RECENT RESULTS IN NUCLEAR ASTROPHYSICS AT THE N_TOF FACILITY AT CERN

Giuseppe Tagliente[1]

[1]INFN sez. di Bari, Bari, Italy

Neutron capture reactions in stars are almost exclusively responsible for the production of all isotopes heavier than Fe. Two processes contribute more or less equally to the overall abundance pattern: the slow neutron capture process (s process), which involves low neutron densities so that radioactive decay is generally faster than neutron capture, and the rapid neutron capture process (r- process) which takes place in environments of high neutron densities, driving the reaction path towards neutron-rich isotopes with short half- life. The key nuclear physics input for s process studies are stellar neutron capture cross sections, in particular the so-called MACS (Maxwellian Averaged Cross Section), i.e. cross-section averaged over the thermal neutron energy spectrum in the stars. In this context, accurate capture cross sections are needed for elements heavier than Fe, as well as for light elements acting as neutron poisons, considering that the uncertainty of a single cross section propagates to the abundances of the heavier isotopes on the s-process path, or over the complete s-process distribution in the case of neutron poisons.

To address some open issues in stellar nucleosynthesis, the n TOF collaboration has been carrying out since several years an ambitious experimental program on nuclear capture reactions with the aim of reducing the uncertainty on cross sections relevant to s-process nucleosynthesis, and of improving the reliability of astrophysical models.

The neutron beam at the n_TOF facility is produced by spallation of 20 GeV/c protons on a Pb target. Two experimental areas are currently available: EAR1, located at the end of a 200 m long flight path, and EAR2, at 20 m on the vertical of the spallation target. The innovative feature of the neutron beam in the two experimental areas i.e. the high instantaneous flux, the high energy resolution and low background, allow for an accurate determination of the neutron capture cross section for radioactive samples or for isotopes with small neutron capture cross sections, which are of interest for Nuclear Astrophysics

The recent results obtained by the n_TOF Collaboration, and their astrophysical implications will be presented in this talk.