The Impact of Io’s Volcanism on the Jovian Extended Neutral Environment

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Jupiter's dynamic and volcanically-active moon Io resides in a complex and time-variable system of neutral and ionized particles, which are sourced by volcanic by-products from Io. Establishing the direct impact of Io’s volcanism on Jupiter’s neutral and plasma environments requires accurate simultaneous timelines of Io’s thermal activity, the neutral sodium brightness, and ion emissions. Such an opportunity has been present over the past few years, as the ISAS/JAXA SPRINT-A/EXCEED mission has been observing the EUV emission from ionized S and O in the Jovian system from Earth orbit in order to understand the physical processes and sources of variability. During this time, we have been tracking the thermal emission from ~60 volcanic hot spots on Io using high-cadence near-infrared imaging with adaptive optics on the Keck and Gemini N telescopes. Coverage of Io was particularly high in the spring of 2016, leading up to the *Juno* arrival. The simultaneous timeline of the neutral sodium cloud variability as observed from Haleakala Observatory allows us to correlate brightening events in the sodium cloud with volcanic eruptions on Io. Past studies shown a correlation between the neutral sodium brightness and volcanic events at Io’s massive lava lake Loki Patera. We detected three events at Loki Patera between 2013 and 2016, but no corresponding sodium brightenings were observed, in direct contrast with past results. However, the timing of several bright transient eruptions coincides with brightenings observed in the extended sodium cloud. These results suggest that Io’s volcanic controls on the sodium cloud variability are more complex than previously thought, and that the impact of an eruption on the sodium cloud may depend more on the style of the eruption than on the amount of thermal emission produced, even varying between eruptions for a single volcanic center. Continued observations, as well as correlation with plasma variability as observed by EXCEED, will provide insight into these complexities in the future.

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