THE ^{40}CA(α,γ)44TI REACTION STUDIED BY IN-BEAM γ-SPECTROSCOPY AND ACTIVATION

Konrad Schmidt[1,2], Shavkat Akhmadaliev[1], Michael Anders[1,2], Daniel Bemmerer[1], Konstanze Boretzky[3], Antonio Caciolli[4], Mirco Dietz[1,2], Zoltán Elekes[1], Zsolt Fülöp[5], György Gyürky[5], Roland Hannaske[1,2], Arnd R. Junghans[1], Michele Marta[1,3], Marie-Luise Menzel[1,2], Ronald Schwengner[1], Tamás Szücs[5], Andreas Wagner[1], Louis Wagner[1,2], Dmitry Yakorev[1] and Kai Zuber[2]

[1] Helmholtz-Zentrum Dresden-Rossendorf (HZDR), Institute of Radiation Physics, Dresden, Germany
[2] TU Dresden, Institute of Nuclear and Particle Physics, Dresden, Germany
[3] GSI Helmholtzzentrum für Schwerionenforschung, Darmstadt, Germany
[4] Istituto Nazionale di Fisica Nucleare (INFN), Padova, Italy
[5] Institute of Nuclear Research of the Hungarian Academy of Sciences (ATOMKI), Debrecen, Hungary

The radioactive nuclide ^{44}Ti is believed to be produced in the alpha-rich freezeout preceding supernova explosions. The γ-rays from its decay have been observed in space-based γ-observatories for the Cassiopeia A and recently also SN 1987A supernova remnants [1]. The rates of the nuclear reactions governing the production and destruction of ^{44}Ti should therefore be known with high precision [2]. Over the last years there have been various studies of the ^{40}Ca(α,γ)^{44}Ti reaction, which is dominating the ^{44}Ti production in supernovae.
Using the α-beam of the 3.3 MV Tandetron at Dresden, the strengths of ^{40}Ca(α,γ)^{44}Ti resonance triplet at 4.5 MeV laboratory alpha-energy has been studied by in-beam gamma-spectroscopy and activation [3]. In addition, preliminary results of resonance strengths between 3.5 and 3.8 MeV will be presented.
The irradiated samples have been analyzed in the underground laboratory Dresden Felsenkeller. The target stoichiometry has been determined by nuclear reactions and by elastic recoil detection analysis (ERDA), whereby the strength of the E_p = 1.842MeV resonance in the ^{40}Ca(p,γ)^{41}Sc reaction could be restudied [4].

[1] S. A. Grebenev et al., Nature (London) 490, 373 (2012).
[2] L.-S. The et al., Astron. Astrophys. 450, 1037 (2006).
[3] Konrad Schmidt et al., Phys. Rev. C 88, 025803 (2013).
[4] Konrad Schmidt et al., Phys. Rev. C, in production, http://arxiv.org/abs/1404.2062