Nozomi - A Japanese Mission to Mars -

Hajime Hayakawa[1]

[1] ISAS

NOZOMI is the first Japan's Mars Orbiter which launched on July 4th of 1998 and will arrive at Mars early January 2004.

Major scientific target of NOZOMI is the interaction of Martian upper atmosphere with the solar wind. This problem was not to be pursued in an optimum way by the formar Mars Probes. NOZOMI science team considered optimizing the spacecraft and its orbit to the study of Martian upper atmosphere and its interaction with the solar wind.

No systematic survey has been made of the Martian upper atmosphere so far. In order to resolve problems raised by the earlier observations, it is essential to carry out measurements of basic parameters of the Martian upper atmosphere, as has been done by the PVO for Venus. Hence, a prime objective of NOZOMI is to measure basic plasma parameters, composition of neutral gases, and the magnetic field in the upper atmosphere. At the same time, the quantitative study of heavy ion flux escaping from Martian atmosphere is extremely important for the understanding the role of the solar wind in the evolution of the Martian atmosphere. This can be done by the measurements of escaping ions in the Martian tail region. In order to realize observations in these two different regions, NOZOMI will employ an elliptical orbit, with periapsis altitude as low as 150 km and apoapsis distance of 15 Mars radii.

In order to realize a comprehensive measurement of the upper atmosphere, 14 scientific instruments are installed on NOZOMI. The role and importance of fluxgate magnetometer (MGF) are obvious. Mounted on the tip of the extensible 5 meters boom, it will give three components of the magnetic field with the accuracy of 0.1 nT. The neutral gas mass spectrometer (NMS) and the UV spectrometer (UVS) measure the neutral gas composition of the upper atmosphere, in situ and remotely, respectively. The Ion mass spectrometer (IMI), energetic electron energy spectrometer (ESA), energetic ion energy spectrometer (ISA), thermal plasma analyzer (TPA) measure ionized component from thermal to a few tens kev. The picked up ions range to higher energy and measured by the solid state particle detector (EIS). The electron temperature is a key parameter to derive the plasma pressure and is measured by the electron temperature probe (PET). The low frequency plasma waves, which will play important roles in the energy conversion processes between the solar wind and the Martian ionosphere, are measured by LFA. In addition to these in situ plasma instruments, NOZOMI carries a topside sounder (PWS) to obtain vertical profiles of the topside ionosphere remotely. The visible camera (MIC) will give the meteorological conditions in the lower atmosphere, which has significant influences on the upper atmosphere.

In addition to the study of the interaction between the solar wind and the Martian upper atmosphere, NOZOMI will contribute to several scientific targets of other science area. The MIC will be used for the study of the Martian meteorology, surface erosion. According to the orbit plan, NOZOMI will make close encounter with the moons of Mars, Phobos and Deimos, several times during her life. The MIC will take close up images of these moons. Some of the theoretical studies tell us that Mars could have thin dust rings. This fascinating idea will be checked by the dust counter (MDC) and also by the MIC. The dust counter measures the distribution of the interplanetary dust during the cruising time of NOZOMI to Mars. The EUV spectrometer measures the He glow around Mars. It has already succeeded in measuring the He+ ions in the earth's plasmasphere and interstellar He. As a part of the UVS instrument, an absorption cell photometer to measure D/H ratio is also included. This measurement along with the isotope measurement by the NMS will provide useful information for the evolution of the atmosphere.