X-RAY MEASUREMENTS FROM THE TANDEM MIRROR EXPERIMENT-UPGRADE (TMX-U)*

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We report the results of X-ray emission measurements made at various plasma locations in the Tandem Mirror Experiment-Upgrade (TMX-U). By manipulating the electron and ion density profiles within the magnetic mirror end cells, a local minimum in the axial electrostatic potential creates a barrier that thermally isolates central cell electrons from those in the end cells. This thermal barrier makes it possible to heat end cell electrons to a temperature (~1.6 keV) that is significantly higher than the central cell value (30 to 200 eV), thereby increasing the ion confining potential. Formation of this potential peak is attributable, in part, to mirror-trapped hot ions (8 keV) that are injected as beams of neutral particles. The resulting ion density profile exhibits two symmetric peaks at the locations of the ion turning points and a depression where the magnetic field is a minimum. Electron cyclotron resonance heating (ECRH) is applied at the density minimum and produces a population of hot, mirror-trapped electrons (20 to 200 keV). It reduces an already depressed electrostatic potential to establish the thermal barrier. In addition, ECRH applied at the outer density peak raises the ion confining potential and enhances central cell ion confinement by increasing the end cell electron temperature. X-ray measurements are made with solid state and scintillation detectors at the ECRH locations. Medium resolution spectra are obtained over a broad energy band and have proven to be an important tool for determining the efficiency of thermal barrier formation. We present our initial findings from these non-Maxwellian plasmas.

*Work performed under the auspices of the U.S. Department of Energy by the Lawrence Livermore National Laboratory under contract number W-7405-ENG-48.