HK 26: Nuclear Structure and Dynamics I

Time: Tuesday 14:00–16:00 Location: H-ZO 40

Invited Group Report HK 26.1 Tu 14:00 H-ZO 40

Mass measurements at JYFLTRAP — •Ari Jokinen — Department of Physics, P.O. Box 35 (YFL), FIN-40014 University of Jyväskylä, Finland

The mass of the ground state of a nucleus can provide insight into the underlying nuclear structure, such as charge symmetry, shell effects, shape coexistence and so forth. Atomic masses are also needed to test and improve mass predictions and astrophysical network calculations. Finally, precise Q-value measurements provide stringent tests of the Standard Model and contribute to double beta decay and neutrino physics.

The JYFLTRAP facility in the Department of Physics, University of Jyväskylä, is a unique combination of the ion traps and ion guide technique. The latter allows access to regions of the nuclide chart unexplored by conventional ISOL techniques. The tandem Penning trap system comprises two traps within one superconducting solenoid allowing independent purification in the first trap and precision measurement in the second trap. In addition, due to the installation of two traps inside a single superconducting solenoid, new trapping techniques have been developed.

Some of the recent highlights from the JYFLTRAP facility will be reviewed. Those include an evolution of the N=50 shell gap, precision Q-value measurements for weak interaction physics and mass measurements for nuclear astrophysics.

Group Report HK 26.2 Tu 14:30 H-ZO 40

ISOLTRAPs 2008 harvest — •Martin Breitenfeldt for the ISOLTRAP-Collaboration — Ernst-Moritz-Arndt-Universität, Greifswald, Germany

With ISOLTRAP [1] at ISOLDE/CERN mass measurements on exotic nuclides are performed down to an accuracy below $\Delta m/m=10^{-8}$. The obtained mass values are of importance for a number of applications, among others nuclear structure studies, test of mass models, and nucleosynthesis calculations. Recent measurements performed at ISOLTRAP help to examine the halo character of ^{17}Ne [2] and the restoration of the neutron-shell gap at N=82 [3]. In addition, the determination of the mass of ^{81}Zn [4] allowed detailed nucleosynthesis calulations in the vicinity of the waiting-point nuclide ^{80}Zn. Furthermore, for the first time a new isotope was discovered in a Penning trap, namely ^{229}Rn [5]. The new mass values of $^{223-229}$Rn as well as of $^{136-146}$Xe are entering in systematic δV_{pn} studies of the interaction between the valence protons and valence neutrons.

[1] M. Mukherjee *et al.*, Eur. Phys. J. A 35, 1-29 (2008).
[2] W. Geithner *et al.*, *in print* Phys. Rev. Lett.
[3] M. Dworschak *et al.*, Phys. Rev. Lett. 100, 072501 (2008).
[4] S. Baruah *et al.*, *in print* Phys. Rev. Lett.
[5] D. Neidherr *et al.*, *submitted.*

HK 26.3 Tu 15:00 H-ZO 40

TRIGA-TRAP: A Penning trap mass spectrometer at the research reactor TRIGA Mainz — •Jens Ketelaer[1], Klaus Blaum[2,3], Michael Block[4], Klaus Eberhardt[5], Martin Eibach[1], Frank Herfurth[4], Jochen Ketter[1], Konstantin Knuth[1], Szilard Nagy[2], Julia Repp[1], and Christian Smorra[3,5] — [1]Institut für Physik, Universität Mainz, D-55128 Mainz — [2]Max-Planck-Institut für Kernphysik, D-69117 Heidelberg — [3]Physikalisches Institut, Universität Heidelberg, D-69120 Heidelberg — [4]GSI Helmholtzzentrum für Schwerionenforschung GmbH, D-64291 Darmstadt — [5]Institut für Kernchemie, Universität Mainz, D-55128 Mainz

Nuclear masses represent the binding energies and, therefore, the sum of all interactions in the nucleus. They provide an important input parameter to nuclear structure models. Presently, a tremendous interest in masses of very exotic neutron-rich nuclides exists to support theoretical models for the nucleosynthesis via the rapid neutron capture process. The research reactor TRIGA Mainz provides access to a large variety of neutron-rich nuclides produced by thermal-neutron induced fission of an actinide target. The double-Penning trap mass spectrometer TRIGA-TRAP will perform high-precision mass measurements in this region of the nuclear chart as well as on actinides from uranium to californium [1]. It also serves as a test facility for the development of new techniques that will be implemented in future facilities like MATS at FAIR (GSI, Darmstadt). The layout of TRIGA-TRAP as well as recent mass measurements will be presented.

[1] J. Ketelaer et al., Nucl. Instr. Meth. A 594 (2008) 162.

HK 26.4 Tu 15:15 H-ZO 40

High resolution (^{3}He,t) reaction on ^{76}Ge and implications to double β decay — •Jan H. Thies, Dieter Frekers, Eike-W. Grewe, Pia Heinrichs, Peter Puppe, and Tim Ruhe — Westfälische Wilhelms-Universität Münster, Wilhelm-Klemm-Straße 9, 48149 Münster

A high-resolution ^{76}Ge(^{3}He,t)^{76}As measurement was performed at RCNP in Osaka (Japan) using the ^{3}He beam at an incident energy of 420 MeV and the high resolution WS course beam line. An energy resolution of 27 keV was achieved.

The measured data were used to extract the GT$^-$ strength in ^{76}As, which is the intermediate nucleus in the double β decay of ^{76}Ge. We observe that the GT$^-$ strength up to 5 MeV is highly fragmented. To construct the $2\nu\beta\beta$ decay matrix element for ^{76}Ge, these data are then combined with GT$^+$ data from a ^{76}Se(d,^{2}He)^{76}As measurement performed at KVI in Groningen (Netherlands). We note a strong level-by-level anti-correlation, which we attribute to the difference of the intrinsic deformation of the two nuclei, ^{76}Ge and ^{76}Se. We will discuss the implications on the matrix element of the ^{76}Ge $2\nu\beta\beta$ decay.

HK 26.5 Tu 15:30 H-ZO 40

Two–neutrino double beta decay of deformed nuclei within QRPA with realistic interaction — Mohamed Saleh Yousef, •Vadim Rodin, Amand Faessler und Fedor Šimkovic — Institut für Theoretische Physik der Universität Tübingen, Auf der Morgenstelle 14, D-72076 Tübingen, Deutschland

A method to implement a realistic nucleon-nucleon residual interaction based on the Brückner G-matrix (for the Bonn CD force) into the Quasiparticle Random Phase Approximation for deformed nuclei is formulated in Ref. [1]. The two-neutrino double beta decay for ground state to ground state transitions ^{76}Ge→^{76}Se and ^{150}Nd →^{150}Sm is calculated along with the Gamow-Teller strength distributions. The effect of deformation on the observables is studied in detail.

[1] M. Saleh Yousef, V. Rodin, A. Faessler, F.Šimkovic, arXiv:0806.0964

HK 26.6 Tu 15:45 H-ZO 40

Neutron Activation of ^{76}Ge — •Georg Meierhofer[1], Petra Kudejova[2,3], Lea Canella[3], Peter Grabmayr[1], Josef Jochum[1], and Jan Jolie[2] — [1]Kepler Center for Astro and Particle Physics, Eberhard Karls Universität Tübingen, 72076 Tübingen, Germany — [2]Institut für Kernphysik, Universität zu Köln, 50937 Cologne, Germany — [3]Institut für Radiochemie, Technische Universität München, 85748 Garching, Germany

The observation of neutrinoless double beta decay is a proof of the Majorana nature of the neutrino. The half-lives for these decays are very long (for ^{76}Ge: $> 10^{25}$ y), therefore background reduction is crucial in double beta experiments. To reduce background from cosmic rays, these experiments are built underground.

The Gerda experiment [1] at the Gran Sasso Laboratory (LNGS) in Italy searches for the neutrinoless double beta decay in ^{76}Ge, an ideal candidate as it can be source and detector at the same time.

A main contribution to the backround arises from the prompt gamma cascades after neutron capture by ^{76}Ge and the following β^--decay of ^{77}Ge. As the prompt gamma decay scheme is poorly known, measurements with isotopically enriched germanium targets were carried out at the PGAA facility at the FRM II (Munich). The measured neutron capture cross section and prompt gamma ray spectra will be used in further MC simulations for the Gerda experiment.

[1] GERDA, Proposal to LNGS, 2004

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