Outstanding problems with the Martian ionosphere - Prospect for collaborative observations by Nozomi and Mars Express

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Although observations relevant to the ionosphere of Mars have been made since 1960s, the structure and dynamics of the ionosphere of Mars have not been fully understood. Recently the Mars Global Surveyor has detected a fairly strong but localized magnetic field which is considered to be of crust origin. It was also found that the magnetic field of core origin is likely to be smaller than about 5 nT, implying that the solar wind interaction with Mars is similar to the solar wind interaction with Venus. However, the behavior of the Martian ionosphere has not been explained by the knowledge of the Venus ionosphere. The major questions at present are; (1) Why is the O2+ ion dominant even in the topside ionosphere of Mars unlike the ionosphere of Venus? (2) Why is a sharp ionopause structure uncommon in the Martian ionosphere? (3) What are effects of local magnetic fields of crustal origin on the ionosphere? (4) What kinds of physical processes control the ion and electron temperatures ? (5) What are effects of lower atmospheric processes on the ionosphere? (6) What controls the global dynamics of the Martian ionosphere? (7) Is there a significant nightside ionosphere at Mars? (8) What kind of role does the kinetic process play in the ionosphere?

Collaborative observations by NOZOMI and Mars Express are expected to give us significant amount of data of the upper atmosphere of Mars, which will answer at least some of the above questions. In this talk, outstanding problems and future prospect are discussed.