# Scaled laboratory experiments and numerical simulations of auroral magnetospheric radio emission

D.C. Speirs[1], K. Ronald[1], R. Bingham[1,2], A.D.R. Phelps[1], S.L. McConville[1], K.M. Gillespie[1], R.A. Cairns[3], B.J. Kellett[1], I. Vorgul[3], A.W. Cross[1]

[1]*Department of Physics, SUPA, University of Strathclyde, Glasgow, G4 0NG, U.K.*

[2]*Central Laser Facility, STFC Rutherford Appleton Laboratory, Chilton, OX11 0QX, U.K.*

[3]*School of Mathematics and Statistics, University of St Andrews, St Andrews, KY16 9SS, U.K.*

Cyclotron maser instabilities are of relevance in various astrophysical contexts including planetary auroral radio emission [1,2], astrophysical shocks [3] and recently discovered periodic radio emission from oblique-rotator stars [4]. These emissions can be attributed to energetic electrons moving into convergent magnetic fields that are typically found in association with dipole-like planetary magnetospheres or shocks. It is found that magnetic compression and conservation of magnetic moment leads to the formation of a velocity distribution having a horseshoe or crescent shape. Under conditions where the local electron plasma frequency ωpe is much less than the cyclotron frequency ωce such distributions are found to be unstable to cyclotron-maser emission. We have established a laboratory-based facility at Strathclyde that has verified many of the details of our original theoretical description [5] and agrees well with numerical simulations [6]. The experiment has demonstrated that the horseshoe distribution is unstable to cyclotron-maser emission at a frequency corresponding to the relativistic electron cyclotron frequency, with polarization close to the X-mode and propagating near perpendicular to the electron beam. In this presentation, an overview of the laboratory experimental programme will be provided along with recent developments in the theory and simulation of the instability, in particular relating to questions regarding radiation propagation and escape.

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