Abstract Submitted
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Hot-filament discharge plasma in argon gas at 140 K[1] SHANNON DICKSON, SCOTT ROBERTSON, University of Colorado — A hot-filament discharge plasma has been created in a double-walled vacuum chamber with the inner wall cooled by liquid nitrogen vapor. The inner brass chamber (16 cm dia. x 30 cm) is wound with copper tubing for cooling. This chamber has two tungsten filaments 10 cm in length oriented axially about 2.5 cm from the wall. Plasma measurements are made using a Pt wire probe. At 300 K, 0.6 mTorr argon in the outer chamber, and 2 mA emission, the electron density is 1 x10^8 cm^{-3} and the electron temperature is 0.054 eV. At 140 K, the density is 1.6 x10^8 cm^{-3} and their temperature is 0.11 eV confirming that the electrons are not cooled by elastic collisions with the gas. The floating potential of the probe is -2.4 V at 300 K and -0.6 V at 140 K as a consequence of the ion current to the probe being about doubled at the lower temperature. The higher ion current may be a consequence of charge-exchange collisions producing cold ions that are more easily captured by the probe. These collisions decrease the ion losses to the wall by slowing ions accelerated by the plasma potential. Electron losses are reduced because of the requirement of quasineutrality, thus reduced evaporative cooling of electrons may be the cause of the increased electron temperature in 140 K gas.

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