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Pc1 (pearl) pulsations with inverse dispersion

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Results of the analysis of 15 unusual Pc1 (pearl) pulsation events with the inverse dispersion in comparison with the dispersion of well known electromagnetic ion-cyclotron (EMIC) waves in the form of the classic Pc1 (pearl) pulsations are presented. The pulsations with the dynamical spectrum consisting both of falling tones only (first type) and events with structures, which start with the falling tones and develop then into rising tones (second type), have been discovered. The first type corresponds to the frequency dispersion of the magnetosonic waves (R-waves), the second type corresponds to the mixed frequency dispersion of the R-waves and EMIC waves (L-waves). All phenomena were observed during quiet geomagnetic periods. The duration of the events is about 20-30 min. For the interpretation of these phenomena the cyclotron instability driven by the energetic protons with relative mean (beam) velocity $v_0$directed parallel or antiparallel to the background magnetic field and corresponding to the energy of approximately 10-100 keV is considered. The interaction of such protons with waves having frequencies $< \omega \quad _i(\omega_i$ is the ion gyrofrequency) leads to the instability, which allows the fastest growth of the electromagnetic oscillations with the dispersion of R-wave type. When the velocity of the proton beam decreases ($v_0 \sim 0$), R-waves attenuate and L-waves will intensify, if the temperature anisotropy coefficient ($(T_\perp/T_{||})$-1) of those protons is positive. This instability is the reason for the generation of the classic Pc1 (pearl) pulsations with the usual dispersion. The transition from R- to L-waves is a very interesting geophysical phenomenon. Alternative variants for the interpretation of such a transition are the propagation of waves through the regions with heavy ions, and nonlinear coupling of EMIC and magnetosonic waves The work was supported by RFBR grants 04-05-64657, 05-05-64992.