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Effect of the magnetic field divergence on the ion velocity distribution in the expanding region of an argon helicon plasma IOANA A. BILOIU, EARL SCIME, West Virginia University, COSTEL BILOIU, Varian Semiconductor Equipment Associates, SAMUEL COHEN, Princeton Plasma Physics Laboratory — Laser induced fluorescence (LIF) observations downstream from a helicon source-diffusion chamber junction revealed bimodal ion velocity distribution functions (ivdf) along diverging magnetic field lines for 1.5 mTorr argon plasma. By increasing the magnetic field divergence in the expansion region, the speed of the faster component of the distribution function increases, reaching a maximum of $\sim$ 10 km/s. The speed of the slower component is essentially zero. Upstream the junction, i.e., at the end of the helicon source, the distributions are also bimodal but no effect of the magnetic field divergence on fast or slow component is observed. LIF tomography observations of the 2D ivdf in the expansion region show the presence of the fast ion component including slight ion conics with cone angle of $2\theta = 64^\circ$. The strong ion acceleration and the ion conics are strong evidence of weak ion collisionality as the plasma flows out along the diverging magnetic field. The parallel velocity of the fast ions increases as a result of acceleration by the potential drop across the electric double layer at the end of the helicon source and acceleration by the magnetic moment conserving $\mu\nabla$B force.

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