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Comparing density, electron temperature, and magnetic fluctuations with gyrokinetic simulations using new synthetic diagnostics[1] D.R. ERNST, MIT, W. BERGERSON, UCLA, P. ENNEVER, M. GREENWALD, A. HUBBARD, J. IRBY, MIT, P. PHILLIPS, U. Texas, M. PORKOLAB, MIT, W. ROWAN, U. Texas, J.L. TERRY, P. XU, MIT, AND THE ALCATOR C-MOD TEAM — Three new synthetic turbulence diagnostics are implemented in GS2 and compared with measurements: phase contrast imaging, polarimetry, and electron-cyclotron (ECE) emission. Our new synthetic diagnostic framework is based on transforming to a real-space annulus in Cartesian coordinates. This allows straightforward convolution with diagnostic point-spread functions, or integration over viewing chords. Wavenumber spectra and fluctuation amplitudes, as well as transport fluxes, are compared with measurements. Both phase contrast imaging and newly observed ECE electron temperature fluctuations, closely follow the electron temperature in an internal transport barrier during on-axis heating pulses, consistent with the role of TEM turbulence [D. R. Ernst et al., APS Inv. (2012), IAEA/TH/1-3 (2006)]. New C-Mod polarimetry measurements, showing strong broadband core magnetic fluctuations, will also be examined against gyrokinetic simulations. The new framework is readily extended to other fluctuation measurements such as two-color interferometry, beam emission spectroscopy, Doppler back-scattering, ECE imaging, and microwave imaging reflectometry.

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D. R. Ernst
MIT

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