Nuclear Astrophysics at the Darmstadt superconducting electron linear accelerator S-DALINAC*

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The superconducting linear electron accelerator S-DALINAC located at the Institut für Kernphysik of the TU Darmstadt, Germany, is an outstanding facility to study cross sections and reaction rates of astrophysical interest using electron and photon beams from 2 to 130 MeV [1].

Experiments on photodisintegration reactions can be performed with highest intensities using continuous-energy bremsstrahlung. The method of photoactivation allows to investigate very small amounts of target material and/or perform measurements with very low cross sections [2-6].

Additionally, a tagged photon beam in the energy range of 6 to 20 MeV is available with an energy resolution of 25 keV at 10 MeV photon energy. High resolution measurements of photodisintegration cross sections with a direct detection of the outcoming particles will provide accurate data in the energy range of astrophysical interest (the so-called Gamow window) for astrophysical network calculations [7].

Electron-scattering reactions at backward angles are particularly sensitive to magnetic dipole excitations. The spin part of the M1 operator is proportional to the Gamow-Teller operator for charge-exchange reactions or allowed weak processes. It has been demonstrated that electron scattering data from the S-DALINAC can be used to shed light on neutrino-induced reactions such as those possibly responsible for the revival of the shock-wave in a supernova explosion [8].

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