

# P1.4001 Gyrokinetics of electron-positron plasmas in a magnetic Z-pinch: towards a turbulence free plasma?

Monday, 8 July 2019 14:00 (2 hours)

See the full abstract here:

<http://ocs.ciemat.es/EPS2019ABS/pdf/P1.4001.pdf>

Gyrokinetic stability of plasmas in a Z-pinch magnetic geometry is studied numerically using the GENE code [1] with a particular focus on the behaviour of “pair plasmas” consisting of positrons and electrons. Importantly, the simulations presented here are potentially applicable to dipole systems such as the upcoming APEX experiments investigating pair plasma confinement [2]. The numerical analysis is performed using a local flux-tube approximation with both plasma species being treated kinetically in a regime dominated by electrostatic fluctuations driven by spatial gradients in the density and temperature profiles. We first examine the linear stability of such plasmas, varying the mass ratio between the positive and negative charge carriers, from conventional hydrogen plasma through to electron-positron plasma. We provide the first numerical support of analytic theory predicting that electron-positron plasmas can be absolutely stable in certain regions of parameter space which may be accessible during the APEX experiments. We also study the stability of electron-positron plasmas in a standard model tokamak configuration to elucidate the favourable peculiarities of the Z-pinch geometry for pair plasma confinement. The insight gleaned from these linear simulations is then used to undertake a comprehensive study on the nonlinear behaviour of two different pair plasma scenarios: (i) an unstable plasma with an outwards heat flux and an inwards particle flux - the so called “inward pinch” known to exist in conventional plasmas which we report on here for the first time in pair plasmas. (ii) an unstable plasma without the inward pinch feature.

## References

- [1] F. Jenko, W. Dorland, M. Kotschenreuther and B. N. Rogers, *Physics of Plasmas* 7, 5 (2000)
- [2] T. S. Pedersen, A. H. Boozer, W. Dorland, J. P. Kremer and R. Schmitt, *Journal of Physics B: Atomic, Molecular and Optical Physics* 36, 5 (2003)

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**Session Classification:** Poster P1

**Track Classification:** BSAP