**PROTO-SPHERA: a magnetic confinement experiment which emulates the jet + torus astrophysical plasmas**

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The phenomenon of magnetic reconnection is ubiquitous in astrophysical plasmas, from the terrestrial Magnetosphere, to the solar Corona, to the Pulsar-wind Nebulae until to the AGN jets. These phenomena can be so summarized: near a point, or a curve, where two magnetic field lines touch each other, but have opposite field direction (so-called X-points), a "tearing" of those lines occurs, followed by a different "stitching" between them; the new resulting magnetic field configuration has a lower energy and so this leads to thermal plasma heating as well as to super-thermal particles acceleration. In magnetic reconnections magnetic flux and electric current are transferred as well. The PROTO-SPHERA experiment was built at the CR-ENEA in Frascati as an innovative configuration of plasma magnetic confinement, in view of Controlled Fusion research, and it is quite different from the confinement experiments studied so far. PROTO-SPHERA attempts to emulate in the laboratory the jet + torus astrophysical plasmas; an internal magnetized plasma centerpost (jet) on the axis of symmetry of the configuration, surrounded by a magnetized plasma torus orthogonal to the plasma centerpost. The confined plasma geometry is simply connected: no metal conductor is topologically linked to the plasma torus and the vacuum chamber is a simple cylinder. The plasma centerpost is sustained by a DC voltage, applied between electrodes internal to the vacuum vessel, and a confined plasma torus is formed by self-organization around the plasma centerpost: the lines of force that wind around the centerpost are broken and reconnected into lines of force winding along the torus. The experiment is capable of sustaining the confined torus as long as the centerpost is kept running, provided that magnetic reconnections are recurring and that the magnetic flux transfer from the jet to the torus is efficient enough. The first difference between PROTO-SPHERA and its cosmical examples is that in Astrophysics the virial theorem is fulfilled by the gravitational force, whereas in the case of a laboratory experiment it is fulfilled by magnetic fields produced by poloidal field coils external to the plasma. The second difference is that in the Pulsar Wind Nebulae models the current in the plasma jet has opposite directions in the 2 emispheres, whereas in PROTO-SPHERA the plasma current goes through the center of the magnetic configuration without changing direction. The final difference is that in non-relativistic Astrophysics the solenoidal condition for the plasma current density nabla with rightwards harpoon with barb upwards on top times j with rightwards harpoon with barb upwards on top equals 0 is always satisfied; instead in a laboratory experiment the plasma charges all nearby metallic conductors present inside the vacuum vessel. But these charged metal surfaces cause an E with rightwards harpoon with barb upwards on top logical and B with rightwards harpoon with barb upwards on top rotation of the overall plasma around its symmetry axis: recent observation of the tilted azimuthal rotation of the plasma and of the non-axisymmetric nature of the recurring magnetic reconnections, show that in PROTO-SPHERA the production of closed toroidal flux surfaces is associated with a plasma that acts as a slightly oblique rotator, which is an unexpected similarity to the oblique plasma rotators present in Pulsar Wind Nebulae.