HK 40: Nukleare Astrophysik

Zeit: Donnerstag 14:00–16:00 Raum: HZ 5

Gruppenbericht HK 40.1 Do 14:00 HZ 5

Nuclear reactions studies for p-process nucleosynthesis* — •Jan Glorius[1,2], Kerstin Sonnabend[1], and René Reifarth[1] — [1]Goethe-Universität Frankfurt am Main, 60438 Frankfurt am Main, Germany — [2]GSI Helmholtzzentrum für Schwerionenforschung, 64291 Darmstadt, Germany

The stellar nucleosynthesis of the so-called p-nuclei involves a large number and variety of nuclear reactions, which have to be studied and understood in order to reliably model these processes. A wide spectrum of experimental approaches can be persued for these investigations. An overview of the activities of the experimental astrophysics group at the Goethe University Frankfurt in the field will be given. This includes the measurement of proton-, α- and γ-induced reactions using in-beam and activation methods as well as storage ring experiments in inverse kinematics at the ESR.

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Gruppenbericht HK 40.2 Do 14:30 HZ 5

The impact of neutrino oscillations on supernova explosion, nucleosynthesis, and the neutrino signals. — •Meng-Ru Wu[1], Tobias Fischer[2], Lutz Huther[1], Gabriel Martinez-Pinedo[1,3], and Yong-Zhong Qian[4] — [1]Institut für Kernphysik, Technische Universität Darmstadt, Darmstadt, Germany — [2]Institute for Theoretical Physics, University of Wrocław, Wrocław, Poland — [3]GSI Helmholtzzentrum für Schwerioneneforschung, Darmstadt, Germany — [4]School of Physics and Astronomy, University of Minnesota, Minneapolis, USA

Core-collapse supernovae are among the major astrophysical sites that produce elements heavier than iron. They are also the most intense sources for MeV neutrinos. These neutrinos play essential roles in various physical processes in supernovae, such as the revival of the supernova shock by neutrino heating and any neutrino-associated nucleosynthesis. Consequently, neutrino oscillations among active flavors or between active and sterile flavors might affect the above mentioned processes significantly. In this talk, we will present our recent calculation of neutrino oscillations in supernovae and their impact on supernova explosion and nucleosynthesis. In addition, we will discuss the expected galactic supernova neutrino signals in current and planned neutrino detectors and their possible implication for both physics of supernovae and the fundamental property of neutrinos.

HK 40.3 Do 15:00 HZ 5

Charged current interactions of ν_μ neutrinos in supernova — •Andreas Lohs[1,2], Gabriel Martinez-Pinedo[1,2], and Tobias Fischer[3] — [1]Technische Universität Darmstadt — [2]GSI Helmholtzzentrum für Schwerionenforschung, Darmstadt — [3]University of Wroclaw, Poland

We calculate opacities and production rates for charged current interaction reactions for muon neutrinos and muons in core collapse supernova. We find that these reactions contribute significantly to the opacity of muon neutrinos at densities of 10^{13} g/cm^3 and higher. Consequently the neutrinosphere position becomes different for ν_μ and $\bar{\nu}_\mu$, probably resulting in spectral differences between ν_μ, $\bar{\nu}_\mu$ and ν_τ, $\bar{\nu}_\tau$. For the above densities, we find that the rate of muon production is faster than the dynamical evolution timescale. Muons will reach equilibrium abundances in the supernova core allready before bounce. The change in composition due to equilibration of muons is investigated in a post-processing way. It leads to a temporary net antineutrino abundance in the core, possibly affecting the deleptonization of the proto neutron star and resulting in a net muon flavour abundance in the stellar core. We therefore recommend implementation of these reactions in future simulations. Andreas Lohs is a member of H-QM Helmholtz graduate school and supported by GSI and HIC for FAIR. This work is partly supported by Deutsche Forschungsgemeinschaft through contract SFB 634.

HK 40.4 Do 15:15 HZ 5

^{13,14}B(n,γ) via Coulomb Dissociation to Constrain the Astrophysical r Process — •Sebastian Altstadt for the R3B-Collaboration — Goethe-Universität Frankfurt — GSI Helmholtzzentrum für Schwerionenforschung GmbH

^{13,14}B(n,γ) was experimentally studied via Coulomb dissociation at the LAND/R^{3}B setup in order to understand the impact of (n,γ) reactions on neutron-rich boron isotopes on the *r* process. A primary beam of ^{40}Ar was fragmented and the isotopes in question were separated from the primary beam using a fragment separator. A secondary beam of ^{14,15}B was then directed onto a Pb-target to investigate the neutron breakup within the equivalent photon field. The results from the Coulomb dissociation measurement and first experimental constraints on the radiative capture cross sections will be presented. Furthermore, new evidence for a 1n halo-structure in ^{14}B will be discussed.

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HK 40.5 Do 15:30 HZ 5

Search for Supernova-produced ^{60}Fe in the Earth's Fossil Record — •Shawn Bishop[1], Peter Ludwig[1], Ramon Egli[2], Valentyna Chernenko[1], Thomas Faestermann[1], Nicolai Famulok[1], Leticia Fimiani[1], Thomas Frederichs[3], Jose Gomez[1], Karin Hain[1], Marianne Hazlik[4], Gunther Korschinek[1], Silke Merchel[5], and Georg Rugel[5] — [1]TU München, Physik Department — [2]ZAMG, Wien — [3]Universität Bremen, Geowissenschaften — [4]TU München, Fakultät für Chemie — [5]HZDR, Dresden

Approximately 1.8 to 2.8 Myr before the present our planet was subjected to the debris of a supernova explosion. The terrestrial proxy for this event was the discovery of live atoms of ^{60}Fe in a deep-sea ferromanganese crust [Knie et al., Phys. Rev. Lett. (2004)]. The signature for this supernova event should also reside in magnetite (Fe_3O_4) magnetofossils produced by magnetotactic bacteria extant at the time of the Earth-supernova interaction; these bacteria were and are ubiquitous in all ocean sediments. We have conducted accelerator mass spectrometry (AMS) measurements, searching for *live* ^{60}Fe in the magnetofossil component of a Pacific Ocean sediment core (ODP Core 848); additional AMS measurements are now ongoing with a second sediment core (ODP Core 851) in which we expect to find a higher ^{60}Fe signal. This talk will present the current preliminary status of our ^{60}Fe search results for both sediment cores.

HK 40.6 Do 15:45 HZ 5

First results of the ^{92}Mo(p,γ)^{93}Tc reaction performed at the HORUS spectrometer in Cologne — •Jan Mayer[1], Martin Baldenhofer[1], Lars Netterdon[1], Anne Sauerwein[2], Philipp Scholz[1], and Andreas Zilges[1] — [1]Institute for Nuclear Physics, University of Cologne — [2]Institute for Applied Physics, Goethe University Frankfurt

The γ process is an important nucleosynthesis mechanism to explain the abundances of the majority of *p* nuclei, which are bypassed by neutron capture processes. To improve the accuracy of reaction rates predicted by theoretical models, precise experimental data is required. In-beam experiments with HPGe detectors aim at measuring total and partial reaction cross sections for stable as well as unstable products and thus either allow the direct calculation of stellar rates or constrain nuclear physics input parameters. Located at the 10 MV tandem accelerator of the University of Cologne, the high-efficiency HPGe γ-ray spectrometer HORUS was used to measure the ^{92}Mo(p,γ)^{93}Tc reaction at proton energies between 3.7 and 5 MeV. In this talk, first results on total and partial cross sections will be presented.

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