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Faculty of Girls

Physics Department

**Experimental studies on Mather-type plasma focus
discharge**

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M.Sc. Physics (2001)

For

Ph. D. Degree of Physics

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Abstract

The aim of this work is to study the characteristics and electrical parameters of the of the used plasma focus system. Also, the plasma current sheath in the axial phase is studied. Finally, the emissions of particles and X-rays from the system and their characteristics are investigated.

In this experiment, a Mather type plasma focus of stored energy in the range from \sim (1 kJ - 2.2 kJ), (8kV-12kV) was used. The capacitor bank consists of 4 capacitors each of 7.71 μ F. Argon gas was used and its pressure varied between 0.5 and 2 torr. Several diagnostic techniques were used, such as Rogowski coil, voltage probe, identical double magnetic probes, a Faraday cup, a PBX-65 photodiode with biasing circuit to measure the discharge current, discharge voltage, azimuthal magnetic field induction, intensity of energetic particles emission, and time resolved x-ray emission respectively.

In the first part of our work, the current and voltage signals were used to calculate the electrical circuit parameters and to study their behaviors as a function of discharge time like the inductance, impedance, power flow, and energy dissipation. The experimental results showed that, the maximum value of discharge current \approx 156.6 kA at charging voltage of 12 kV. Also, the maximum value of power flow and energy dissipation were 359MW and 143 Joule respectively, at the same charging voltage (12kV) and at argon gas pressure = 1.5 torr. The external circuit inductance was calculated from the discharge current signal without plasma ($V_{ch}=12$ kV and $p=8$ torr) and it was about 160.5 nH. The plasma inductance curves showed that the inductance starts high at the beginning of discharge and begins to decrease till it shows a sudden and temporal increase at the focus time, the peak value of plasma inductance at the focus time =27.3 nH at $V_{ch}= 12$ kV and $p=1.5$ torr . The external circuit resistance was

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