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Structure and dynamics of the Martian subsolar ENA jet

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The observations of the global structure and dynamics of the ENA (Energetic Neutral Atoms) jet generated at the subsolar region of Mars are reported. During the first year of survey in vicinity of Mars, the Neutral Particle Detector (NPD) of the ASPERA-3 experiment onboard Mars-Exress under suitable observation geometry detected an intense ENA flux emitted anisotropically from the subsolar region. Time-of-Flight analysis shows that the detected ENAs are hydrogen atoms with an energy of 1.4 KeV on average. This flux is likely to be generated in a compact region close to the Induced Magnetosphere Boundary (IMB) forming a jet (cone) like structure. Several tens of orbits have been analysed and in 19 orbits the ENA fluxes have very evident short-time scale variations as the spacecraft moves outwards the planet. The oscillation periods range from 130 to 240 sec and the changes in the ENA flux reach 30% - 60%. These flux oscillations can be interpreted by either temporal variations in the ENA generation region or spatial structure of the ENA jet. The temporal changes are caused by instabilities at the IMB, where the ENA jets are generated. For example in situ observations by an electron instrument of ASPERA-3 show signatures of electron flux variations in the magnetosheath. The spatial structures are due to patchy and intense generation regions of the ENA jet, which form the wavering structure of the intense ENA jet. As satellite transverse that structure, the NPD can observe the oscillations of the ENA jet. We also discuss long-term variations of the jet intensity and the spatial distributions. Even the ENA jet flux was almost constant over the three month period of observations, the spatial distributions of the ENA jet flux occasionally changed orbit to orbit (MEX orbital period is about 6 hr). These observations indicate that there exist long-term variations of the subsolar ENA jet structure.