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## 12.47 A heterodyne dispersion interferometer for wide-bandwidth density measurements on DIII-D

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In order to improve both the density and particularly the temporal resolution beyond previous dispersion interferometers (DI), a heterodyne technique based on an acousto-optic (AO) cell has been added to the DI. A 40 MHz drive frequency for the AO cell allows density fluctuation measurements into the MHz range. A CO<sub>2</sub> laser based heterodyne DI (HDI) was installed on DIII-D. The total beam path length is approximately 100 m, and a feedback alignment system originally developed for the ITER TIP prototype [1] was found to be essential for reliable HDI operation. It is demonstrated that the HDI is capable of tracking the density evolution throughout DIII-D discharges, including disruption events and other rapid transient phenomena. The data also show good agreement with independent density measurements obtained with the existing DIII-D two-color interferometer. The HDI line-integrated density resolution sampled over a 1s interval is  $\sim 9 \times 10^{-17}$  m<sup>-2</sup>. Density fluctuations induced by MHD instabilities are also successfully measured by the HDI and will be presented. This work was supported by US-Japan Fusion Collaboration Program FP5-3 (2015) and FP5-8 (2016), as well as U.S. DOE under DE-FC02-06ER54875 and DE-FC02-08ER54972. [1] M.A. Van Zeeland et. al., PPCF 59, 125005 (2017).

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