set up at RCNP

Grand Raiden spectrometer used to separate out the reaction products at 0°



Beam line dispersion matched to the spectrometer



This project is funded by the NSF through grant PHY0216783, and the Universities of JINA.