EPSC Abstracts
Vol. 13, EPSC-DPS2019-873-2, 2019
EPSC-DPS Joint Meeting 2019

EPSC
EPSC-DPS Joint Meeting 2019
15–20 September 2019 | Geneva, Switzerland

Observations of Io's SO2 Atmosphere In and Out of Eclipse

Erin Redwing(1), Imke de Pater(1), Patricio Rojo(2), Statia Luszcz-Cook(3), Katherine de Kleer(4), and Arielle Moullet(5)
(1) University of California, Berkeley, USA, (eredwing@berkeley.edu) (2) Universidad de Chile, Santiago, Chile, (3) Columbia University, New York, USA, (4) California Institute of Technology, Pasadena, USA, (5) SOFIA Science Center, Moffett Field, USA

1. Introduction

As the most volcanically active body in our solar system, Jupiter's satellite Io provides an intriguing target for understanding the dynamic processes of volcanically-driven atmospheres. While volcanic activity is the root source of the SO_2 that makes up Io's tenuous atmosphere, it remains unclear whether volcanic outgassing or sublimation of Io's surface SO2 frost are the dominant source of its replenishment. Additionally, it is estimated that SO, created by photolysis of SO_2, makes up 10% of Io's atmosphere[1]. Past observations[2] show that Io's tenuous sulfurous atmosphere collapses when Io enters Jupiter's shadow, as reduced temperatures result in the rapid condensation of SO_2, but the morphology and dynamics of its re-establishment once Io has re-entered sunlight have not been observed until now.

2. Observations and Results

Observations were taken in Band 6 (211-275 GHz) of the Atacama Large Millimeter Array (ALMA) telescope on July 26, 2016. Over the course of an hour of observation, Io traveled from eclipse into sunlight, entering sunlight at around the twenty minute mark. Four SO2 and two SO emission lines were imaged using the Common Astronomy Software Applications (CASA) package.

We present maps of SO2 and SO location and abundance at 10-15 minute time intervals throughout Io's journey from eclipse into sunlight. These images show the re-establishment of Io's atmosphere as SO2 ice sublimates post-eclipse (Fig. 1). The observed morphology and dynamics of this process provide insight into the question of the dominant replenishing source of Io's atmosphere: volcanic outgassing or surface SO2 sublimation.

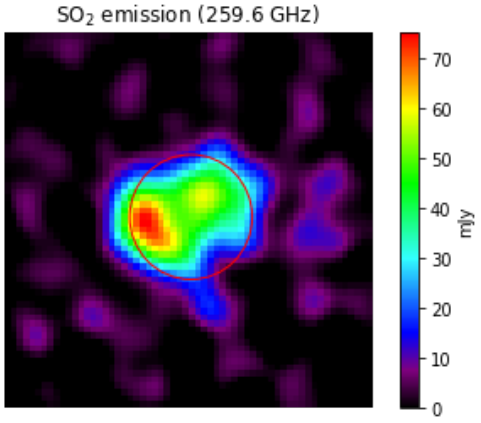

Figure 1: SO_2 emission at 259.6 GHz line after sulfurous atmosphere has been re-established.

Acknowledgements

This work was supported by the National Science Foundation grant AST-1313485 to UC Berkeley, the Chancellor's Graduate Student Fellowship at UC Berkeley. This project makes use of ALMA data #2015.1.00995.S. E. Redwing is supported by the Chancellor's Fellowship for Graduate Study at UC Berkeley.

References

[1] Lellouch, E., et al.: "Detection of sulfur monoxide in Io's atmosphere." The Astrophysical Journal Letters 459.2 (1996): L107.

[2] Tsang, C., et al.: "The collapse of Io's primary atmosphere in Jupiter eclipse." Journal of Geophysical Research: Planets 121.8 (2016): 1400-1410.