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Implosion of shock wave generated by an underwater electrical explosion of spherical wire array

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Recent experimental results on strong shock wave (SSW) convergence are presented. Converging SSW was generated using underwater electrical explosion of a spherical wire array with radius of either 10 mm or 15 mm. Arrays were composed of 40 either Al or Cu wires. Wire diameter was adjusted to obtain the aperiodic discharge current with amplitude ≤240 kA and rise time of ≤800 ns. As a result of SSW implosion a strong light emission of a water with duration of ˜60 ns was obtained in the vicinity of the array origin. The continuous spectrum of this light emission was analyzed using spectrometer with array of 16 photomultiplier tubes at its output. Applying black body approximation, the temperature of the surface of the light emitted volume was estimated of ˜0.7 eV. It was shown that the obtained time-of-flight of the SSW and emission spectra agree well with the results of the 2D hydrodynamic simulation coupled with equation of state for water and radiative transfer model. Namely, these simulations showed that the water density, temperature and pressure should be larger than ˜ 3 g/cm-3, ˜ 1.4 eV and ˜ 2*10ˆ11 Pa, respectively, at radii < 25 μm with respect to the origin of the SSW implosion.

Authors: Dr EFIMOV, Sergey (Technion); Prof. KRASIK, Yakov (Technion); Dr NITISHINSKIY, Michail (Technion); Mr ROSOSHEK, Alexander (Technion); Mr YANUKA, David (Technion)

Presenter: Dr EFIMOV, Sergey (Technion)

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