HK 20 Kern- und Teilchen-Astrophysik

Zeit: Montag 14:00–16:00 Raum: TU MA144

HK 20.1 Mo 14:00 TU MA144

Neutrino transport in proto neutron stars — •Jens Berdermann[1], David Blaschke[2,3], and Hovik Grigorian[1,4] — [1]Fachbereich Physik, Universität Rostock, Germany — [2]Bogoliubov Laboratory of Theoretical Physics, ¿ Joint Institute for Nuclear Research, 141980, Dubna, Russia — [3]Fakultät für Physik, Universität Bielefeld, ¿ D-33615 Bielefeld, Germany — [4]Department of Physics, Yerevan State University, 375025 ¿ Yerevan, Armenia

¿ Proto neutron stars (PNS) are created after type II supernova explosions ¿ with initial temperatures up to 40 MeV. ¿ In such a hot, dense environment, as long as the ¿ temperature $T \geq 1$ MeV, the neutrino mean free path ¿ is much smaller than the star radius $R \sim 10$ km and the ¿ PNS is practically opac for neutrinos. ¿ The neutrino transport in this neutrino trapping regime ¿ is described in the equilibrium diffusion approximation, ¿ which gives a satisfactory description for the limiting cases of ¿ trapping ¿ ($Y_l \approx 0.38, s \simeq 1, T \geq 1 \div 3$ MeV) ¿ and free radiation ($Y_\nu \approx 0, s \simeq 2, T \leq 1 \div 3 >$ MeV). ¿ We show the advantages and limitations of this approximations and give ¿ an ¿ outlook to effects due to the inclusion of accretion and rotation ¿ of the PNS. ¿ ¿ ¿ *Partially supported by DFG Graduiertenkolleg 567 "Stark korrelierte ¿ ¿ Vielteilchensysteme" at Universität Rostock. ¿ ¿ ¿ ¿ ¿ ¿*

HK 20.2 Mo 14:15 TU MA144

Cooling of neutron stars with color superconducting quark core — •Hovik Grigorian[1,2], David Blaschke[3,4], and Dmitri Voskresensky[5,6] — [1]Fachbereich Physik, Universität Rostock, Germany — [2]Department of Physics, Yerevan State University, 375025 Yerevan, Armenia — [3]Bogoliubov Laboratory of Theoretical Physics, Joint Institute for Nuclear Research, 141980, Dubna, Russia — [4]Fakultät für Physik, Universität Bielefeld, D-33615 Bielefeld, Germany — [5]Theory Division, GSI mbH, D–64291 Darmstadt, Germany — [6]Moscow Institute for Physics and Engineering, 115409 Moscow, Russia

We present a nonlocal, chiral quark model which allows hybrid star configurations with color superconducting quark matter cores and masses below 1.4 $M_\odot$. We study the cooling of these objects in isolation for different values of the gravitational mass and thus different composition and structure of the interior. phase We argue that, if phases with unpaired quarks were allowed, the corresponding hybrid stars would cool too fast to describe the neutron star cooling data existing by today. We discuss two possibilities to have all quarks paired in two-flavor quark matter under neutron star constraints: (1) the "2SC+X"phase and (2) the CSL phase. In both cases the weak pairing gaps are of the order of 10 - 100 keV with a decreasing density dependence giving the best explanation of the cooling data. *Partially supported by Virtual Institute of the Helmholtz Association under grant No. VH-VI-041, DFG grant No. 436 RUS 117/17/03 and by the DAAD Partnership Programme.*

HK 20.3 Mo 14:30 TU MA144

Heavy particle production in a conformal cosmological model — •David Blaschke[1,2,3], Alexander Prozorkevich[4], and Stanislav Smolyansky[3,4] — [1]Bogoliubov Laboratory of Theoretical Physics, Joint Institute for Nuclear Research, 141980, Dubna, Russia — [2]Fakultät für Physik, Universität Bielefeld, D-33615 Bielefeld, Germany — [3]Fachbereich Physik, Universität Rostock, Germany — [4]Physics Department, Saratov State University, 410026, Saratov, Russia

In the framework of a conformal cosmological model, we consider the vacuum creation of heavy massive particles (vector bosons and top quarks). The inertial mechanism due to a time dependence of the conformal mass, $m(t) = a(t)m_0$ (m_0 is the present-day value of the mass) is the foundation of this effect. The function $a(t)$ is the conformal factor of the isotropic FRW space-time, $a(t) = (t/t_H)^\alpha$, where $\alpha = 2/(3\gamma - 2)$, γ is the barotropic parameter, $t_H = (1+\alpha)H$ is the age of the Universe, H is the Hubble constant. We derive the corresponding kinetic equations of non-markovian type for the vacuum creation of massive vector bosons and fermions and we solve these KE's numerically for different equations of state of the matter filling the Universe (stiff fluid, radiation etc.). The basic result of the work is demonstration of the fact that the general contribution of the produced matter can be sufficient to explain the present density of CMB photons. *Partially supported by DFG Graduiertenkolleg 567 at Universität Rostock and DFG grant No. 436 RUS 117/78/04.*

HK 20.4 Mo 14:45 TU MA144

Two-flavor color superconducting quark matter phases in compact stars — •Deborah Nancy Aguilera[1,2], David Blaschke[1,3,4], and Hovik Grigorian[5] — [1]Fachbereich Physik, Universität Rostock, Universitätsplatz 1, D-18051 Rostock, Germany — [2]Instituto de Física Rosario, Bv. 27 de febrero 210 bis, 2000 Rosario, Argentina — [3]Bogoliubov Laboratory for Theoretical Physics, JINR Dubna, 141980 Dubna, Russia — [4]Fakultät für Physik, Universität Bielefeld, D-33615 Bielefeld, Germany — [5]Department of Physics, Yerevan State University, Alex Manoogian Str. 1, 375025 Yerevan, Armenia

We study the occurrence of two-flavor color superconducting phases (2SC = two-flavor color superconductivity and CSL = color spin locking) in quark matter under compact star constraints within a nonlocal model. We analyze the sensitivity to changes in the formfactor and the coupling constants for the quark interaction.
As observables we calculate the configurations and show that stable hybrid star branches with 2SC quark cores could explain observations of small compact objects.
The CSL phase leads to a pairing pattern in which all quarks are paired and the smallest gaps do not exceed 1 MeV. Such a phase is a candidate for a successful explanation of the cooling behaviour of neutron stars with quark matter cores. *Partially supported by the Virtual Institute of the Helmholtz Association under grant no. VH-VI-041 and by the Landesgraduiertenförderung MV.*

HK 20.5 Mo 15:00 TU MA144

Photoactivation of *p*-process nuclei — •M. Erhard[1], E. Grosse[1,2], A. Hartmann[1], A.R. Junghans[1], K. Kosev[1], C. Nair[1], N. Nankov[1], G. Rusev[1], K.D. Schilling[1], W. Schulze[1], R. Schwengner[1], and A. Wagner[1] — [1]Institut für Kern- und Hadronenphysik, Forschungszentrum Rossendorf, Dresden, Germany — [2]Technische Universität Dresden, Dresden, Germany

A research program was started at the ELBE-bremsstrahlung beam to study experimentally the near-threshold photodisintegration reaction of nuclides in the chain of cosmic heavy-element production. An important prerequisite for such studies is the profound knowledge of the bremsstrahlung characteristic which has been investigated experimentally as well as theoretically. First data of astrophysical importance were obtained for the target nucleus ^{92}Mo by observing the radioactive decay of nuclides produced in the photodissociation at electron energies between 11.8 and 13.2 MeV. The results are compared to recent calculations by Rauscher and Thielemann[1].

[1] T. Rauscher and F.-K. Thielemann, Atomic Data and Nuclear Data Tables, **88** (2004) 1

HK 20.6 Mo 15:15 TU MA144

***s*-Prozess Wirkungsquerschnitte – Experimente mit reellen Photonen** — •K. Sonnabend[1], D. Galaviz[1], A. Kretschmer[1], S. Müller[1], T. Rauscher[2], M. Zarza[1] und A. Zilges[1] — [1]Institut für Kernphysik, TU Darmstadt, D–64289 Darmstadt — [2]Institut für Physik, Universität Basel, CH–4056 Basel, Schweiz

Im astrophysikalischen *s*-Prozess wird die relative Häufigkeit der Isotope eines Elements wesentlich durch das Verhältnis von β-Zerfallsrate λ_β und Neutroneneinfangrate $\lambda_{(n,\gamma)}$ der sogenannten Verzweigungskerne bestimmt. Die direkte Messung des Neutroneneinfangquerschnitts $\sigma_{(n,\gamma)}(E)$ der kurzlebigen Verzweigungskerne mit Halbwertszeiten im Bereich einiger Dutzend Tage ist nur schwer möglich. Um die Vorhersagen für diese Wirkungsquerschnitte [1] im Rahmen des Statistischen Modells [2] einzuschränken, wird die Umkehrreaktion (γ,n) mit Hilfe reeller Photonen und der Methode der Photoaktivierung am S–DALINAC untersucht [3]. Wir stellen die Ergebnisse unserer Experimente zu den Verzweigungskernen ^{95}Zr, ^{187}Re und ^{193}Ir und deren astrophysikalische Konsequenzen vor.

* gefördert durch die DFG (SFB 634)

[1] Z.Y. Bao *et al.*, At. Data Nucl. Data **76**, 70 (2000).
[2] T. Rauscher, F.-K. Thielemann, At. Data Nucl. Data **75**, 1 (2000).
[3] K. Sonnabend *et al.*, Astroph. J. **583**, 506 (2003).

HK 20.7 Mo 15:30 TU MA144

The (n,γ) cross sections of light p nuclei at kT= 25 keV: Towards an updated experimental database for the p process — •Iris Dillmann[1,2], Michael Heil[1], Franz Käppeler[1], Thomas Rauscher[2], and Friedrich-Karl Thielemann[2] — [1]Forschungszentrum Karlsruhe, Postfach 3640, D-76021 Karlsruhe — [2]Universität Basel, Klingelbergstrasse 82, CH-4056 Basel

Experimental reaction rates of p nuclei are still very scarce. Therefore these (n,γ), (p,γ), (α,γ) and the respective inverse rates have to be inferred by statistical Hauser-Feshbach calculations. Concerning stellar (n,γ) rates of the 19 p-only nuclei between ^{74}Se and ^{132}Ba, experimental data are available for 13 of these nuclei. We report on first results of the missing cross sections of ^{74}Se, ^{84}Sr, ^{102}Pd, ^{120}Te and ^{132}Ba at kT= 25 keV, which were measured with the activation method using the ^{7}Li(p,n)^{7}Be reaction. The aim of this work is the update of the Bao et al. compilation for p nuclei and the creation of a website containing all experimental data on (n,γ), (p,γ), (α,γ) and inverse cross sections for p-process studies.

HK 20.8 Mo 15:45 TU MA144

Neutrinonukleosynthese der ungerade-ungerade Isotope^{138}La und ^{180}Ta* — •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. Jacobs[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] und Y. Shimbara[2] — [1]TU Darmstadt — [2]Osaka University — [3]Universität zu Köln — [4]Universität Münster — [5]UniversiteitGent — [6]University of Witwatersrand — [7]LosAlamos — [8]University of Aarhus — [9]Universität Basel

Der Ursprung der exotischen Isotope ^{138}La und ^{180}Ta ist weitgehend ungeklärt. Neueste Rechnungen im Rahmen einer umfassenden Modellierung der Nukleosynthese in massiven Sternen >10 $M_\odot$ sagen eine signifikante Produktion durch geladene Stromreaktionen (ν_e, e) voraus. Die Wirkungsquerschnitte werden durch die GT Stärke bei niedrigen Energien im Tochterkern dominiert. Diese lassen sich in hochauflösenden ^{138}Ba, ^{180}Hf(^{3}He,t) Experimenten unter null Grad vermessen. Erste experimentelle Resultate und ihre astrophysikalische Relevanz werden diskutiert.

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