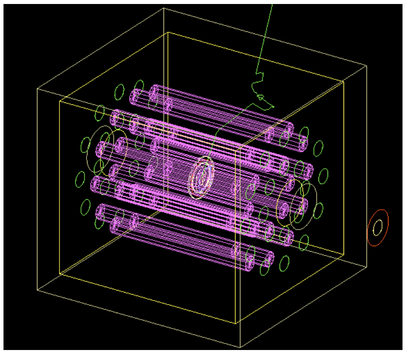
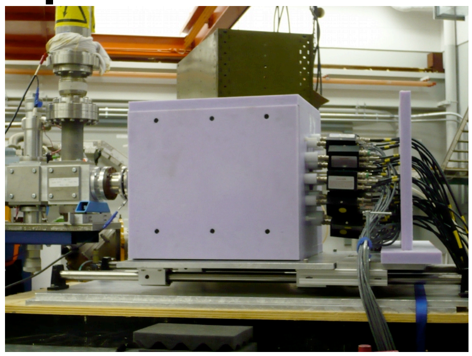
Neutron poisoning efficiency of ^{16}O in the s-process





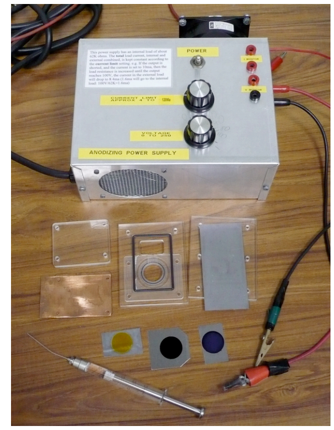
Most of the heavy elements in the universe are produced by sequential neutron captures on lighter nuclei during the helium burning stage of stellar evolution. The efficiency of these processes depends on the abundance of neutron sources, of seed nuclei for the buildup towards heavier elements and so called *neutron poisons*, which remove neutrons from the stellar burning environment.

An important neutron poison is believed to be ^{16}O. After it captures a neutron there are two possible competing reaction branches: $^{16}O(n,\gamma)^{17}O(\alpha,n)^{20}Ne$ and $^{16}O(n,\gamma)^{17}O(\alpha,\gamma)^{21}Ne$. The former path reemits the neutron and therefore neutralizes the poisoning effect of ^{16}O. It is necessary to know the ratio of the stellar burning rates of these two branches to model the galactic nucleosynthesis accurately [1]. The $^{17}O(\alpha,n)^{20}Ne$ rate is not known accurately enough to clearly investigate the strength of the poisoning effect.

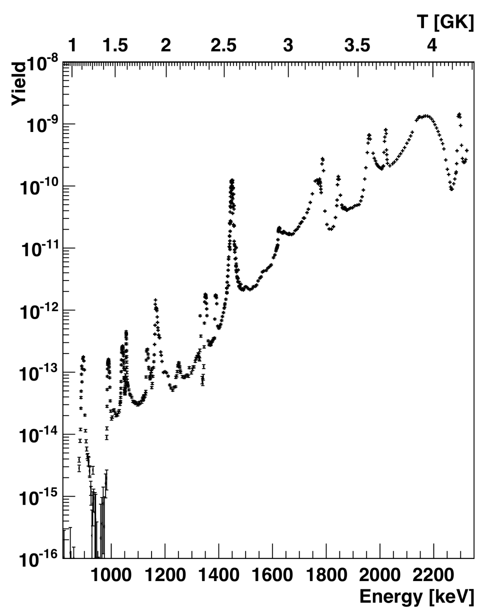
Using a newly designed high efficiency neutron detector [2] this reaction has been measured down into the energy range of stellar burning temperatures [3]. The detector has been modeled in a computer simulation and the reaction cross section has been determined with excellent accuracy over a range of more than six magnitudes.

The results will be implemented into stellar models to shed light on the effect of $^{16}O(n,\gamma)$ on the abundance evolution of the heavy elements.

[1] M. Rayet, M. Hashimoto, A&A 354, 740(2000)
[2] Falahat et al. (2009), AIP Conf. Proc. 1090, p. 303
[3] Best et al. (2010), in preparation



Target preparation using highly enriched $H_2^{17}O$



Measured yield of the $^{17}O(\alpha, n)^{20}Ne$ reaction. The effective stellar burning temperature is displayed on the upper y-axis.

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