

Exploration of Venus ionosphere and upper atmosphere by Japanese Venus orbiter

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We present a near-future exploration of the Venus upper atmosphere and ionosphere carried out by the Japanese Venus orbiter (Planet-C), which will be launched in 2008 and arrived at Venus in 2009. In this mission, direct and/or indirect measurements of the plasma, neutral particles, plasma wave and magnetic field in these regions will be made by the plasma instrument package; particle (ion/electron) analyzer, particle (extremely ultraviolet) imager, plasma wave analyzer and fluxgate magnetometer, as well as optical imaging of the lower atmosphere will be performed in terms of several wavelengths. In this presentation, we concentrate on describing the principal scientific objectives related to the upper atmosphere and the ionosphere and discussing observation strategies for various phenomena occurring in these regions, particularly the particle escape processes from Venus atmosphere.

Despite extensive studies based on Pioneer Venus Orbiter observations and other spacecrafts, there still remain many unresolved issues of the plasma dynamics in the upper atmosphere and ionosphere on Venus: 1) atmospheric escaping process, 2) plasma dynamics and characteristic structure in the nightside ionosphere and ionotail (ion hole, patch, cloud, streamer etc.), 3) plasma transport and global circulation, and 4) mass and energy transfer mechanism through the ionopause. The observation of particle escape processes from Venus is one of the most important scientific objectives in this mission, given the important influence of these processes on the evolution of the Venus atmosphere and the critical lack of quantitative information on the total flux of the escaping particles. We are assessing the feasibility of installing several instruments on the spacecraft for the observation of these processes: 1) extreme ultraviolet imager, 2) nonthermal ion mass/spectrum analyzer and electron spectrum analyzer, 3) thermal plasma analyzer, 4) plasma wave analyzer and sounder, and 5) magnetometer.

Considering that Planet-C will arrive at Venus during solar maximum period, a nominal operation period of 2-3 years will provide a significant data set of the Venus upper atmosphere and ionosphere, which is known to exhibit a remarkable dependence on the solar activity. We will discuss the current status of our feasibility study and the instruments and methodology necessary for understanding the key scientific issues.