# Seminar

# Institute for Plasma Research

**Title :** Towards a Sustainable Energy Future: A New Hybrid Fusion-Fission Reactor

**Speaker :** Dr. Mike Cassidy
CEO, Apollo Fusion, Inc.

**Date :** 3rd April 2017 (Monday)

**Time :** 11.00 AM

**Venue :** Seminar Hall, IPR

**Abstract :**

Apollo Fusion has been developing a new type of power plant, using a combination of fusion and fission components. In Apollo Fusion's Modular Hybrid Fusion/Fission Reactor (MHFFR) design, we use the output from our novel fusion cores to drive a subcritical (k_eff=0.98) fission blanket, the result of which is a net energy producing Energy Amplifier (EA). The EA is constructed in a way that is walk-away safe, and does not require complicated operations nor specialized operator training. The fusion core consists of a number of modules, called HEAT, which use a unique combination of magnetic electron confinement and electrostatic ion acceleration in order to heat and compress a plasma to thermonuclear temperatures. The fusion yield is further improved by using a pulsed compression of the plasma volume, which is performed many times per second, and with an 80% duty cycle, so that the average number of neutrons produced per second is 1e11 n/s at an average energy of 2.45 MeV for D-D fuel, or 5e12 n/s at 14.1 MeV for D-T fuel. Absolute and time resolved neutron yields are measured as a function of 5 system parameters, and we have partnered with Lawrence Livermore National Lab (LLNL) for neutron detector calibration. The fusion reactor prototype and vacuum facilities hardware is operated autonomously using a machine learning algorithm that is able to plan and perform hundreds of experiments per night. The fusion reactor has accumulated 110 hrs of total operation time, with the longest continuous run lasting 14 hrs. During operations of a planned commercial reactor, the plasma facing components of the HEAT fusion cores would be replaced once every 5 years, with the thermal spectrum graphite moderated fission blanket lasting the entire lifetime of the system, 20 years.