P 10: Poster: Astro- und geophysikalische Plasmen, warme dichte Plasmen

Zeit: Dienstag 17:00–19:00 Raum: Foyer

P 10.1 Di 17:00 Foyer

Influence of Nuclear Fusion on the Plasma of the Solar Core — •Michael Endres, Claudia-Veronika Meister, and Dieter Heinz Hermann Hoffmann — Institut für Kernphysik, TU Darmstadt, Schlossgartenstraße 9, 64289 Darmstadt, Germany

The equation of state of the nonideal plasma mixture of the solar core is investigated applying the virial expansion method in density order 5/2. Thereat the quantum virial function describing Heisenberg quantum effects and quantum-physical exchange phenomena has been evaluated in third order with respect to the Born parameter for a mixture of electrons, protons and helium nuclei. Thus the pressure due to coulomb interaction in warm dense matter is calculated. Above all, the energy production in the solar core by the proton-proton fusion process is analysed. The temporal variations of the free energy and the pressure of the solar core by fusion are studied for some millions of years. There, within the frame of a first approximation, heat and radiation transport between the inner solar layers are neglected. It is shown that the changes of the solar pressure by nuclear fusion during 500.000 years, obtained within the frame of the present approximations, should be resolvable by recent helioseismology.

P 10.2 Di 17:00 Foyer

Experimental Investigation of Magnetic Flux Tubes — •Jan Tenfelde, Holger Stein, Thomas Tacke, and Henning Soltwisch — Institut für Experimentalphysik V - AG Laser- und Plasmaphysik, Universitätsstr. 150, 44780 Bochum

The FlareLab experiment is designed to investigate the evolution of arch-shaped magnetic flux tubes. Recently, the experimental setup has been modified following the model considerations proposed by Titov and Demoulin in order to reproduce a certain class of solar phenomena. First results obtained with the improved plasma source are presented: differences of the magnetic topology as compared to a previous plasma source design are shown; the corresponding influence on the discharge evolution is investigated. The phenomenon of pronounced striations perpendicular to the current channel is presented, which appears to be damped by an axial magnetic field.

P 10.3 Di 17:00 Foyer

Optical and electrical diagnostics for magnetized pulsed-power discharges — •Philipp Kempkes, Felix Mackel, Sascha Ridder, Holger Stein, Thomas Tacke, Jan Tenfelde, and Henning Soltwisch — Ruhr-Universität Bochum

A set of diagnostics with high temporal resolution for magnetized pulsed-power discharges at the FlareLab experiment has been developed. The experiment is designed to produce arc-shaped magnetic flux tubes which are widely used as a descriptive model for ascending arc-shaped solar protuberances. Typical values for the electron temperature and density of the produced plasmas are around 10^{21} m^{-3} and 5-10 eV, respectively. The occuring magnetic flux densities are around 100 mT, typical timescales for the discharge evolution are in the microsecond range. The diagnostics set consists of several electrostatic triple and double probes, electromagnetic Bdot probes and a CO_2 Laser interferometer. We present a comparative study, in which the diagnostics are benchmarked against each other, together with a detailed characterization of the experiment. A fast framing camera is used to correlate the output of different diagnostics with visible structures in the plasma emission.

P 10.4 Di 17:00 Foyer

Dispersion of magnetoacoustic waves in the anisotropic magnetosheaths of Earth, Jupiter, and Saturn — •Christoph Maurer, Claudia-Veronika Meister, and Dieter Heinz Hermann Hoffmann — Institut für Kernphysik, TU Darmstadt, Schlossgartenstraße 9, 64289 Darmstadt, Germany

In the magnetosheath plasmas of Earth, Jupiter and Saturn anisotropies of the plasma parameters are caused by strong magnetic fields via Lorentz forces. These anisotropies influence the dispersion relation of excited magnetohydrodynamic waves considerably. In the present work, based on the double-adiabatic Chew-Goldberger-Low approximation, the dispersion of magnetoacoustic waves and the variations of the polytropic coefficient of the plasma by these waves are studied. It is shown that in the case of slow magnetoacoustic waves, regions with effective polytropic coefficients smaller than unity may exist in the magnetosheaths of the three studied planets. Additionally, growth rates of the magnetoacoustic waves are estimated using kinetic theory.

P 10.5 Di 17:00 Foyer

Modification of electromagnetic waves by upstreaming acoustic ones in the ionospheric E-layer before strong earthquakes — •Benjamin Mayer, Claudia-Veronika Meister, and Dieter Heinz Hermann Hoffmann — Institut für Kernphysik, TU Darmstadt, Schlossgartenstraße 9, 64289 Darmstadt, Germany

The many-fluid magnetohydrodynamic theory is applied to describe modifications and the additional excitation of electromagnetic waves in the ionospheric E-layer by acoustic waves originating from lower altitudes. In comparison to the works by other authors both the stratification of the ionosphere and the background electrostatic field are taken into account. The altitudinal profiles of the plasma parameters and the background electromagnetic field are fitted to recent experimental data. It is shown that normal magnetohydrodynamic waves, like Alfvén and magnetoacoustic ones, are generated in the E-layer. However, by the influence of the acoustic waves and the related modification of the momentum transport between the neutral and charged particles, the amplitudes and propagation directions of the magnetohydrodynamic waves are changed. Additional Joule heating processes caused by the acoustic waves and the forming nonlinear current systems result into temperature and plasma density modifications in the E-layer. Thus, also the characteristic $f_{0,E}$ frequency changes, which is regularly measured by ionospheric sounding stations. Indeed, one day before 175 Asian earthquakes $f_{0,E}$ modifications of, on the average, 30 % have been observed. The studied $f_{0,E}$ variations seem not to be caused by the solar activity.

P 10.6 Di 17:00 Foyer

Opazitätsmessungen in warmer dichter Materie — •Johanna Otto[1], Boris Ecker[2,3,4], Daniel C. Hochhaus[1,2,5], Joachim Jacoby[1], Paul Neumayer[5], Vladimir G. Novikov[6], Andreas Tauschwitz[2], Anna Tauschwitz[1] und Jörg Wiechula[1] — [1]Goethe Universität Frankfurt — [2]GSI Darmstadt — [3]Helmholtz Institut Jena — [4]Johannes Gutenberg Universität Mainz — [5]EMMI, GSI Darmstadt — [6]Keldysh Institute of Applied Mathematics, Moscow, Russia

Als warme dichte Materie wird der Zustand der nicht-idealen stark gekoppelten Plasmen bezeichnet. Theoretische Näherungen zur Beschreibung dieses Zustandes sind schwierig und dem entsprechend experimentelle Daten notwendig. Eine aussagekräftige Untersuchung zur Bestimmung der atomphysikalischen Eigenschaften stark gekoppelter Plasmen sind Opazitätsmessungen; diese sind allerdings stark temperaturabhängig. Hydrodynamische Simulationen haben ergeben, daß durch die Heizung von dünnen Hoch-Z-Folien mit intensiven Schwerionenstrahlen isotherme Plasmen erzeugt werden können. Im VUV-Bereich besitzen verschiedene Metalle eine besonders hohe Transparenz. Doch sowohl die unter CXRO und NIST tabellierten Werte für die Transmission durch kalte Materialien unterscheiden sich als auch entsprechendene Modelle für geheiztes Material führen zu unterschiedlichen Ergebnissen. Diese Diskrepanz soll in einem Experiment geklärt werden. Dabei wird eine möglichst kontinuierliche geeignete Backlighterquelle mittels eines Laserplasmas erzeugt und dessen Transmission durch das ionenstrahlgeheizte isotherme Plasma gemessen.

P 10.7 Di 17:00 Foyer

Untersuchung an indirekt geheizten Plasmen aus niedrig-Z Schäumen für Experimente zur Ionenstrahl-Plasma-Wechselwirkung — •Tim Rienecker[1], Joachim Jacoby[1], Andrey Kunin[3], Thomas Nisius[4], Nikolay Orlov[5], Johanna Otto[1], Olga N. Rosmej[2], David Schäfer[4], Nikolay Suslov[3], Galina Vergunova[6] und Jörg Wiechula[1] — [1]Goethe Universität, Frankfurt am Main, Deutschland — [2]Gesellschaft für Schwerionenforschung, Darmstadt, Deutschland — [3]VNIIEF, Sarov, Russland — [4]ReihnAhrCampus, Remagen, Deutschland — [5]Joint Institute for High Temperatures, Moskau, Russland — [6]Lebedev Physical Institute, Moskau, Russland

Die einzigartige Kombination des Petawatt Hoch-Energie Laser Systems für Ionenstrahl Experimente „Phelix“ und dem intensiven Schwerionenstrahl des UNILAC-Beschleunigers der GSI-Darmstadt erlaubt Experimente zur Untersuchung der Wechselwirkung zwischen Ionenstrahlen und Plasmen. Das benötigte, zeitlich ($\sim$ 5 ns) und räumlich ($\sim$ 1 mm) homogene, Plasma wurde durch ein kombiniertes Target, bestehend aus einem Gold-Hohlraum (dem Konverter) und einem niedrig-Z Schaum, realisiert. Im Konverter erzeugt ein Nanosekunden-Puls des PHELIX-Laser-Systems Hohlraumstrahlung. Der Schaum wird dabei, durch die Hohlraumstrahlung geheizt, und dient als Target für den Ionenstrahl. Schaumtargets zeichnen sich durch eine hohe Konversionseffizienz der zugeführten Strahlungsenergie in innere Energie, bei langsamem hochdynamischen Ansprechen aus. Ergebnisse zu den Messungen werden vorgestellt.