EX/P4-22 · Investigations into the Relationship between Spheromak, Solar, and Astrophysical Plasmas

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Abstract: Spheromaks offer the potential for a simple, low cost fusion reactor and involve physics similar to certain solar and astrophysical phenomena. A program to improve understanding of spheromaks by exploiting this relationship is underway using (i) a planar spheromak gun and (ii) a solar prominence simulator. These devices differ in symmetry but both involve spheromak technology whereby high-voltage is applied across electrodes linking a bias magnetic flux created by external coils. The planar spheromak gun consists of a co-planar disk and annulus linked by a poloidal bias field. Application of high voltage across the gap between disk and annulus drives a current along the bias field. If the current to flux ratio exceeds the inverse of the characteristic linear dimension, a spheromak is ejected. A distinct kink forms just below the ejection threshold. The solar simulation gun consists of two adjacent electromagnets which generate a "horse-shoe" arched bias field. A current is driven along this arched field by a capacitor bank. The current channel first undergoes pinching, then writhes, and finally bulges outwards due to the hoop force.

EX/P5-01 · Progress in Plasma Heating and Confinement at the Multimirror Trap GOL-3

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Abstract: Recent results on heating and confinement of plasma at the multimirror trap GOL-3 are presented. This facility is open trap for confinement of hot (0.1-1 keV) dense ($10^{15} - 10^{16} 1/cm^3$) plasma. The plasma heating is provided by high-power electron beam (1 MeV, 30 kA, 8 μs) with energy content of up to 200 kJ. The upgrade to full-scale corrugation of a magnetic field was completed during last two years at the facility. In the 12-meter solenoid the multimirror sections of 4-meter-length were made at the both ends of the solenoid (B_{max}/B_{min} = 5.2 / 3.2 T, cell length is 22 cm). The modified source of preliminary plasma was put in operation for improvement of macroscopically stable beam transport through the plasma column. Search of optimal conditions for confinement of plasma with $\sim 10^{15} 1/cm^3$ density and high ion temperature, and also for macroscopically stable system "electron beam – plasma" was carried out in the new configuration of facility. As a result of the experiments the plasma with density of $(1-2) \times 10^{15} 1/cm^3$, $n(e)T(e) + n(i)T(i) = (0.5 - 2) \times 10^{15}$ keV/cm^3 and confinement time of 100–200 μs in a multimirror trap is obtained. Dynamics of electron and ion temperatures is discussed.

EX/P5-02 · Perturbative Analysis of Transport and Fluctuation Studies on RFX

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Abstract: On the RFX reversed field pinch different transport mechanisms govern the centre and the edge of the plasma. Core transport is driven by parallel transport in a stochastic magnetic field, giving rise to an outward directed particle convection velocity. At the edge, roughly corresponding to the region outside the toroidal field reversal surface (where q = 0), electrostatic fluctuations are an important loss channel, but more than 50% of the power losses have been associated to localized plasma-wall interaction due to the non-axisymmetric magnetic perturbations caused by locked modes. In the paper we present the most recent progress made in the modeling and understanding of the above mechanisms underlying particle and energy transport. The paper also discusses the correlations between core and edge transport phenomena. The main tools are perturbative transport studies by pellet injection and the analysis of the contribution of intermittency processes to particle transport in the edge.