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Ground-based observations of Io's volcanism and atmospheric escape

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Io is the most volcanically active body in the solar system. Io's atmosphere consists of volcanic gas, and this volcanic gas continuously escapes from Io into Jupiter's inner magnetosphere. Jupiter's inner magnetosphere is therefore occupied [U+3000] by plasma which consists of heavy ions. However, Io's contribution to Jupiter's magnetospheric change has not been investigated well while we know Jupiter's inner magnetosphere is filled with Iogenic plasma. In this study, we tried to reveal this outstanding issue. Jupiter's sodium nebula, extending over several hundreds of Jovian radii, is a result of atmospheric escape of sodium atoms from Io through the Io plasma torus. We have been making ground-based observations of Jupiter's sodium nebula in the past decade. Its D-line brightness changed year by year. In addition, we found a few enhancements of the sodium nebula which lasted several days. In addition to the observation of the sodium nebula, we are making ground-based observations of Io's volcanic activity itself using a 1-m telescope at the University of Tokyo Atacama Observatory, Chile, in a wavelength range of middle infrared. Observations of the Io's volcanic activity in past studies have been made mainly in near infrared because thermal radiation of Io's volcanoes has its peak in that wavelength. However, the observations for Io's volcanic activity have two serious problems. One is that this type observation can be made only when Io is in Jupiter's shadow because solar radiation has a strong flux in near infrared. The other problem is that Io's rotational and orbital period are synchronized, so we can observe only Io's Jupiter-facing hemisphere. On the other hand, the solar flux is negligibly-small compared to the thermal emission of Io in mid infrared. We seem to be only a group that makes ground observations of Io's volcanic activity and atmospheric escape. However, several missions of spacecraft to Jupiter are now planned in the world. Our ground-based observations may be able to support these missions. In this presentation, we would like to obtain requests or opinions from the field of Jupiter's magnetosphere for the collaboration among future missions and our ground-based observations.