Langmuir turbulence driven by natural O-/Z-mode emissions in the auroral ionosphere

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The recently discovered coherent returns in the Poker Flat Incoherent Scatter Radar (PFISR) data with the flat ion-line spectrum and simultaneous double-peaked plasma-line spectrum in the lower ionospheric *F*-region are experimentally investigated in more details. These echoes are believed to indicate the occurrence of naturally produced Langmuir turbulence. Our understanding of the generation mechanism for natural Langmuir turbulence is incomplete. Typically, a beam-plasma interaction is assumed to be directly responsible. However, the average energy of an electron beam capable of producing Langmuir turbulence is believed to be less than 200 eV. These electrons cannot penetrate to the altitudes where natural Langmuir turbulence is observed (200-250 km). Furthermore, even a mono-energetic electron beam will interact with the ionosphere over an extended altitude range. Yet the observed turbulence is confined to a thin layer exhibiting a sharp altitude cut-off. Finally, the turbulent regions seem to occur just outside regions of auroral ionization. Considering these difficulties, a single explanation for all naturally enhanced ion-acoustic lines based on beam plasma interactions is not convincing. This report presents new experimental data recorded by the 450-MHz PFISR facility. Based on the new observations, i.e. (1) localization of the turbulence in thin layers, (2) occasional appearance of the second layer about 50 km blow the main turbulent layer, and (3) simultaneous measurement of the radar echoes and natural auroral electromagnetic emissions, we propose the possibility that natural electromagnetic Z-/O-mode emissions accompanying the aurora are the direct source mechanism of the process responsible for the radar echoes.