Plasma Confinement by Pressure of Rotating Magnetic Field in Toroidal Device

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Summary

- Toroidal plasma confinement device in which plasma is confined in a dynamic steady state equilibrium by the pressure of rotating magnetic field is proposed.
- Plasma equilibrium and stability in this device are achieved due to constraint of conservation of amplitude of the oscillating magnetic flux through any section of layer between plasma and conducting shell.
- Numerical modeling of plasma equilibrium and stability demonstrated that plasma is in stable MHD equilibrium in the proposed device.
- Further theoretical and also experimental studies of this confinement concept are needed to better evaluate its practical performance.
- Possible application of this plasma confinement concept to an efficient fusion reactor would require availability of superconductors for the shell material, which can operate in magnetic field $\sim 1\,\mathrm{T}$ in $1\,\mathrm{MHz}$ frequency range.
- In a reactor, a layer of solid low loss dielectric between the plasma and the shell is needed to isolate superconducting shell from plasma. The insulating dielectric would be cooled by a liquid dielectric flowing in a cavity inside the solid dielectric.