P 8: Helmholtz Graduate School HEPP II

Time: Tuesday 14:00–15:15 Location: P-H12

P 8.1 Tue 14:00 P-H12

PIC-Simulations of Perpendicular Collisionless Shocks in Multiple-Ion GRB Plasmas — •Jonas Graw, Martin Weidl, and Frank Jenko — Max-Planck-Institut für Plasmaphysik, Boltzmannstr. 2, 85748 Garching, Deutschland

Ultra-high-energy cosmic rays (UHECRs) are electrically charged particles, which move throughout the universe with energies greater than about 1 EeV. One likely source of UHECRs is a gamma-ray burst (GRB). The latter eject gas parallel to the axis of rotation with high velocities. Shocks are formed in these jets, in which particles are believed to be accelerated to extremely high velocities. Due to such high energies, protons and neutrons fuse to alpha particles. In our research, we simulate an astrophysical plasma consisting of multiple ion species in a mildly relativistic shock.

We simulate perpendicular collisionless shocks with multiple ion species in a mildly relativistic ($\gamma\beta = 2$) 2D3V PIC setup and we analyze in how far these shocks differ compared to single ion shocks. We observe alternating maxima of the two ion species in real space. When analyzing the highest-energetic particles, we observe that they are accelerated by shock-drift acceleration. We conduct research on how multiple-ion shocks affect the electron acceleration efficiency ϵ_e - a quantity that is observable by astronomers due to synchrotron emission and notice that ϵ_e is only slightly influenced by multiple-ion shocks. Furthermore, we analyze how the shock physics changes when using in-plane and out-of plane shock simulations and when using different magnetizations $\sigma = 1, 0.1, 0.01$.

P 8.2 Tue 14:25 P-H12

TALIF on H_2 Plasmas and its Application to Negative Ion Sources — •Frederik Merk, Christian Wimmer, Stefan Briefi, and Ursel Fantz — Max-Planck-Institut für Plasmaphysik, Garching, Germany

Two-photon absorption laser induced fluorescence (TALIF) is a tool to determine both the density and the velocity distribution function of ground state H atoms in H_2 plasmas. This is done by using a pulsed, frequency tripled dye laser (resulting in 205.08 nm radiation) in order to excite the atoms. The subsequent fluorescence radiation is collected for diagnostic purposes.

In H^-/D^- ion sources, the main mechanism of H^- production is the H atom conversion at a (caesiated) low work function surface. This raises the need for a deeper understanding of the H atom dynamics close to that surface. Therefore a TALIF setup is newly installed at the H^-/D^- ion source BATMAN Upgrade (plasma created with 100 kW of RF power) which comes with multiple challenges due to the high voltage environment of the ion source (45 kV) and the complexity of the diagnostic itself. Thus, to gain experience beforehand, TALIF was installed at a planar ICP (600 W, 13.56 MHz). In order to give context to the TALIF measurements, optical emission spectroscopy is performed on the experiment and evaluated with a collisional radiative model for the determination of basic plasma parameters.

Results of TALIF measurements are presented for the planar ICP unsing H_2, a H_2/He mixture and D_2 as working gases as well as results of the applications to BATMAN Upgrade.

P 8.3 Tue 14:50 P-H12

Investigations into the confinement of positrons in a magnetic dipole trap — •Stefan Nissl[1,2], Eve Stenson[1,2,3], Jens von der Linden[1], Adam Deller[1,3], Juliane Horn-Stanja[1], Uwe Hergenhahn[1,7], Thomas Sunn Pedersen[1,4], Haruhiko Saitoh[6], Christoph Hugenschmid[2], Markus Singer[1,2], Matthew Stoneking[1,5], and James Danielson[3] — [1]Max-Planck-Institute for Plasma Physics — [2]Technische Universität München — [3]University of California, San Diego, La Jolla, CA, USA — [4]University of Greifswald — [5]Lawrence University, Appleton, WI, USA — [6]The University of Tokyo — [7]Fritz-Haber-Institut der Max-Planck-Gesellschaft

The APEX (A Positron-Electron Experiment) collaboration aims to create a strongly magnetized, low-temperature, electron-positron plasma in a magnetic trap. This *pair plasma* is predicted to have unique characteristics and excellent stability properties due to the equal masses of the participating species. In order to achieve plasma densities using the available rate of positrons, it is beneficial to confine positrons for as long as possible and to be able to add them to the trap in multiple batches. Previous experiments in a prototype dipole trap already demonstrated a lifetime of >1s. Single-particle simulations helped to identify the main loss mechanisms and guided key improvements to the trap structure and experiment parameters. Upcoming experiments with significantly improved gamma detection capabilities will focus, among other objectives, on the confirmation of longer confinement times as well as the feasibility of accumulating multiple positron pulses in the trap.