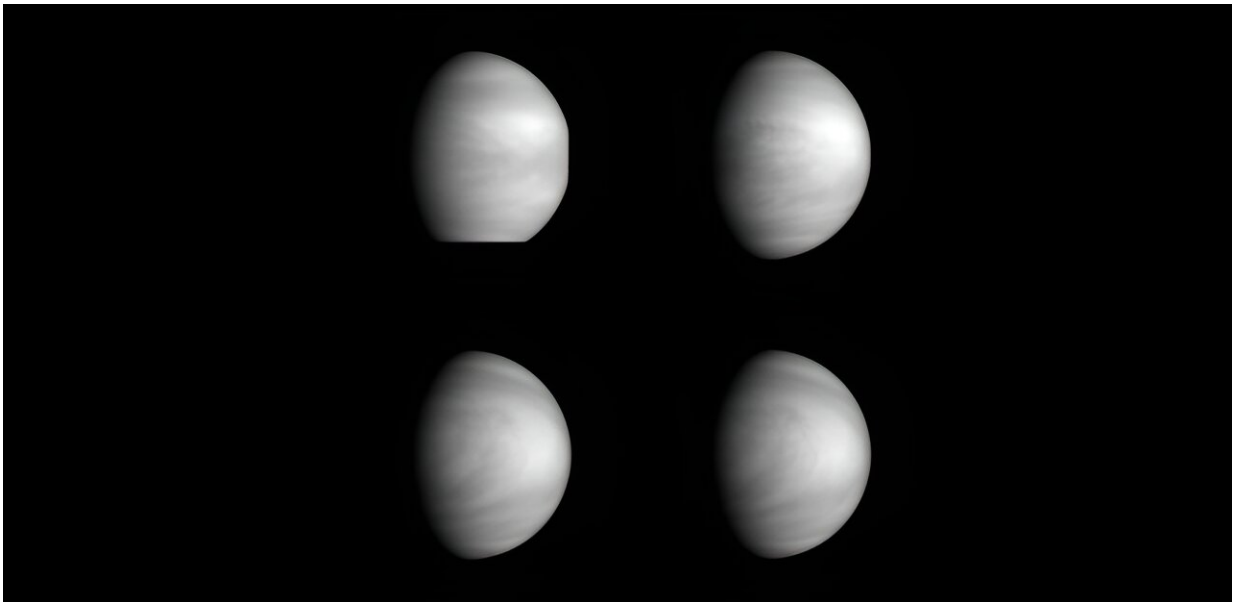


Mysterious missing component in the clouds of Venus revealed

January 5 2024, by Vanessa Bismuth



Multiple Views of Venus' High-level Clouds. Credit: [NASA/JPL](#). Credit: NASA/JPL

What are the clouds of Venus made of? Scientists know it's mainly made of sulfuric acid droplets, with some water, chlorine, and iron. Their concentrations vary with height in the thick and hostile Venusian atmosphere. But until now they have been unable to identify the missing component that would explain the clouds' patches and streaks, only visible in the UV range.

In a new [study](#) published in *Science Advances*, researchers from the University of Cambridge synthesized iron-bearing sulfate minerals that are stable under the harsh chemical conditions in the Venusian clouds. Spectroscopic analysis revealed that a combination of two minerals, rhomboclase and acid ferric sulfate, can explain the mysterious UV absorption feature on our neighboring planet.

"The only available data for the composition of the clouds were collected by probes and revealed strange properties of the clouds that so far we have been unable to fully explain," said Paul Rimmer from the Cavendish Laboratory and co-author of the study. "In particular, when examined under UV light, the Venusian clouds featured a specific UV absorption pattern. What elements, compounds, or minerals are responsible for such observation?"

Formulated on the basis of Venusian atmospheric chemistry, the team synthesized several iron-bearing sulfate minerals in an aqueous geochemistry laboratory in the Department of Earth Sciences.

By suspending the synthesized materials in varying concentrations of sulfuric acid and monitoring the chemical and mineralogical changes, the team narrowed down the candidate minerals to rhomboclase and acid ferric sulfate, of which the spectroscopic features were examined under light sources specifically designed to mimic the spectrum of solar flares (Paul Rimmer and Samantha Thompson's FlareLab at the Cavendish Laboratory).

A photochemistry lab at Harvard collaborated in the research by providing measurements of the UV absorbance patterns of ferric iron under extreme acidic conditions, in an attempt to mimic the even more extreme Venusian clouds. The scientists are part of the newly established Origins Federation, which promotes such collaborative projects.

"The patterns and level of absorption shown by the combination of these two [mineral](#) phases are consistent with the dark UV-patches observed in Venusian clouds," said co-author Clancy Zhijian Jiang, from the Department of Earth Sciences, Cambridge. "These targeted experiments revealed the intricate chemical network within the atmosphere, and shed light on the elemental cycling on the Venusian surface."

"Venus is our nearest neighbor, but it remains a mystery," said Rimmer. "We will have a chance to learn much more about this planet in the coming years with future NASA and ESA missions set to explore its atmosphere, clouds and surface. This study prepares the grounds for these future explorations."

More information: Clancy Zhijian Jiang et al, Iron-sulfur chemistry can explain the ultraviolet absorber in the clouds of Venus, *Science Advances* (2024). [DOI: 10.1126/sciadv.adg8826](https://doi.org/10.1126/sciadv.adg8826)

Provided by University of Cambridge

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