

Abstract for an Invited Paper
for the DPP07 Meeting of
The American Physical Society

Laboratory study of auroral cyclotron emission processes¹

KEVIN RONALD, SUPA and Department of Physics, University of Strathclyde

Electrons encounter an increasing magnetic field and increase in pitch angle as they descend towards the auroral ionosphere, according to the conservation of the magnetic moment. This process results in a horseshoe shaped distribution function in electron velocity space which has been observed by satellites [1]. Research has shown this distribution to be unstable to a cyclotron maser instability [2] and the emitted Auroral Kilometric Radiation is observed to be polarised in the extraordinary mode. Experimental results are presented based on an electron beam of energy 75keV having a cyclotron frequency of 4.45GHz, compressed using magnet coils to mimic the naturally occurring phenomenon. The emitted radiation spectrum was observed to be close to the cyclotron frequency. Electron transport measurements confirmed that the horseshoe distribution function was obtained. Measurements of the antenna pattern radiated from the output window demonstrated the radiation to be polarised and propagating perpendicular to the static magnetic field. The radiation generation efficiency was estimated to be 2% in close agreement to the numerical predictions of the 2D PiC code KARAT. The efficiency was also comparable with estimates of the astrophysical phenomenon.

[1] R. J. Strangeway et al, Geophys. Rev. Lett., 25, 1998, pp. 2065-2068

[2] I Vorgul et al, Physics of Plasmas, 12, 2005, pp. 1-8

¹Thanks to the AKR team and the EPSRC.