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The Maxwell Demon and its instabilities[1] CHI-SHUNG YIP, J.P. SHEEHAN, UMAIR SUDDIQUI, NOAH HERSHKOWITZ, Dept. of Engineering Physics, University of Wisconsin, Madison, Wisconsin 53706, GREG SEVERN, Dept. of Physics, Unversity of San Diego, San Diego, CA, 92110 — Previous experiments have shown that in a low pressure, low temperature plasma, positively biasing an array of thin wires can increase electron temperature. This works, it is thought, by creating an angular momentum trap to absorb cold electrons. In this experiment, such a Maxwell demon device was reproduced by welding 0.025mm tungsten wires onto stainless steel shafts, which were coated with a ceramic coating. However, we found that the effect of such device is identical to a plate with the same total surface area. These devices was used to more than double the plasma electron temperatures in a multi-dipole chamber operating in the mTorr regime. Moreover, the demon is observed to reduce the cold electron population in a plasma with a bi-Maxwellian electron distribution, leaving a single Maxwellian electron distribution. In addition, at high positive voltage, relaxation instabilities in the kHz range occured, as MacKenzie et al. had observed. The instability was determined to be pulsing anode spots, and the measurement of time-resolved plasma parameters in this instability was achieved by using a slow sweeping Langmuir probe. Relaxation time of the instability was modeled by a production-lost balanced method.

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