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P2.4016 Apparatus for investigating non-linear microwave interactions in magnetised plasma

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In many plasma applications, electromagnetic (EM) waves are key to providing energy. Plasmas can demonstrate complex dynamics when exposed to multiple EM signals. Raman coupling (by Langmuir oscillation) or Brillouin scattering (through ion-acoustic waves) are important in laser plasma interactions: Microwave beams can be formed at normalised intensities comparable to those used some laser plasma interactions, and can interact in tenuous, cool and accessible plasmas potentially enhancing insight into the plasma dynamics. Magnetic confinement fusion physics may directly benefit from multifrequency microwave interaction in plasma to access, for example, cyclotron and hybrid resonances in dense plasma, either for heating or current drive.
Building on earlier research investigating geophysical cyclotron wave emissions [1,2], a new "linear plasma" experiment is under construction to test multifrequency microwave interactions in magnetised plasma. The magnetic field will reach up to 0.05T, and the plasma will be created by a helicon wave launched from an RF antenna. This will produce a large, dense, cool plasma with potential for a high ionisation fraction. Fixed frequency, and wideband sources and amplifiers will provide microwave beams for the multi-signal interaction experiments. The paper will present progress on this system.
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[2] Speirs D.C., Bingham R., Cairns R.A., Vorgul I., Kellett B.J., Phelps A.D.R., Ronald K., 2014, Phys. Rev. Lett., 113, art 155002

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