Abstract Submitted
for the DPP12 Meeting of
The American Physical Society

Millimeter Wave Interferometer for Measuring Plasma Density in PCX[1] WEIFENG PENG, MIKE CLARK, WEIXING DING, JOHN WALLACE, CARY FOREST, Department of Physics, University of Wisconsin, Madison — A microwave interferometer is designed to determine the plasma density in the Plasma Couette Experiment (PCX) at UW-Madison. PCX is characterized by a cold low density plasma. Two 15 mW, 320 GHz microwave sources and two mixers for detecting the phase shift of the microwaves are employed. The 3 dB radius of the beam is about 1 inch. The size of optical elements in this experiment is determined by the beam shape. The beam splitters are made of a wire mesh in an aluminum frame with the mesh number (MN) = 17. It is found that for MN = 17 half of the power is reflected and half is transmitted. The two source frequencies are offset by 1 MHz, i.e. 320 GHz and 320+0.001 GHz. The 320 GHz beam passes through free space and the other beam passes through the plasma experiment. Both beams terminate on their respective mixer. By measuring the phase difference of the mixers and the path length of the microwave beams, the plasma density can be calculated. Four microwave lenses, 4 flat mirrors, and 4 beam splitters are mounted on a linear motion optics table and used to accurately measure the plasma density in PCX. The design and construction of the system is discussed.

[1]Supported by NSF and DOE.

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Date submitted: 13 Jul 2012 Electronic form version 1.4