Contribution ID: **518** Type: **Invited**

New insights in pulsed power driven explosion of underwater wires and wire arrays

Wednesday 26 June 2019 10:00 (30 minutes)

Pulsed power driven underwater wire explosions are accompanied by the efficient generation of strong shockwaves. In the case of cylindrical or quasi-spherical wire arrays, convergence of these shockwaves results in high energy density conditions with multi Mbar pressures being obtained on axis, even in compact 'table-top' experiments. However much of the physics underlying wire explosion and shockwave interactions remains undiagnosed –making modelling efforts difficult and prone to misinterpretation.
Recently, we have performed the worlds first high current pulsed power experiments coupled to a synchrotron. The resultant multiframe, phase contrast radiography images provide absolute density measurements at high resolution. On the ID19 beamline at ESRF we explored the explosion of aluminium, copper and tungsten wires, using a ˜30kA, 500ns current source. As the wires expanded and ionised unexpected striation instability growth was observed inside the dense wire material. In two wire experiments, interacting a shockwave launched into the water with the surface of the exploding wires produced a new test bed for Richmeyer Meshkov instability growth. With a cylindrical array of wires, multiple shock reflections were observed and the increase in density of the water at convergence of the shockwaves seen.
As part of the talk we will compare the quantitative data produced with leading hydrodynamic codes. We will show that underwater wire explosions can be used for the determination of phase transitions which are accompanied by a weak shock generation; as well as show direct evidence of Al wire combustion obtained through spectroscopy. Finally we will discuss how the techniques can be extended, exploring the use of underwater arrays for flyer acceleration, and the production of different hydrodynamic instabilities such as the Kelvin Helmholtz.
This work was sponsored by Sandia National Laboratories, First Light Fusion, EPSRC, NNSA under DOE Agreement Nos. DE-NA0003764 and DE-SC0018088 and the Israeli Science Foundation.

Authors: BLAND, Simon (Imperial College London); YANUKA, David (Imperial College London); Mr ROSOSHEK, Alexander (Technion); Mr THEOCHAROUS, Savva (Imperial College London); EFIMOV, Sergey (Technion); Dr OLBINADO, Margie (European Synchrotron Radiation Facility); Dr RACK, Alexander (European Synchrotron Radiation Facility); Prof. KRASIK, Ya.E. (Technion)

Presenter: BLAND, Simon (Imperial College London)

Session Classification: 4.6 Fast Z Pinches I

Track Classification: 4.6 Fast Z Pinches