SAIP2017



Contribution ID: 85

Type: Oral Presentation

Nuclear level densities and gamma-ray strength functions of ^{180,181,182}Ta and neutron capture cross sections

Thursday, 6 July 2017 14:40 (20 minutes)

Most stable and extremely low abundance proton-rich nuclei with <i>A</i> ~ 110 are thought to be produced by the photodisintegration of <i>s</i> and <i>r</i> process seed nuclei. However, this so-called <i>p</i>-process is insufficient to explain the observed low abundance (0.012%) of the ¹⁸⁰Ta isotope. Hence combinations of several processes are considered to reproduce the observed abundance of ¹⁸⁰Ta in the cosmos, provoking debates and making it a unique case to study. Significant uncertainties in the predicted reaction rates in ^p-nuclei arise due to large uncertainties in nuclear properties such as the nuclear level densities (NLD) and gamma-ray strength functions (γ SF) [1], as well as the actual astrophysical environments. An experiment was performed in October 2014 to extract the NLD and ySF in ^{180,181,182}Ta isotopes which provide important input parameters for nuclear reaction models. In the present case study, these parameters were measured using the reactions ¹⁸¹Ta(³He, ⁴He'γ) and ¹⁸¹Ta(³He, αγ) with 34 MeV beam, ¹⁸¹Ta(d, d'y) and ¹⁸¹Ta(³He, ty) with 15 MeV beam, and ¹⁸¹Ta(d, d'y) and ¹⁸¹Ta(d, py) with 12.5 MeV beam at the Oslo Cyclotron Laboratory. Using the SiRi array at backward angles (64 silicon particle telescopes) and the CACTUS array (26 NaI(Tl) detectors), the NLD and γSF were simultaneously extracted below the neutron separation energy from particle-γ coincidence matrices through iterative procedures using the Oslo method [2]. The experimental results have been used to determine the corresponding neutron capture cross sections, which in turn were utilized to extract Maxwellian averaged cross sections. The latter can be used in astrophysical network calculations to investigate the galactic production mechanism of 180Ta. In this talk I will present results of this investigation.

[1] S. Goriely et al., A&A J. 375, L35 (2001).

[2] A. Schiller et al., NIM Phys. Res. A 447, 498 (2000).

Apply to be
 considered for a student
 award (Yes / No)?

Yes

Level for award
 (Hons, MSc,
 PhD, N/A)?

PhD

Main supervisor (name and email)
and his / her institution

Mathis Wiedeking (wiedeking@tlabs.ac.za) Department of Subatomic Physics, iThemba LABS, Old Faure Road, 7131, South Africa

Would you like to
 submit a short paper
 for the Conference
 Proceedings (Yes / No)?

Primary author: Mr MALATJI, Kgashane (SU)

Co-authors: Prof. GÖRGEN, Andreas (Department of Physics, University of Oslo, NO-0316 Oslo, Norway); Dr LARSEN, Ann-Cecilie (Department of Physics, University of Oslo, NO-0316 Oslo, Norway); Dr KHESWA, Bonginkosi (UJ); Mr BRITS, Christiaan (SU); Dr BLEUEL, Darren (Lawrence Livermore National Laboratory, Livermore, California 94551, USA); Dr SAHIN, Eda (Department of Physics, University of Oslo, NO-0316 Oslo, Norway); Mr ZEISER, Fabio (Department of Physics, University of Oslo, NO-0316 Oslo, Norway); Dr GIACOPPO, Francesca (Helmholtz Institute Mainz, 55099 Mainz, Germany and GSI Helmholtzzentrum fur Schwerionenforschung, 64291 Darmstadt, Germany); Mr BELLO GARROTE, Frank (Department of Physics, University of Oslo, NO-0316 Oslo, Norway); Dr TVETEN, Gry (Department of Physics, University of Oslo, NO-0316 Oslo, Norway); Dr NYHUS, Hilde (Department of Physics, University of Oslo, NO-0316 Oslo, Norway); Dr HADYNSKA-KLEK, Kasia (INFN, Laboratori Nazionali di Legnaro Padova, 35020 Legnaro, Italy); Prof. GUTTORMSEN, Magne (Department of Physics, University of Oslo, NO-0316 Oslo, Norway); Dr KLINTEFJORD, Malin (Department of Physics, University of Oslo, NO-0316 Oslo, Norway); Dr WIEDEKING, Mathis (Department of Subatomic Physics, iThemba LABS, Old Faure Road, 7131, South Africa); Dr ROSE, Sunniva (Department of Physics, University of Oslo, NO-0316 Oslo, Norway); Prof. SIEM, Sunniva (Department of Physics, University of Oslo, NO-0316 Oslo, Norway); Dr RENSTRØM, Therese (Department of Physics, University of Oslo, NO-0316 Oslo, Norway); Dr HAGEN, Trine (Department of Physics, University of Oslo, NO-0316 Oslo, Norway); Mr INGEBERG, Vetle (Department of Physics, University of Oslo, NO-0316 Oslo, Norway)

Presenter: Mr MALATJI, Kgashane (SU)

Session Classification: Nuclear, Particle and Radiation Physics 1

Track Classification: Track B - Nuclear, Particle and Radiation Physics