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High confinement in fusion oriented plasmas with kV-order potential, ion, and electron temperatures with controlled radial turbulent transport in GAMMA 10

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The tandem mirror system has achieved improved energy confinement times ($>$ 60-90 ms) with radial transport dominating the Pastukhov axial energy confinement time ($>$ 100 ms). This high confinement regime establishes a proof of principle that the combination of electrostatic and magnetic mirror confinement can successfully insulate electrons from thermal ions. ECH controlled hot-layer formation facilitates plasma-rotation profile formation with a radially localized high-vorticity layer. In the vicinity of the layer, a radial transport barrier is formed [1], showing similar properties to ITB in toroidal plasmas. Coaxially nested intense E(r)$\times$B sheared flow [2] in the GAMMA 10 core plasma realizes an upgraded stable regime having (i) $>$ 0.75 keV bulk central electron temperature with (ii) an achievement of larger stored energy for axially potential-confined ions exceeding that (i.e., diamagnetism) for central magnetically confined ions ($\approx$ 7 keV). The radially sheared flow having peak-on-axis high vorticity guards and improves whole core plasma confinement, and is controlled by (iii) improved $\approx$ 3 kV ion-confining potential due to simultaneous central and plug ECH. X-ray imaging of the suppression of turbulent structures [1-3] will be shown [1,2].

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