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.

* Gefördert durch die DFG unter SFB 634 und 446 JAP-113/267/0-1

HK 21 Instrumentation und Anwendungen

Zeit: Montag 14:00–16:00 Raum: TU MA042

Gruppenbericht

HK 21.1 Mo 14:00 TU MA042

Investigation of solid D_2 for UCN sources — •K. Kirch[1], F. Atchison[1], K. Bodek[2], B. van den Brandt[1], T. Bryś[1], M. Daum[1], P. Fierlinger[1], P. Geltenbort[3], M. Giersch[4], P. Hautle[1], M. Hino[5], R. Henneck[1], S. Heule[1], M. Kasprzak[1,2,4], J. Kohlbrecher[1], J.A. Konter[1], G. Kühne[1], M. Kuźniak[1,2], A. Michels[1], A. Pichlmaier[1], Y. Pokotilovskiy[6], U. Szerer[2], M. Utsuro[5], M. Wohlmuther[1], A. Wokaun[1], and J. Zmeskal[4] — [1]PSI, Villigen, CH — [2]JU, Cracow, PL — [3]ILL, Grenoble, FR — [4]OeAW, Wien, AU — [5]KU, Kyoto, JP — [6]JINR, Dubna, RU

Solid deuterium (sD_2) will be used for the production of ultra-cold neutrons (UCN) in the PSI UCN source. In order to optimize the source performance it is important to know the UCN production cross sections as well as the relevant cross sections for UCN transport out of the sD_2. Also future cold moderator development calls for knowing neutron cross sections in liquid D_2. In addition, the scattering system, neutron-D_2, is simple enough to allow a complete theoretical treatment; thus measured cross sections should be compared with theoretical models. We report on transmission measurements of slow neutrons (CN, VCN, UCN) through gaseous, liquid and solid D_2 and the extraction of total scattering cross sections. We also give results from a recent experiment in which UCN have been produced from a cold neutron beam on gaseous, liquid and solid D_2 targets.

HK 21.2 Mo 14:30 TU MA042

The New Source of Ultra Cold Neutrons at PSI — •Axel Pichlmaier[1], M. Daum[1], F. Atchison[1], K. Bodek[2], B. van den Brandt[1], T. Brys[1], P. Fierlinger[1], P. Geltenbort[3], W. Gloor[1], P. Hautle[1], G. Heidenreich[1], R. Henneck[1], St. Joray[1], K. Kirch[1], S. Kistryn[2], K. Kohlik[1], J. A. Konter[1], G. Kühne[1], S. Mango[1], H. Obermaier[1], Ch. Perret[1], U. Rohrer[1], H. J. Temnitzer[1], H. Zmeskal[4], and G. Szigmond[1] — [1]Paul Scherrer Institut, Villigen, Switzerland — [2]Jagellonian University, Cracow, Poland — [3]Institut Laue Langevin, Grenoble, France — [4]Österreichische Akademie der Wissenschaften, Vienna, Austria

Ultra-cold neutrons (UCN) are used, among others, for precision measurements in particle physics. Experiments are often crippled by statistical limitations. A new high intensity source of UCN is currently being built at PSI. It uses the full intensity proton beam of the PSI ring cyclotron (2 mA, 590 MeV) in macro pulses of a few seconds length. Spallation neutrons are produced on a heavy metal target, thermalized in heavy water and finally down scattered into UCN in solid D_2. The UCN are extracted into a storage volume from where neutron guides lead to experiments. We expect UCN densities of up to 4000 cm^{-3} in the storage tank, an improvement of about two orders of magnitude compared to the only UCN source in operation now. The primary aim for the new source is to provide UCN for a new precision search for a neutron electric dipole moment. Other applications include neutron lifetime measurements or a phase space transformer to produce a high intensity beam of cold neutrons.

HK 21.3 Mo 14:45 TU MA042

Diamond-like carbon coatings for ultra-cold neutron reflectors — •St. Heule[1], T. Brys[1], M. Daum[1], P. Fierlinger[1], A. Foelske[1], M. Gupta[1], R. Henneck[1], M. Kasprzak[1], K. Kirch[1], T. Lippert[1], C.-F. Meyer[2], F. Nolting[1], A. Pichlmaier[1], B. Schultrich[2], P. Siemroth[2], and U. Straumann[3] — [1]Paul Scherrer Institut, 5232 Villigen, Switzerland — [2]Fraunhofer Institut fuer Werkstoff- und Strahltechnik, Winterbergstrasse 28, 01277 Dresden, Germany — [3]Physik-Institut der Universitaet Zuerich, Winterthurerstrasse 190, 8057 Zuerich, Switzerland

At PSI we are presently setting up a new, high-intensity source for ultracold neutrons (UCN). For the storage (and transport) of UCN so far one has widely used Beryllium-coatings which are toxic and therefore difficult to handle. As an alternative to Be we investigate diamond-like carbon (DLC), for which loss factors close to that of Be have been obtained in a recent experiment at ILL. We produce DLC-coatings by Pulsed Laser Deposition (PLD), a process which results in a very low hydrogen content of the films. This is crucial for our applications as UCNs are up-scattered on hydrogen atoms and therefore immediately lost. The deposition process will be optimized to obtain maximum density in order to get maximum limiting velocity. We are in the process of optimizizing the coating process with small-size test samples and - in parallel - building up a facility for coating real guide tubes. We report first results on the characterization of these samples as well as of additional calibration samples by Raman spectroscopy, x-ray spectroscopy (XPS,NEXAFS), neutron reflectometry and laser-acoustic methods.

HK 21.4 Mo 15:00 TU MA042

A superconducting magnetic UCN trap for the precise measurement of the neutron lifetime — •Rüdiger Picker, Igor Altarev, Johannes Bröcker, Andreas Frei, Erwin Gutsmiedl, F. Joachim Hartmann, Axel R. Müller, Stephan Paul, Gerd Petzoldt, Daniele Tortorella, and Oliver Zimmer — Physik-Department E18, Technische Universität München

The lifetime τ_n of the neutron has important implications on our picture of the weak interaction and on cosmology. The latest experimental result for τ_n is smaller by 7.2 s ($\approx 6\,\sigma$) than the value recommended by the Particle Data Group (PDG), $\tau_n = (885.7 \pm 0.8)\,s$. The new measurement was performed by storing ultra-cold neutrons (UCN) in material bottles, similar to the most precise earlier experiments. Losses during the UCN collisions with the bottle walls prevent the systematic errors to be decreased to values well below 0.5 s. Magnetic storage is a good alternative.

In our planned experimental set-up UCN shall be stored in a large ($\approx 800\,dm^3$) volume between two nested cylinders: superconducting coils at walls and bottom of the cylinder produce a magnetic multipole field that reaches about 2 Tesla at 1 cm distance from the magnets. Gravitation serves as the upper cover of the trap. We intend to determine τ_n not only from the number of surviving neutrons but also, more important, by real-time detection of the decay protons. Using the new UCN source