Contribution ID: **201** Type: **Poster**

On the activation method for stellar cross-sections measurements: flat sample correction in measurements relatives to gold.

Tuesday, 26 June 2018 19:00 (1h 30m)

Maxwellian-averaged cross-sections (MACS) are needed as an input for the models of stellar s- and r-processes nucleosynthesis. In many cases, MACS can be obtained from activation measurements, irradiating a flat sample with the neutron field generated by the 7Li(p,n)7Be reaction at 1912 keV proton energy (a quasi-maxwellian neutron spectrum or QMNS). In most measurements, the sample is placed between gold foils, and the gold cross section is used as a reference. Data analysis to obtain the MACS includes a correction for the difference between a quasi-maxwellian neutron spectrum (QMNS) vs. a true maxwellian one. This spectrum correction is depending on the sample cross-section behavior. However, an additional correction taking into account the effect of the incidence angle of the neutrons into a flat sample and the subsequent variation in the effective mass thickness experienced by the neutrons, has not been historically taken into consideration in this measurements relative to gold. This correction is also depending on the energy-angle distribution of the neutron flux and on the sample cross-section. So, this flat sample correction in general will have different values for gold and for the measured sample, and therefore it can't be cancelled in relative measurements. We have calculated that this missing correction could affect these activation relative measurements results in some cases up to a 2-3%. We propose an analytic expression for the calculation of this flat simple correction, and we suggest a revision of the existing activation measurements results.
Recently it has been showed that is possible to generate a closer maxwellian neutron spectrum at kT=30 keV if we shape the energy profile of the incident proton beam. With this method (MNS), the spectrum correction is highly reduced. However, in this case the mentioned flat sample correction is increased, due to a higher aperture of the neutron flux cone (more than 90 degrees). We propose a further improvement in the activation technique, consisting on a modified experimental geometry, in which the samples are placed slightly further from the neutron source, covering a lower solid angle. In this way, the flat sample corrections are highly reduced, while the spectrum correction is maintained low.

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Session Classification: Poster session