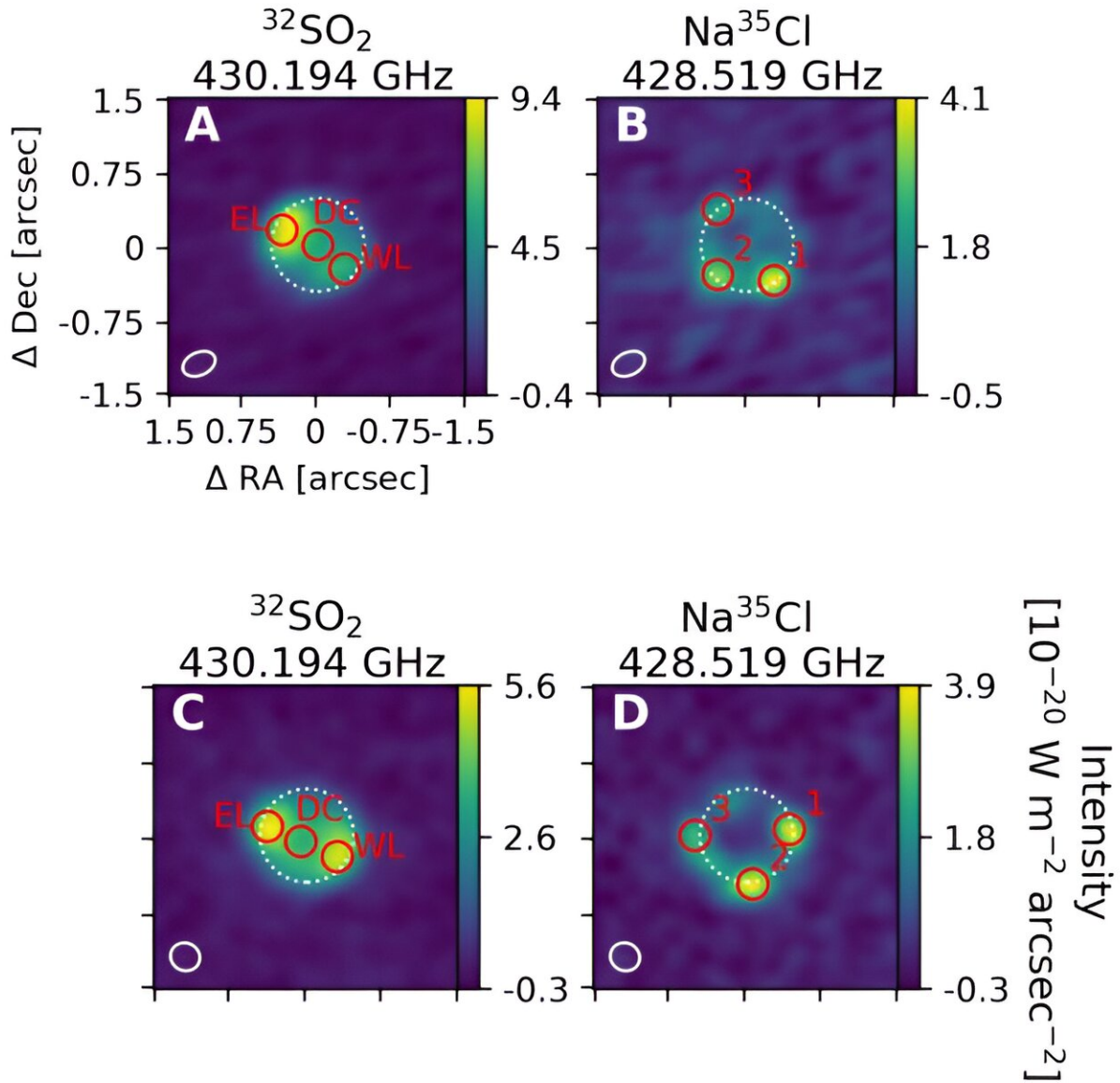


Study suggests Io's volcanoes have been active for 4.5 billion years

April 19 2024, by Bob Yirka



Locations used for local model fitting. Images of (A–B) the leading and (C–D) trailing hemisphere in example emission lines of (A,C) $^{32}\text{SO}_2$ and (B,D) Na^{35}Cl . Red circles indicate the apertures used for our tests. Credit: *Science* (2024). DOI: 10.1126/science.adj0625

A team of geologists and planetary scientists from the California Institute of Technology, the University of California Santa Cruz, New

York University, and NASA Goddard Space Flight Center reports evidence that Io's volcanic activity has been ongoing since the beginning of the solar system. In their study, [published](#) in the journal *Science*, the group studied sulfur isotopes in Io's atmosphere to determine how long the moon has been volcanically active.

Prior research has shown that the solar system is approximately 4.5 billion years old and that Jupiter's [moon](#), Io, is the most volcanically active body in the solar system. But until now, researchers did not know how long the moon has been active. To find out, the research team used data from ALMA to analyze the gases present in Io's atmosphere.

Io is volcanically active due to the gravitational effects of Jupiter and also the two moons Ganymede and Europa—together, they tug on Io, leading to a build-up of underground pressure, which escapes through [volcanic eruptions](#). The unending eruptions have led to a constant flow of lava onto the moon's surface, which results in continuous changes to its geography, making it difficult to learn more about its history.

The team focused on ALMA data about molecules with chlorine and stable isotopic ratios of sulfur. They found that both were more heavily represented in Io's atmosphere compared to the atmospheres of other planets and moons in the solar system. The team also found that between 94% and 96% of the sulfur isotopes that make it into the atmosphere due to volcanic eruptions are lost to space. The evidence indicates that the steady volcanism has been ongoing for as long as Io has existed, approximately 4.5 billion years.

The research team plans to continue to study Io to investigate whether the moon had an initial cooler period that ended due to the relentless volcanism. They will also be looking into whether the moon might have

had an ice crust or ocean.

More information: Katherine de Kleer et al, Isotopic evidence of long-lived volcanism on Io, *Science* (2024). [DOI: 10.1126/science.adj0625](https://doi.org/10.1126/science.adj0625)

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