Plenary Talk PV I Mon 11:00 HS1+HS2

Status and perspectives of double beta decay searches — •Kai Zuber — Inst. f. Kern- und Teilchenphysik, TU Dresden, Dresden

Double beta decay is a very rare nuclear decay characterised by a change of 2 units the ordering number Z while leaving the mass number A constant. It can basically occur in two modes, with the emission of two electrons and two anti-neutrinos or the emission of two electrons only. The neutrinoless double beta decay of nuclei is not allowed in the Standard Model and is of outstanding importance for neutrino physics. It can only occur if a neutrino is its own antiparticle and if it has a non-vanishing rest mass.

After a general introduction into double beta decay, the talk focusses on the current experimental searches and results and their implications for particle physics. An outlook towards future projects and the involved challenges is given. This includes a discussion on nuclear matrix elements and possible supporting experimental activities.

Plenary Talk PV II Tue 9:30 HS1+HS2

QuarkNet: Teaching and Learning 21st Century Physics — •Thomas Jordan — University of Florida & Fermilab

QuarkNet is an extension of the US particle physics community. Started in 1998, the project has invited well over 1000 US teachers to attend workshops, perform research, assemble hardware and explore ways to teach modern physics topics to high school students.

Teachers have built and tested components for Tevatron and LHC experiments, analyzed data from the Sloan Digital Sky Survey. They build and use classroom cosmic ray muon detectors, and have explored ways to introduce their studnets to topics such as the production of the Top Quark. Teachers can use their web-browser to access data from the LIGO observatory and share their findings with other student users across the globe.

I will discuss the practices, tools and findings of this successful collaboration.

Evening Talk PV III Tue 20:00 HS1+HS2

Vom Erfolg der Kosmologie und den Rätseln unserer Welt — •Matthias Bartelmann — Institut für Theoretische Astrophysik, Universität Heidelberg

Plenary Talk PV IV Wed 8:45 HS1+HS2

Ab Initio Nuclear Structure Theory with Chiral Two- plus Three-Nucleon Interactions — •Robert Roth — Institut für Kernphysik, Technische Universität Darmstadt, Germany

Low-energy nuclear theory has entered an era of ab initio nuclear structure and reaction calculations based on input from QCD. One of the most promising paths from QCD to nuclear observables employs Hamiltonians constructed within chiral effective field theory as consistent starting point for precise ab initio nuclear structure and reaction studies. However, the full inclusion of chiral two- plus three-nucleon (NN+3N) interactions in exact and approximate many-body calculations still poses a formidable challenge. We discuss recent developments towards this goal, ranging from consistent Similarity Renormalization Group evolutions of NN+3N Hamiltonians to large-scale ab initio calculations for ground states and spectra in the Importance-Truncated No-Core Shell Model with full 3N interactions. We highlight recent achievements and discuss open issues and future perspectives for nuclear structure theory with QCD-based interactions. Moreover, we discuss successful steps towards merging ab initio structure and reaction theory and show applications to low-energy reactions in the p-shell relevant for astrophysics.

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Plenary Talk PV V Wed 11:00 HS1+HS2

ALICE in Wonderland: first results from the ALICE experiment at the LHC — •Peter Braun-Munzinger — EMMI, GSI

Since November 2009 the ALICE experiment at the CERN LHC has taken data, first with proton-proton collisions at 0.9 and 7 TeV center-of-mass energy, then in November 2010 with Pb–Pb collisions at 574 TeV. More than 700 million events were recorded with pp collisions, more than 20 million events with Pb–Pb collisions. We will briefly describe the performance of the detector and report on new physics results with emphasis on new insights into the physics of the quark-gluon plasma at LHC energy.

Plenary Talk PV VI Thu 8:45 HS1

Strangeness im Nukleon — •Sebastian Baunack für die A4-Kollaboration — Institut für Kernphysik, Universität Mainz, Deutschland

Für die Struktur des Nukleons spielen Seequarks eine wichtige Rolle. Die Untersuchung von Strangequark-Beiträgen nimmt eine besondere Rolle ein, da Strangequarks einerseits nicht als Valenzquarks im Nukleon auftreten, andererseits ihre Masse mit etwa 100 MeV noch so gering ist, daß nennenswerte Beiträge zu den Eigenschaften des Nukleons wie Masse, Spin oder Vektorstrom erwartet werden können.

Im Vortrag wird der Stand der Forschung vorgestellt, wobei der Schwerpunkt auf dem Strangenessbeitrag zu den Vektorformfaktoren des Nukleons liegt, welcher mit paritätsverletzender Elektronstreuung gemessen werden kann.

Plenary Talk PV VII Thu 11:00 HS1

Exploring the spin structure of the nucleon in polarized high-energy scattering — •Werner Vogelsang — Institute for Theoretical Physics, Tuebingen University, 72076 Tuebingen

Three decades of experiments in polarized deep inelastic scattering have provided important and exciting information on the spin structure of the nucleon. Over the past few years, these efforts have been joined by a powerful program with colliding polarized protons at the Relativistic Heavy Ion Collider (RHIC). The talk highlights some of the recent developments and results in theory and experiment in this field.

Plenary Talk PV VIII Fri 8:45 HS1

Reaktionen mit relativistischen radioaktiven Strahlen bei GSI und FAIR — •Thomas Aumann — Technische Universität Darmstadt

Experimente mit relativistischen radioaktiven Strahlen sind ein ideales Werkzeug zur Untersuchung der Eigenschaften von kurzlebigen Kernen und deren Reaktionen, sowie zur Charakterisierung asymmetrischer Kernmaterie. Die exotischen Kerne werden durch Fragmentationsreaktionen von Schwerionenstrahlen erzeugt und stehen mit Energien von mehreren hundert MeV/Nukleon am Fragmentseparator bei der GSI zur Verfügung. Die Experimentieranlage R3B (Reactions with Relativistic Radioactive Beams) erlaubt kinematisch vollständige Messungen von Reaktionen dieser Sekundärstrahlen. Ein Beispiel ist die elektromagnetische Anregung zur Untersuchung von kollektiven Anregungsmoden wie z.B. der Pygmy Dipolresonanz in neutronenreichen Kernen. Des Weiteren werden erste Messungen zur quasifreien Streuung von Protonen an exotischen Kernen in inverser Kinematik diskutiert. Reaktionen vom Typ (p,2p), (p,pn), oder (p,pα) sind besonders geeignet zur Untersuchung der Einteilchen- und Clusterstruktur, sowie von Nukleon-Nukleon Korrelationen in Neutron-Proton asymmetrischen Kernen. Der Vortrag gibt auch einen kurzen Ausblick auf die nächste Generation des R3B Experimentaufbaus, der an der FAIR Beschleunigeranlage installiert werden wird.

Plenary Talk PV IX Fri 11:00 HS1

Trigger Challenges of Future Experiments — •Ivan Kisel — GSI, Darmstadt, Deutschland

Fast online data analysis and selection (triggering) is one of the challenging problems of the data analysis in modern and future high-energy physics experiments. This is especially important for heavy-ion experiments like ALICE (CERN, Switzerland) and CBM (FAIR/GSI, Germany) with thousands of particles produced in a collision (so-called event). The finding of particle trajectories (tracks) among huge amount of measurements is the most time consuming stage of the event reconstruction. Thus, every track finder has to solve a very complicated combinatorial optimization problem. The benefit of the cellular automaton (CA) method consists in building up short track segments already before the beginning of the combinatorial search. The CA method is intrinsically local and parallel. Because of the high particle track densities, the CA track finder includes the Kalman filter (KF) algorithm for the track parameters estimation. Online event selection involves in addition reconstruction of the full event topology with particular consideration of short leaved particles with interesting physics. Future many-core CPU and GPU architectures require a fundamental redesign of the traditional approaches to data processing. A massive hardware parallelization at the level of cores, threads and vectors should be adequately reflected in a mathematical and programming optimization of the algorithms. Therefore, in collaboration with Intel the reconstruction algorithms are mathematically and numerically optimized with respect to the future computer systems.