ICAP'24 GSI TECHNISCHE UNIVERSITÄT DARMSTADT

Contribution ID: **45** Type: **Contributed talk**

Simulation of driven plasma modes in Penning-Malmberg traps

Friday, 4 October 2024 10:00 (20 minutes)

The system under investigation is an infinite plasma column surrounded by a perfect conducting cylindrical wall and space charge fields govern the motion of the particles. Additionally, the drift-kinetic approximation is valid which allows to track just the drift centers of the particles. Commonly, perturbations of the equilibrium space charge field are decomposed into modes. Driving those modes can be used for plasma diagnostics or even for compression of the plasma column. These are valuable techniques in experiments with trapped plasma in Penning-Malmberg traps like the the antiProton Unstable Matter Annihilation experiment (PUMA), where antiprotons will be transported in a trap from one facility to another which requires very long confinement times. In contrast to experiments, simulations allow full control of the plasma parameters and therefore may help to deepen the physical understanding of the response of the plasma column to external field perturbations. To track the drift centers and investigate the response of the plasma to a drive, several conditions have to be fulfilled. In particular the compression is a weak effect, the relative change of the central density during one characteristic rotation of the plasma column is approximately 10^{-6}. This requires very low numerical noise and long computation times. Moreover, reducing unwanted higher modes would be beneficial to stabilize the simulation. Two methods are tested. A Particle-In-Cell code with a Cartesian grid for the space charge calculation and a spectral solver in cylindrical coordinates. The first method takes advantage of the efficient field calculations on Cartesian grids but the numerical noise prohibits up to now the investigation of the compression effects. The second method is advantageous in terms of the present cylindrical symmetries and the naturally integrated low-pass-filter. Furthermore, it allows the direct read out of the important parameters. First results will be presented whether this approach can reduce the numerical noise.

Primary author: RIIK, Luisa (Technische Universität Darmstadt)

Co-authors: BOINE-FRANKENHEIM, Oliver (GSI Helmholtzzentrum für Schwerionenforschung GmbH(GSI)); KORMANN, Katharina (Ruhr Universität Bochumm)

Presenter: RIIK, Luisa (Technische Universität Darmstadt)

Session Classification: Sessions in Living Room 1+2

Track Classification: D-2 Dynamics – Spin, Precision, Space Charge