

HK 26 Kern- und Teilchen-Astrophysik

Zeit: Dienstag 17:00–18:30

Raum: E

HK 26.1 Di 17:00 E

Activation Measurements of the $^{27}\text{Al}(n,\gamma)^{28}\text{Al}$ and $^{23}\text{Na}(n,\gamma)^{24}\text{Na}$ Cross Sections at $kT=25$ keV — ●ETHAN UBERSEDER, MICHAEL HEIL, and FRANZ KAEPELER — Forschungszentrum Karlsruhe, Postfach 3640, 76021 Karlsruhe

New measurements of the $^{27}\text{Al}(n,\gamma)^{28}\text{Al}$ and $^{23}\text{Na}(n,\gamma)^{24}\text{Na}$ cross sections have been done with the Karlsruhe 3.75 MV Van de Graaff accelerator. The activations used the $^7\text{Li}(p,n)^7\text{Be}$ reaction as a neutron source, creating a quasi-stellar neutron spectrum at $kT=25$ keV. While the half life of ^{24}Na allowed for the employment of the standard activation technique, the short half life of ^{28}Al necessitated the use of the fast cyclic activation method. ^{27}Al and ^{23}Na are considered to be neutron poisons for the s-process, thus an accurate determination of their neutron capture cross sections at stellar temperatures is vital for models of nucleosynthesis. Preliminary results yield a lower cross section for both isotopes in comparison to previous time of flight measurements. The uncertainties are expected to be within 6 percent. The astrophysical implications of these new values on the stellar models of nucleosynthesis are discussed.

HK 26.2 Di 17:15 E

Isomers along the rp-process path and 1st experiments — ●TIMO GRIESEL^{1,2}, ANDREAS WÖHR², ANI APRAHAMIAN², PLAMEN BOUTACHKOV², and KARL-LUDWIG KRATZ^{1,2} — ¹Kernchemie Mainz, HGF-VISTARS, Mainz Germany — ²ISNAP, Univ. of Notre Dame, JINA, Notre Dame, USA

Accretion disks of binary star systems are thought to have the right density and temperature conditions to ignite a thermonuclear runaway of rapid-proton (rp-process) and alpha capture reactions leading to the synthesis of proton rich nuclei. The recent observation of a low energy shape isomer in the even-even self-conjugated $N=Z$ nuclei ^{72}Kr has given some indication for potential new pathways for the rp-process reaction path in bypassing waiting points. Similar shape isomers have been predicted for the $N=Z$ waiting point nuclei ^{68}Se and ^{64}Ge . A series of experiments to search for isomers has started at ISNAP at the Univ. of Notre Dame. First tests via the reactions $^{54}\text{Fe}(^{12}\text{C}, 2n)^{64}\text{Ge}$ and $^{56}\text{Ni}(^{12}\text{C}, 2n)^{68}\text{Se}$ were made. To identify the isotopes ^{64}Ge and ^{68}Se , n-g coincidences were measured.

A status report on the measurements and data analysis will be given.

This work was supported by NSF (Notre Dame, JINA) and HGF-Vistars.

HK 26.3 Di 17:30 E

Determination of stellar neutron cross sections with AMS — ●L. DILLMANN^{1,2}, L. COQUARD¹, M. HEIL¹, T. FÄSTERMANN³, F. KÄPPELER¹, K. KNIE³, G. KORSCHNEK³, W. KUTSCHERA⁴, M. POUTIVSEV³, T. RAUSCHER³, G. RUGEL³, F.-K. THIELEMANN², and A. WALLNER⁴ — ¹Institut für Kernphysik, Forschungszentrum Karlsruhe, D-76021 Karlsruhe — ²Departement Physik und Astronomie, Universität Basel, CH-4056 Basel — ³Physik Departement E15, Technische Universität München, D-85748 Garching — ⁴Vienna Environmental Research Accelerator (VERA), Institut für Isotopenforschung und Kernphysik, Universität Wien, A-1090 Wien

The activation technique, which represents a well established tool for measurements of stellar neutron cross sections, has been combined with accelerator mass spectroscopy (AMS) for investigation of the stellar (n,γ) cross sections of ^9Be , ^{40}Ca , ^{58}Ni , and ^{78}Se at a thermal energy of $kT=25$ keV. In all those cases, direct off-line counting of the produced activity with a HPGe is compromised by the long half-lives of the reactions products and the absence of suited γ -ray transitions.

The activation measurements were performed at the 3.7 MV Van de Graaff accelerator at Forschungszentrum Karlsruhe by irradiating natural samples in a quasi-stellar neutron spectrum of $kT=25$ keV produced by the $^7\text{Li}(p,n)^7\text{Be}$ reaction. The AMS measurements were done at the Vienna Environmental Research Accelerator (^9Be and ^{40}Ca) and with the Gas-filled Analyzing Magnet System (GAMS) at the Munich MP Tandem accelerator (^{58}Ni and ^{78}Se).

HK 26.4 Di 17:45 E

β -decay properties of r-process nuclei in the ^{132}Sn region — ●R. KESSLER¹, J. PEREIRA², H. SCHATZ², M. HELLSTRÖM³, T. FAESTERMANN⁴, and K.-L. KRATZ¹ for the FRS-GSI E040 collaboration — ¹Inst. für Kernchemie & HGF-VISTARS, Univ. Mainz, Germany — ²NSCL/MSU & JINA, USA — ³GSI, Germany — ⁴TU München, Germany

Masses and β -decay properties of extremely neutron-rich nuclei in the region around the doubly-magical ^{132}Sn are important for the understanding and modeling of the r-process, especially with respect to the $A\approx 130$ solar-system abundance peak. For this purpose, under E040 two experiments have been performed at FRS and ESR at GSI, using projectile fission of a 750 MeV/u ^{238}U beam impinging on a Pb target. We report here on the measurements of $T_{1/2}$ and P_n values at the FRS with the Munich β -detector system and the Mainz 4π neutron longcounter. Several new isotopes north-east of ^{132}Sn have been identified, among them the r-process “waiting pointss” ^{136}Sn , ^{137}Sb and ^{140}Te .

HK 26.5 Di 18:00 E

Neutrino nucleosynthesis of the exotic nuclei ^{138}La and ^{180}Ta by charged current reactions* — ●A. BYELIKOV¹, T. ADACHI², P. VON BRENTANO³, D. FREKERS⁴, D. DE FRENNE⁵, H. FUJITA⁶, Y. FUJITA², A. HEGER⁷, E. JAKOBS⁵, Y. KALMYKOV¹, K. LANGANKE⁸, E. KOLBE⁹, A. NEGRET⁵, P. VON NEUMANN-COSEL¹, L. POPESCU⁵, S. RAKERS⁴, A. RICHTER¹, A. SHEVCHENKO¹, and Y. SHIMBARA² — ¹TU Darmstadt — ²Osaka University — ³Universität zu Köln — ⁴Universität Münster — ⁵Universiteit Gent — ⁶University of Witwatersrand — ⁷Los Alamos — ⁸GSI — ⁹Universität Basel

The origin of the exotic isotopes ^{138}La and ^{180}Ta is an open question so far. The latest calculations [1] with detailed modelling of nucleosynthesis in massive stars $> 10M_{\odot}$ predict a significant production through charged current reactions (ν_e, e) on ^{138}Ba and ^{180}Hf , respectively. The cross sections at low energies in the daughter nuclei are dominated by GT transitions. The GT response could be measured in high resolution $^{138}\text{Ba}, ^{180}\text{Hf}(^3\text{He}, t)$ experiments under zero degree. The talk presents the final experimental results and discusses their astrophysical relevance.

[1] A. Heger et al., Phys. Lett. B606 (2005) 258

*Supported by the DFG through SFB 634 and 446 JAP-113/267/0-1.

HK 26.6 Di 18:15 E

Untersuchung des astrophysikalisch relevanten*(γ, n)-Wirkungsquerschnitts von $^{191,193}\text{Ir}$ * — ●J. HASPER¹, D. GALAVIZ², A. KRETSCHMER¹, T. RAUSCHER³, K. SONNABEND¹ und A. ZILGES¹ — ¹Institut für Kernphysik, TU Darmstadt, D-64289* Darmstadt, Germany — ²Michigan State University, East Lansing, MI 48824-1321, USA — ³Institut für Physik,*Universität Basel, 4056 Basel, Schweiz

Am supraleitenden Elektronenbeschleuniger S-DALINAC wurden unter Verwendung der Photoaktivierungsmethode [1,2] der Wirkungsquerschnitt sowie die Reaktionsraten im astrophysikalisch relevanten Energiebereich für den Grundzustand der Reaktionen $^{191}\text{Ir}(\gamma, n)^{190}\text{Ir}$ und $^{193}\text{Ir}(\gamma, n)^{192}\text{Ir}$ knapp oberhalb der Neutronenseparationsenergie $S_n = 8.072$ MeV bzw. $S_n = 7.772$ MeV vermessen. Die Ergebnisse liefern wichtige Informationen für die Umkehrreaktionen $^{190}\text{Ir}(n, \gamma)^{191}\text{Ir}$ und $^{192}\text{Ir}(n, \gamma)^{193}\text{Ir}$ und tragen so zu einem besseren Verständnis des s-Prozesses in dem entsprechenden Massenbereich bei. Insbesondere ^{192}Ir spielt als Verzweigungspunkt eine wichtige Rolle im s-Prozess.

* Dieses Projekt wird gefördert durch die DFG (SFB 634)

[1] K. Sonnabend et al., Astrophysical Journal **583**, 506 (2003)

[2] P. Mohr et al., Phys. Lett. **B488**, 127 (2000)