HK 19: Nukleare Astrophysik I

Zeit: Dienstag 14:00–16:00 Raum: HG VI

Gruppenbericht HK 19.1 Di 14:00 HG VI

Exploiting the superior resolution of the Munich Q3D spectrograph for nuclear astrophysics — •Anuj Parikh[1], Thomas Faestermann[1], Ralf Hertenberger[2], Reiner Krücken[1], Hans Wirth[2], Thomas Behrens[1], Vinzenz Bildstein[1], Shawn Bishop[1], Alan Chen[3,4], Jason Clark[5], Catherine Deibel[5,6], Katrin Eppinger[1], Clemens Herlitzius[1], Christoph Hinke[1], Olga Lepyoshkina[1], Peter Maierbeck[1], Georg Rugel[1], Dominik Seiler[1], Kiana Setoodehnia[4], Kathrin Wimmer[1], and Chris Wrede[7] — [1]Physik Department E12, TU-München — [2]Fakultät für Physik, LMU-München — [3]Excellence Cluster Universe, TU-München — [4]Department of Physics and Astronomy, McMaster Univ. — [5]Physics Division, Argonne — [6]JINA, Michigan State Univ. — [7]CENPA, Univ. Washington

Classical novae are unique in nuclear astrophysics because most of the involved reaction rates are constrained by experiments. This allows one to judge which measurements are still necessary to improve the nuclear physics input to models. In this context, the ^{30}P(p,γ)^{31}S reaction rate needs to be better determined over nova temperatures. Direct measurements of this reaction are not possible yet, and so indirect techniques must be used. There has been significant recent activity on this issue, but difficulties have been encountered in nuclear spectroscopy studies (e.g., ^{31}P(^{3}He,t)^{31}S) due to experimental energy resolution. For this and other reactions, we discuss recent measurements using the superior resolution of the Munich Q3D spectrograph (ΔE/E$\approx$2 x 10^{-4}) that can improve determinations of thermonuclear rates.

Gruppenbericht HK 19.2 Di 14:30 HG VI

The high density QCD phase transition in compact stars — •Giuseppe Pagliara[1], Matthias Hempel[1], Irina Sagert[2], and Jurgen Schaffner-Bielich[1] — [1]Institut für Theoretische Physik, Ruprecht-Karls-Universität, Philosophenweg 16, D-69120, Heidelberg, Germany — [2]Institut für Theoretische Physik, Johann Wolfgang Goethe-Universität, Max von Laue–Str. 1, D-60438 Frankfurt, Germany

The study of the QCD phase diagram at high density is still in its infancy. A promising source of experimental informations comes from the physics of neutron stars, the core of which might reach densities up to ten times nuclear matter density. We review the different possible signals from neutrons stars which bring informations about the equation of state of strongly interacting matter from their birth, in a Supernova explosion [1], to the deleptonization era [2] and the early or late cooling, to eventually their final instants of life within the merger process in binary systems [3]. A special emphasis will be put on the modeling of the equation of state of matter from sub-saturation densities up to the large densities at which the chiral phase transition is believed to occur.

[1]Phys.Rev.Lett.102:081101,2009
[2]Phys.Rev.Lett.103:171102,2009
[3]Phys.Rev.Lett.103:011101,2009

HK 19.3 Di 15:00 HG VI

^{96}Ru(p,γ)^{97}Rh measurement at the GSI storage ring — •Rene Reifarth for the E062-Collaboration — GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt, 64291, Germany — J.W. Goethe Universität, Frankfurt a.M, 60438, Germany

The nucleosynthesis of elements beyond iron is dominated by neutron captures in the s and r processes. However, 32 so-called p-nuclei are thought to be produced in the p process, where proton-rich nuclei are made by sequences of photodisintegrations and (p,γ) reactions and following β^+ decays on existing r- and s-seed nuclei.

Cross section measurements on (p,γ) and (α,γ) reactions in the astrophysically interesting energy range are already very challenging on stable nuclei. Only a minute part of the nuclei involved in p-process networks, however, is stable. The most promising approach to determine the desired reaction rates is to produce the isotopes in Radioactive Ion Beam facilities and to investigate the reactions in inverse kinematics.

A pioneering experiment was recently performed at the Experimental Storage Ring (ESR) at GSI. Fully stripped ions of ^{96}Ru were injected into the storage ring and slowed down to a few MeV/nucleon. The reaction products were detected with different particle detectors.

This project is supported by the HGF Young Investigators Project VH-NG-327.

HK 19.4 Di 15:15 HG VI

Updated ^{14}N(p,γ)^{15}O data from LUNA — •Michele Marta[1], Daniel Bemmerer[1], Claus Rolfs[2], Frank Strieder[2], and Hanns-Peter Trautvetter[2] for the LUNA-Collaboration — [1]Forschungszentrum Dresden-Rossendorf, Dresden, Germany — [2]Institut für Experimentalphysik III, Ruhr-Universität Bochum, Bochum, Germany

The ^{14}N(p,γ)^{15}O reaction controls the rate of the hydrogen burning CNO cycle. By detecting solar CNO neutrinos (e.g. in Borexino, SNO+) one can in principle measure directly the carbon and nitrogen abundance at the center of the Sun. However this requires more precise nuclear data. Updated experimental results on capture to various excited states (as well as to the ground state) in ^{15}O are shown, together with improved branching ratios obtained for the $E_{\mathrm{p}} = 278$ keV resonance.

HK 19.5 Di 15:30 HG VI

Experiment zur ^{14}N(p,γ)^{15}O–Reaktion bei 0.6-2.0 MeV — •Daniel Bemmerer[1], Roland Beyer[1], Carlo Broggini[2], Antonio Caciolli[2], Martin Erhard[1,2], Zsolt Fülöp[3], Eckart Grosse[1], György Gyürky[3], Roland Hannaske[1], Arnd Rudolf Junghans[1], Michele Marta[1], Roberto Menegazzo[2], Chithra Nair[1], Ronald Schwengner[1], Tamas Szücs[1,3], Erik Trompler[1], Andreas Wagner[1] und Dmitry Yakorev[1] — [1]Forschungszentrum Dresden-Rossendorf (FZD), Dresden — [2]INFN Sezione di Padova, Padova, Italien — [3]ATOMKI, Debrecen, Ungarn

Die Rate des Bethe-Weizsäcker-Zyklus des Wasserstoffbrennens wird von der langsamsten Reaktion, ^{14}N(p,γ)^{15}O, bestimmt. Diese Reaktion ist kürzlich u.a. bei LUNA im Energiebereich unterhalb 0.5 MeV neu untersucht worden. Allerdings spielen auch höherenergetische Daten eine Rolle bei der Extrapolation des Wirkungsquerschnitts zu extrem niedrigen, unmessbaren Energien. Die Reaktion wurde jetzt am FZD-Tandetron im Energiebereich von 0.6-2.0 MeV neu untersucht. — Unterstützt von der Herbert-Quandt-Stiftung (Stipendium für T.S.) und der Europäischen Union (FP6 AIM RITA 025646).

HK 19.6 Di 15:45 HG VI

Measurement of the ^{15}O($2p,\gamma$)^{17}Ne cross section by Coulomb Dissociation of ^{17}Ne — •Justyna Marganiec[1], Thomas Aumann[2], Michael Heil[2], Ralf Plag[2], and Felix Wamers[2] for the R3B-Collaboration — [1]ExtreMe Matter Institute EMMI, GSI Darmstadt, Darmstadt, Germany — [2]Kernreaktionen und Nuklear Astrophysik, GSI Darmstadt, Darmstadt, Germany

For the production of proton-rich nuclei during the *rp* process two-proton capture plays an important role. This process can bridge long-lived waiting points which otherwise hamper the mass flow between CNO material and the FeNi mass region. One of these waiting points is ^{15}O. The three-body radiative capture can proceed sequentially or directly from the three-body continuum. The rate of the ^{15}O($2p,\gamma$)^{17}Ne reaction obtained using the two-successive-proton-capture model has been discussed in J. Görres *et al.* (*Phys. Rev. C* 51, 392, 1995). The role of continuum states (^{15}O+$2p$) for the rate calculation has been demonstrated in L.V Grigorenko, M.V. Zhukov (*Phys. Rev. C* 72, 015803, 2005). It has been suggested that the reaction rate can be enhanced by a few orders of magnitude by taking into account the three-body continuum. In order to verify these calculations, we have deduced the ^{15}O($2p,\gamma$)^{17}Ne cross section by studying the time-reversed process, the Coulomb dissociation of ^{17}Ne, at the LAND/R^{3}B setup at GSI, using a ^{17}Ne secondary beam from the fragment separator FRS.

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