Diagnostics on Inertial Electrostatic Confinement Discharges

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Inertial electrostatic confinement (IEC) is a method of producing nuclear fusion at a laboratory bench-top scale. A spherically symmetric electrostatic potential well is established in order to confine and accelerate ions to fusion relevant energies. Although the fusion energy output is many orders of magnitude less than the energy input, various methods of achieving a higher energy gain are currently being explored.

Presently, IEC devices can produce significant fluxes of neutrons as a result of fusion of deuterons. These devices are being explored as a replacement for traditional neutron emitting radioisotopes since the ability to switch off the device enables safe storage of an IEC neutron source.

Self sustaining and non-self sustaining discharges occur that are generally non-neutral and non-Maxwellian. These discharge regimes have presented a challenge for traditional diagnostics associated with langmuir probes [1, 2] and spectroscopy [3]. For example, in order to determine the plasma density from optical emission spectroscopy using collisional-radiative modelling one is faced with significant ion and electron populations both in the eV and keV energies ranges. This type of analysis becomes insensitive in the keV region resulting in very large uncertainties.

The conference talk will contain the various IEC schemes we are pursuing and the implementation and modification langmuir probes and their analysis, as well as various spectroscopic methods in order to determine basic plasma parameters for these non-standard discharge devices.

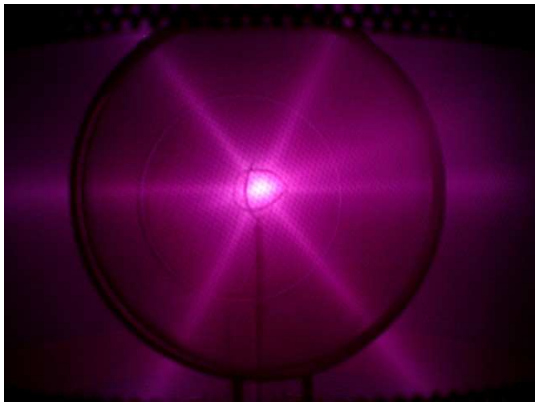

Fig. 1: *An IEC discharge*

References

[1] Matthew Carr and Joe Khachan, PHYSICS OF PLASMAS **20**, 052504 (2013)

[2] S. Cornish, D. Gummersall, M. Carr, and J. Khachan, PHYSICS OF PLASMAS **21**, 092502 (2014)

[3] J. Kipritidis, J. Khachan, M. Fitzgerald, and O. Shrier, PHYSICAL REVIEW E **77**, 066405 (2008)