HK 71: Structure and Dynamics of Nuclei XVI

Time: Thursday 15:45–17:15 Location: SCH/A117

Group Report HK 71.1 Thu 15:45 SCH/A117

Broken axial symmetry as essential feature for a consistent modelling of various observables in heavy nuclei — •Eckart Grosse[1] and Arnd R. Junghans[2] — [1]IKTP, Techn. Universität Dresden — [2]Helmholtz-Zentrum Dresden-Rossendorf, 01314 Dresden

Although most experimental data do not deliver accurate information on nuclear axiality the ad-hoc assumption of symmetry about one axis found widespread use in nuclear model calculations. In the theoretical interpretation of nuclear properties as well as in the analysis of experimental data triaxiality was considered - if at all - only for some, often exotic, nuclides. Allowing breaking of axial symmetry combined to a spin-independent moment of inertia results in a surprisingly simple heuristic triaxial parametrization of the yrast sequence in all heavy nuclei, including well deformed ones. No additional fit parameters are needed in detailed studies of the mass and charge dependence of the electric dipole strength in the range of and outside of giant dipole resonances. Allowing triaxiality also avoids the introduction of an arbitrary level density parameter $\tilde{a}$ to fit the accurate values observed in n-capture experiments. Predictions for radiative neutron capture yields as derived on the basis of non-axiality are improved as well. The broken axial symmetry experimentally favoured apparently is in accord to HFB and MC-shell model calculations already for nuclei in the valley of stability.

HK 71.2 Thu 16:15 SCH/A117

Eigenvector continuation for the pairing Hamiltonian — •Margarida Companys Franzke[1], Alexander Tichai[1,2,3], Kai Hebeler[1,2,3], and Achim Schwenk[1,2,3] — [1]Technische Universität Darmstadt, Department of Physics — [2]ExtreMe Matter Institute EMMI, GSI Helmholtzzentrum für Schwerionenforschung GmbH — [3]Max-Plank Institut für Kernphysik, Heidelberg

The design of emulation techniques for the evaluation of many-body observables is attracting increasing attention over the past years. In particular the framework of eigenvector continuation (EC) has been identified as a powerful tool if the Hamiltonian admits for a parametric dependence. By training the emulator on a set of training data the many-body solution for arbitrary parameter values can be robustly predicted in many cases. Furthermore, it can be used to resum perturbative expansions. In this work, we apply EC to the pairing Hamiltonian and show that i) EC-resummed perturbation theory is in qualitative agreement with the exact solution and ii) EC-based emulators robustly predict the ground-state energy once the training data are chosen appropriately. In particular the phase transition from a normal to a superfluid regime is quantitatively predicted from a very low number of training points. Finally the use of approximate training data is discussed and how many-body truncations may affect the emulator's performance.

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HK 71.3 Thu 16:30 SCH/A117

Improved coalescence model for (anti)nuclei formation — •Maximilian Horst — Technical University Munich

In accelerator experiments, the production of light (anti)nuclei such as (anti)deuterons and (anti)helium-3 can be studied in a wide range of collision systems, from small (pp) to large (A–A) emission source sizes. However, the microscopic mechanism through which they are produced and how they survive such hot and turbulent conditions, are still unknown. The most commonly used models to describe this process are the statistical hadronization model and the coalescence approach. In this talk, a state-of-the-art coalescence model based on the Wigner function formalism to describe (anti)nuclear production on an event-by-event basis is presented. The model developed in this work is parameter-free and tuned on experimental measurements of nucleon production spectra and of the emitting source size measured with ALICE. Such a model would find application in astroparticle physics to predict (anti)nuclear fluxes in cosmic rays, which are a crucial ingredient for indirect Dark Matter searches. This work was supported by DFG SFB1258 and BMBF Verbundforschung (05P21WOCA1 ALICE).

HK 71.4 Thu 16:45 SCH/A117

Electromagnetic interactions as the source of all known four forces. — •Osvaldo Domann — Stephanstr. 42, 85077 Manching

The SM represents the space as empty with the subatomic particles moving in it. The proposed focal-point approach models the space as filled with Fundamental Particles (FPs) with longitudinal and transversal angular momenta that move from infinite to infinite. The different types of subatomic particles are formed by different configurations of FPs. Fermions are focal-points of rays of FPs with aligned angular momenta, photons are rays of FPs with alternating opposed angular momenta, and neutrinos are pairs of FPs with opposed angular momenta. Forces between subatomic particles are the result of the interactions (scalar and vector product) of the angular momenta of their FPs. No fictitious force carriers are required. All four forces are due to electromagnetic interactions and described by QED. An important finding of the approach is that the interaction between two charged SPs tends to zero for the distance between them tending to zero. Atomic nuclei can thus be represented as swarms of electrons and positrons that neither attract nor repel each other. As atomic nuclei are composed of nucleons which are composed of quarks, the quarks can also be seen as swarms of electrons and positrons. The charge quantum number Q of a quark is now interpreted as the relative charge of electrons and positrons. No fractional charges Q are required and the charge of an electron or positron is thus the unit charge of nature. More at: www.odomann.com

HK 71.5 Thu 17:00 SCH/A117

Simulations for the ASY-EOS II experiment — •Leandro Milhomens da Fonseca[1,3] and Igor Gašparić[2,3] for the R3B-Collaboration — [1]Technische Universität Darmstadt, Fachbereich Physik, Institut für Kernphysik, 64289 Darmstadt, Germany — [2]Ruđer Bošković Institute, 10000 Zagreb, Croatia — [3]GSI Helmholtzzentrum für Schwerionenforschung, 64291 Darmstadt, Germany

The ASY-EOS II experiment aims to place new and more stringent constraints on the density dependence of the symmetry energy at supra-saturation densities. The system proposed for the study is Au+Au at 250, 400, 600 and 1000 AMeV, which can only be performed nowadays at the GSI/FAIR facilities. The experiment is based on the NeuLAND detector to measure neutrons, protons and light-charged clusters emitted from mid-rapidity. To discriminate between neutrons and charged particles, it is the intention to use a VETO detector in front of the NeuLAND detector. It is a proposal to use a double plane of the R3B TOFD detector in front of the NeuLAND due to its ability to detect charged particles efficiently and let neutrons pass through without leaving any signal. As a proof of concept for this apparatus, this work aims to show simulations performed to determine detection efficiencies for the particles of interest and to assess the possibility of distinguishing the differently charged light particles coming from the reaction. This project was supported by the BMBF project No. 05P21RDFN2, and the GSI-TU Darmstadt cooperation.