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}Al$(n,\gamma)^{28}$Al and ^{23}Na$(n,\gamma)^{24}$Na Cross Sections at kT=25 keV — •Ethan Uberseder, Michael Heil, and Franz Kaeppeler — Forschungszentrum Karlsruhe, Postfach 3640, 76021 Karlsruhe

New measurements of the ^{27}Al$(n,\gamma)^{28}$Al and ^{23}Na$(n,\gamma)^{24}$Na cross sections have been done with the Karlsruhe 3.75 MV Van de Graaff accelerator. The activations used the ^{7}Li$(p,n)^{7}$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 Wöhr[2], Ani Aprahamian[2], Plamen Boutachkov[2], and Karl-Ludwig Kratz[1,2] — [1]Kernchemie Mainz, HGF-VISTARS, Mainz Germany — [2]ISNAP, 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 $^{54}Fe(^{12}C,2n)^{64}Ge$ and $^{56}Ni(^{12}C,2n)^{68}Se$ 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.

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HK 26.3 Di 17:30 E

Determination of stellar neutron cross sections with AMS — •I. Dillmann[1,2], L. Coquard[1], M. Heil[1], T. Fästermann[3], F. Käppeler[1], K. Knie[3], G. Korschinek[3], W. Kutschera[4], M. Poutivsev[3], T. Rauscher[2], G. Rugel[3], F.-K. Thielemann[2], and A. Wallner[4] — [1]Institut für Kernphysik, Forschungszentrum Karlsruhe, D-76021 Karlsruhe — [2]Departement Physik und Astronomie, Universität Basel, CH-4056 Basel — [3]Physik Departement E15, Technische Universität München, D-85748 Garching — [4]Vienna 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 ^{9}Be, ^{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}Li(p,n)^{7}Be reaction. The AMS measurements were done at the Vienna Environmental Research Accelerator (^{9}Be 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. Kessler[1], J. Pereira[2], H. Schatz[2], M. Hellström[3], T. Faestermann[4], and K.-L. Kratz[1] for the FRS-GSI E040 collaboration — [1]Inst. für Kernchemie & HGF-VISTARS, Univ. Mainz, Germany — [2]NSCL/MSU & JINA, USA — [3]GSI, Germany — [4]TU 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$\simeq$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. Byelikov[1], T. Adachi[2], P. von Brentano[3], D. Frekers[4], D. De Frenne[5], H. Fujita[6], Y. Fujita[2], A. Heger[7], E. Jakobs[5], Y. Kalmykov[1], K. Langanke[8], E. Kolbe[9], A. Negret[5], P. von Neumann-Cosel[1], L. Popescu[5], S. Rakers[4], A. Richter[1], A. Shevchenko[1], and Y. Shimbara[2] — [1]TU Darmstadt — [2]Osaka University — [3]Universität zu Köln — [4]Universität Münster — [5]Universiteit Gent — [6]University of Witwatersrand — [7]Los Alamos — [8]GSI — [9]Universität 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}Ba,^{180}Hf(^{3}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

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HK 26.6 Di 18:15 E

Untersuchung des astrophysikalisch relevanten*(γ,n)-Wirkungsquerschnitts von ^{191,193}Ir * — •J. Hasper[1], D. Galaviz[2], A. Kretschmer[1], T. Rauscher[3], K. Sonnabend[1] und A. Zilges[1] — [1]Institut für Kernphysik, TU Darmstadt, D-64289*Darmstadt, Germany — [2]Michigan State University, East Lansing, MI 48824-1321, USA — [3]Institut 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}Ir$(\gamma,n)^{190}$Ir und ^{193}Ir$(\gamma,n)^{192}$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}Ir$(n,\gamma)^{191}$Ir und ^{192}Ir$(n,\gamma)^{193}$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. B**488**, 127 (2000)