

Seminar

Institute for Plasma Research

Title : Basic studies on a hundred joules plasma focus device and its applications in biological sciences

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Date : 26th November 2018 (Monday)

Time : 03.30 PM

Venue : Seminar Hall, IPR

Abstract :

Plasma focus (PF) devices consist in a co-axial electrode geometry in which, cathode bars symmetrically surround central anode. An insulator covers partial length of the anode. On applying high voltages at the anode, gas breakdown takes place in the vicinity of the electrodes and a plasma current sheet (PCS) forms over the insulator that allows the flow of electric current between the electrodes. Later, PCS runs over the length of the anode under the action of Lorentz force. On arriving at the open end of the anode, the PCS compresses neutral gas ahead of it, ionizes the neutral gas, and produces a plasma column, known as pinch. At the time of compression and pinch, various physical phenomena take place that accelerate electrons toward the anode and ions away from the anode. Electrons produce X-rays pulses upon impinging the anode bottom, mainly, via bremsstrahlung and if the filled gas is deuterium, neutrons are produced via beam-target fusion mechanism, mainly. After pinch, axial plasma shocks and plasma jets form. The emitted pulsed radiation can be used to study its effects on biological and inorganic samples. Note that Pulsed reduced dose rate (PRDR) radiotherapy is useful in the case of recurrent cancerous tumor. Nonetheless, the distinctions between the effects of pulsed and continuous radiations on cancer cells are little known.

In the present work, a hundreds joule plasma focus device, PF-400J, was operated at various hydrogen pressures and optimized pressure was identified based on electrical signal analysis. The pulsed radiation was detected and various kinds of radiations were identified. Radiation was temporally correlated with pinch. Dose measurements were carried out. Later, the pulsed radiation emitted from PF-400J was applied to irradiate the colorectal cancer cells in in vitro experiments. DNA damage in the form of double strand break (DSB) and cell death were investigated at different time points after irradiation. Obtained results will be presented and discussed during the presentation.
