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Theory     Experiment

**Turbulent Ion Temperature Fluctuation Measurements on DIII-D,\*** I.U. Uzun-Kaymak, R.J. Fonck, G.R. McKee, *U. Wisconsin-Madison* — A novel dual-channel, high throughput, high efficiency, charge exchange spectrometer (UF-CHERS) has been developed to measure impurity ion temperature and toroidal velocity fluctuations with 1  $\mu$ s time resolution. These measurements are primarily needed for identifying underlying instabilities and validation of transport simulation codes. Based on the measured photon flux levels for the entire spectral line, a photon noise floor  $\sim 1\%$  is expected. Statistical averaging over long data records should provide turbulence measurements to 1/5 to 1/10 of the estimated photon noise floor. Correlation measurements in DIII-D plasmas demonstrate broadband ion-temperature fluctuations from 0–150 kHz, while cross-correlation with BES measurements of density fluctuations exhibits cross-power between density and ion temperature fluctuations to 250 kHz in ECH-heated low-collisionality L-mode discharges. The fluctuation level is  $\tilde{T}_i/T_i \sim 2\%$ , with  $\langle \tilde{n}\tilde{T}_i \rangle$  correlation lengths in the range of 3-5 cm. A new detector system will provide improved signal-to-noise level and higher frequency measurements.

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