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The influence of lightnings on VLF/LF signals observed by radiophysical stations — •Bo Ram Lee, Claudia-Veronika Meister, Christoph Maurer, and Dieter H.H. Hoffmann — Institut für Kernphysik, TU Darmstadt, Schlossgartenstraße 9, 64289 Darmstadt, Germany

The theory of cosmic-ray shower-runaway breakdown in thunderclouds predicted by Gurevich et al. (Gurevich, Milikh, Roussel-Dupre, Phys. Lett. A 165, 463, 1992) is reviewed, and estimates of the electrical conductivity and electric fields during the electron avalanche are estimated. It is shown that the critical electric field amounts to a few 100 kV/m, which is below the usual atmospheric breakdown values. With the onset of the breakdown lightnings occur, which may be connected with the generation of radio pulses with frequencies of a few MHz. Besides also lower-frequency waves in the VLF region are excited. An overview on such waves is given. It is shown that lightnings influence the signals received by the TU Darmstadt VLF/LF radiophysical station VADAR constructed to detect possible earthquake precursors in Europe.

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The Darmstadt VLF/LF radiophysical station VADar — •Christoph Maurer, Claudia-Veronika Meister, Steffen Hauf, and Dieter H. H. Hoffmann — Institut für Kernphysik, TU Darmstadt, Schlossgartenstraße 9, 64289 Darmstadt

Since 2010, based on the knowledge of the Graz and Bari members of the **I**nternational **N**etwork for **F**rontier **R**esearch on **E**arthquake **P**recursors INFREP, a new VLF/LF radiophysical receiver called VADar (**VLF A**ntenna **Dar**mstadt), is under construction at Darmstadt University of Technology. VADar uses the UltraMSK software for measuring phase and amplitude of MSK-modulated signals with carrier-frequencies up to 96 kHz. This is double the usual frequency-range of other facilities using UltraMSK. It is planned to add two loop antennas for direction finding. In order to conduct phase-measurements a time standard of sufficient precision is necessary, which is provided by a one-**P**ulse-**P**er-**S**econd (PPS) signal of a GPS-station. The VADar data will be used to record short-term electron density variations in the lower ionosphere and atmosphere. This data will be used for comparison of modifications of signals propagating at the same time above seismo-active and non-seismic regions. First Darmstadt VLF data are presented.

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Expansion Velocity of Arch-shaped Magnetic Flux Tubes — •Jan Tenfelde[1], Jürgen Dreher[2], Philipp Kempkes[3], Felix Mackel[1], Sascha Ridder[1], Henning Soltwisch[1], Richard D. Sydora[4], and Thomas Tacke[2] — [1]Institut für Experimentalphysik V - AG Laser- und Plasmaphysik, Ruhr-Universität Bochum — [2]Institut für Theoretische Physik I, Ruhr-Universität Bochum — [3]Ernst-Moritz-Arndt-Universität Greifswald, MPI for Plasma Physics, Greifswald — [4]University of Alberta, Edmonton, Canada

The arch-shaped flux tubes generated in the FlareLab discharge show constant diameter and apex expansion velocities. The expansion at constant rate is unexpected, as the steeply rising discharge current should cause a continual increase of the hoop force and lead to an accelerated expansion of the plasma arch. This is observed for a wide range of operational parameters and already develops in early stages of the discharge evolution.

Time-dependent numerical MHD-simulations model the flux tube expansion using an approximate arch equilibrium. In the kink-unstable regime, an inward modulation of the apex of the plasma arch is observed, which could lead to a reduction of the observed velocity. The predicted evolution of the flux tube as obtained from the simulations is then compared to measured characteristics from the laboratory experiment.

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The detector for the PRIOR proton microscope — •Philipp-M. Lang[1], Steffen Hauf[1], Alexander Hug[2], Dieter H. H. Hoffmann[1], Alexey Kantsyrev[3], Sergey Kolesnikov[3], Fesseha Mariam[4], Frank Merrill[4], Dmitry Nikolaev[3], Lev Shestov[3], Vladimir Turtikov[3], Dmitry Varentsov[2], and Serban Udrea[1] — [1]Technische Universität Darmstadt, Institut für Kernphysik, Darmstadt, Germany — [2]GSI Helmholtzzentrum für Schwerionenforschung, Darmstadt, Germany — [3]ITEP, Moscow, Russia — [4]Los Alamos National Laboratory, Los Alamos, USA

While the idea to use charged particles for radiography is known since 1960's, the technique was not widely used because scattering in the radiographed sample caused a substantial image blur. A way to overcome this blur was discovered in the 90's at the Los Alamos National Laboratory by using a set of magnetic quadrupole lenses to image the object on the detector, and to correct chromatic aberrations.
Based on this experience, the proton microscope PRIOR (Proton Microscope for FAIR) is currently under construction at GSI. Its spatial resolution of less than 10 μm will by far exceed the capabilities of other proton radiography systems available at LANL (Los Alamos) and ITEP (Moscow).
Here we present a first design of the designated detector system for future dynamic experiments with PRIOR, which consists of a scintillator screen and a high resolution CCD camera. Geant4 Monte Carlo simulations have been carried out for optimizing the detector performance.

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Numerical Investigation on Complex Target Geometries in the Context of Laser-Acclerated Proton Beams — •O. Deppert[1], K. Harres[1], S. Busold[1], G. Schaumann[1], C. Brabetz[2], M. Schollmeier[3], M. Geissel[3], V. Bagnoud[4], D. Neely[5], P. McKenna[6], and M. Roth[1] — [1]IKP, Technische Universität Darmstadt — [2]IAP, Goethe Universität Frankfurt — [3]Sandia National Laboratories, NM, USA — [4]GSI - Helmholtzzentrum für Schwerionenforschung, Darmstadt — [5]Rutherford Appleton Laboratory, UK — [6]University of Strathclyde, UK

The irradiation of thin metal foils by an ultra-intense laser pulse leads to the generation of a highly laminar, intense proton beam accelerated from the target rear side by a mechanism called TNSA. This acceleration mechanism strongly depends on the geometry of the target. The acceleration originates from the formation of a Gaussian-like electron sheath leading to an electric field in the order of TV/m. This sheath field-ionizes the target rear side and is able to accelerate protons from a hydrogen contamination layer. The Gaussian-like sheath adds an energy dependent divergence to the spatial proton beam profile. For future applications it is essential to reduce the divergence already from the source of the acceleration process. Therefore different target geometries were studied numerically with the help of Particle-In-Cell (PIC) simualtions. Both, the influence of the target geometry as well as the influence of the laser beam profile onto the proton trajectories will be discussed. Furthermore, the first experimental results of a dedicated target geometry for laser-ion acceleration will be presented.

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Experimente zur Wechselwirkung niederenergetischer Ionenstrahlen mit Gastargets — •Behrooz Fathinejad, Rustam Berezov, Joachim Jacoby und Oliver Meusel — Institut für Angewandte Physik, Goethe Universität, Frankfurt am Main

Bei der Wechselwirkung von Ionenstrahlen mit Gastargets können Phänomene wie elastische und/oder inelastische Streuungen, Ladungsaustausch, Ionisation und Photonenemission auftreten. Diese Prozesse werden durch Untersuchungen von Änderungen der Eigenschaften des Ionenstrahls und des Gastargets beobachtbar. Ziel der geplanten Experimente ist eine Validierung der Wechselwirkungsquerschnitte.

Für die Experimente sind eine energetisch variierbare Ionenquelle und ein Gastarget erforderlich. Unter Gastarget versteht man einen homogenen Strahl von Gasatomen mit bekannter Dichte, Impuls und Energie. Dafür wurde eine spezielle Düse entwickelt, die den Gasstrahl auf Schallgeschwindigkeit beschleunigt und die Strahlverteilung homogenisiert. Für das Gastarget wird ein Gasstrahl aus Helium benutzt. Aus der Ionenquelle wird einfach ionisierter He-Strahl extrahiert. Der Strahlstrom beträgt etwa 1 mA und die Energie ist variabel zwischen 5 und 45 keV.

In der Präsentation werden verschiedene Diagnoseverfahren diskutiert, mit denen Informationen über die Wechselwirkungsmechanismen gewonnen werden können.