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Observations of a Phase Transition in the Plasma Turbulence Across the HF Radar Spectral Width Boundary

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SuperDARN radars routinely observe a distinct transition from large spectral width (>150 m s^{-1}) located at higher latitude to low spectral width (<50 m s^{-1}) located at lower latitude . The spectral width boundary (SWB) is a proxy for the poleward edge of energetic electron precipitation, and thus also a step-like change in Pedersen conductance. This paper presents evidence for a phase transition in the F-region ionospheric plasma turbulence across the SWB: (1) There is a relatively rapid decrease in LOS Doppler velocity (electric field) across the SWB. (2) The 2-D beam swinging vectors decrease across the SWB. (3) The 2-D vectors change from more to less isotropic across the SWB. (4) The intermittency of the 2-D vectors increases just poleward of the SWB. (5) The actual existence of the SWB indicates the flows change from more to less isotropic across the SWB. (6) The mode values of the spectral widths bifurcate when approaching the SWB from the equatorward side. (7) The Doppler spectral shapes change from Lorentzian to Gaussian across the SWB. (8) Double-peaked Doppler spectra are concentrated in the region poleward of the SWB. (9) The fractal dimension of electric field fluctuations changes across the SWB. Combined, these observations suggest a phase transition in the plasma turbulence across the SWB. The observations will be related to second-order phase transition theory using the Pedersen conductance as the control parameter.