HK 31 Kern- und Teilchen-Astrophysik

Zeit: Mittwoch 14:00–16:00 Raum: E

Gruppenbericht HK 31.1 Mi 14:00 E

Anwendungen der Beschleuniger-Massenspektrometrie in der nuklearen Astrophysik — •Klaus Knie[1], Andres Arazi[2], Iris Dillmann[3], Thomas Faestermann[1], Jorge Fernandez-Niello[2], Michael Heil[3], Franz Käppeler[3], Gunther Korschinek[1], Mikhail Poutivtsev[1], Edgar Richter[4], Georg Rugel[1] und Anton Wallner[5] — [1]Teuchnische Universität München, Fakultät für Physik — [2]Laboratorio TANDAR, Buenos Aires, Argentinia — [3]Forschungszentrum Karlsruhe, Institut für Kernphysik — [4]Forschungszentrum Rossendorf — [5]Universität Wien, Institut für Isotopenforschung und Kernphysik

Mit Beschleuniger-Massenspektrometrie (AMS) können langlebige Radionuklide mit höchster Empfindlichkeit nachgewiesen werden. Der GAMS-Aufbau am Münchner Tandembeschleuniger ermöglicht eine so hohe Untergrundunterdrückung, dass im Massenbereich $40 < A < 80$ einzigartige Empfindlichkeiten erreicht wurden.

Die Methode wurde zur Vermessung mehrerer für die Nukleosynthese relevanten Wirkungsquerschnitte verwendet. Hierzu zählen ^{58}Ni(n,γ)^{59}Ni, ^{78}Se(n,γ)^{79}Se und ^{26}Mg(p,n)^{26}Al.

Ein anderes Anwendungsgebiet ist die Bestimmung von Halbwertszeiten langlebiger Radionuklide wie ^{59}Ni, ^{60}Fe und ^{53}Mn.

Gruppenbericht HK 31.2 Mi 14:30 E

Electromagnetic Excitations in Nuclei: From Photon Scattering to Photo-dissociation* — •R. Beyer[1], F. Dönau[1], M. Erhard[1], E. Grosse[1,2], A. R. Junghans[1], K. Kosev[1], C. Nair[1], N. Nankov[1], G. Rusev[1], K.-D. Schilling[1], R. Schwengner[1], and A. Wagner[1] — [1]Inst. für Kern- und Hadronenphysik, FZ Rossendorf, PF 510119, 01314 Dresden — [2]Inst. für Kern- und Teilchenphysik, TU Dresden, 01062 Dresden

The synthesis of chemical elements by nuclear transformation processes in high temperature cosmic environments plays a key role for the observed abundances of isotopes in the solar system. In order to understand the details of element production and element disruption we started an experimental program at the new bremsstrahlung facility [1] of the superconducting electron accelerator ELBE. The experimental setup is designed such that the scattering of photons from nuclei and the dissociation of nuclei by photons can be studied around the particle separation energies under optimized background conditions. Photon scattering experiments on ^{92,98,100}Mo, ^{88}Sr, ^{89}Y, and ^{90}Zr will be shown and compared to calculations based on a random-phase approximation method for deformed nuclei. Photo-dissociation has been studied in $(\gamma,\mathrm{p}), (\gamma,\mathrm{n})$ and (γ,α) reactions on ^{92,100}Mo and the results are compared to values used in recent astrophysical network calculations [3,4]. *Work supported by Deutsche Forschungsgemeinschaft under contract Do 466/1-2. [1] R. Schwengner, et al., NIM A 555 (2005) 211; [2] F. Dönau, Phys. Rev. Lett. 94 (2005) 092503; [3] M. Arnould and S. Goriely, Phys. Rep. 382 (2003) 1; [4] T. Rauscher, F.-K. Thielemann, ADNDT 88 (2004) 1

Gruppenbericht HK 31.3 Mi 15:00 E

The weak s process in massive stars — •Michael Heil — Forschungszentrum Karlsruhe, Postfach 3640, 76021 Karlsruhe

Over the last decades, considerable effort in experimental nuclear astrophysics, stellar modelling, and observations led to an improved understanding of various nucleosynthesis scenarios. This is particularly true for the main s process in low-mass AGB stars, which is largely responsible for the production of about half of the elemental abundances in the mass range 90<A<209. The weak s process, which produces elements with A<90 is, however, much less understood. Since this process operates in massive stars and, therefore determines the composition of the supernova progenitors, it is ultimately linked with the abundance contributions of explosive nucleosynthesis. More accurate neutron capture cross sections in the mass range 56<A<90 are indispensable for a meaningful comparison of model predictions with observational data. Recent experiments have shown that many neutron capture cross sections in this mass range are systematically overestimated. New results for neutron capture cross sections on light and medium mass nuclei will be presented and the influence on the production rate in massive stars will be discussed.

Gruppenbericht HK 31.4 Mi 15:30 E

Abundance Clues to the Nature of Two r-Processes — •K.-L. Kratz[1], B. Pfeiffer[1], F. Farouqi[1], J.J. Cowan[2], C. Sneden[3], and J.W. Truran[4] — [1]Inst. für Kernchemie & HGF-VISTARS, Univ. Mainz, Germany — [2]Univ. of Oklahoma, USA — [3]Univ. of Texas, USA — [4]Univ. of Chicago, USA

Abundances of neutron-capture elements beyond Ba in several ultra-metal-poor (UMP) halo stars in the early Galaxy accurately replicate the Solar System r-process pattern, whereas the lighter elements show distinct under-abundances. This appears to require contributions from a second type of r-process synthesis event. We examine r-process model predictions to explore the nuclear and astrophysical implications of the solar and stellar observations. We find that the isotopic fractions of Ba, together with the Ba/Eu elemental abundance ratios in the UMP stars can only be matched by computations in which the neutron densities are $\mathrm{n}_n > 10^{23}$ cm^{-3} (”main” r-process), whereas the reproduction of the lighter-element pattern requires only ”weak” r-process conditions of $\mathrm{n}_n < 10^{23}$ cm^{-3}. Further, our calculations indicate that it is difficult to decouple full production of the 2nd r-process abundance peak from the oberved full solar pattern beyond Ba. Finally, in the n_n-ranges required for production for the observed solar / stellar $3^r d$ r-process peak, our prediction of inter-peak element Hf follows closely those of the $3^r d$ peak elements Os through Pb, Bi. This suggests that abundance comparisons of Hf to lower-Z rare-earth elements and to $3^r d$-peak elements, as well as to the Th, U cosmochronometers, can shed furhter light on claims of invariance in the entire heavy end of the r-process abundance pattern.