The Nozomi (Planet-B) Neutral Gas Mass Spectrometer

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The Planet-B (Nozomi) Neutral Gas Mass Spectrometer (NMS) is designed for in-situ measurements of the neutral gas composition in the upper atmosphere of Mars. The NMS is a quadrupole mass spectrometer with a mass range of 1-60 amu (atomic mass units and a dual electron multiplier to increase the signal dynamic range. The ion source, which is collinear with the analyzer, operates in two different modes: 1) a closed source mode for measuring non-surface reactive neutral species that have thermally accommodated to the gas inlet walls; and 2) an open source mode for measuring chemically surface active species by direct beaming with no surface collisions. The instrument will be opened to the Mars environment after orbit insertion. Measurements of He, N, O, CO, N2, NO, O2, Ar, and CO2 will be done at periapsis. The data will be used to determine the variation of the neutral atmosphere densities, temperature, and isotopic ratios with altitude, local solar time and season. Measurements are possible from about 130-140 km to 500 km. The data will contribute to the studies of thermosphere energetics, lower atmosphere meteorology (e.g. dust storms) and serve as a resource for studies of the interaction of the upper atmosphere with the solar wind. The near equatorial orbit of Nozomi and the near polar orbit of Mars-Express (MEX) will provide complimentary views of the seasonal extremes in thermospheric structure during the Nozomi-MEX observational period. Data from the NMS and UVS instruments on Nozomi and the SPICAM instrument on MEX can be combined to piece together a global (empirical) picture of neutral upper atmosphere densities and temperatures. The PFS instrument on MEX can provide lower atmosphere data to explore the coupling between the lower atmosphere and upper atmosphere. Results from the Mars Thermospheric General Circulation Model (MTGCM) can be compared with Nozomi and MEX measurements to investigate the processes that maintain the upper atmosphere structure and dynamics, and its response to dust storms. This will be important for studies that address the role of volatile escape rates in the present and in the past. The synergy between MEX (high latitude) and Nozomi (low latitude) measurements suggests a coordinated Nozomi-MEX data taking campaign and possibly joint data analysis tasks.