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High-speed imaging of auroral microstructures

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We have been conducting high-speed (100 Hz) imaging observations of auroral microstructures since January 2010 at Poker Flat Research Range (PFRR), Alaska. For example, from the observations in the last winter season, we showed evidence that auroral folds were periodically formed in a breakup arc and the luminosity is exponentially increased for about 10 sec before an auroral breakup onset. The evolution of turbulent microstructures and the formation of folds may be interpreted by the nonlinear evolution of inertial Alfven wave (IAW) turbulence in the thin current sheet. In this presentation we report the development and initial results of a new optical instrument system installed at PFRR since November 2010. Using a Hamamatsu EMCCD camera, we are conducting 180 Hz and 250 Hz imaging of the breakup aurora for the first time to search unexpectedly fast auroral phenomena, and to understand the electron acceleration mechanisms associated with dispersive Alfven waves in collaborations with Tohoku University and University of Alaska, Fairbanks. We use a telephoto lens of 300mm/F2.8 to resolve the finest scale of aurora with attaching a BG3 filter to see only the prompt emissions from molecular nitrogen.