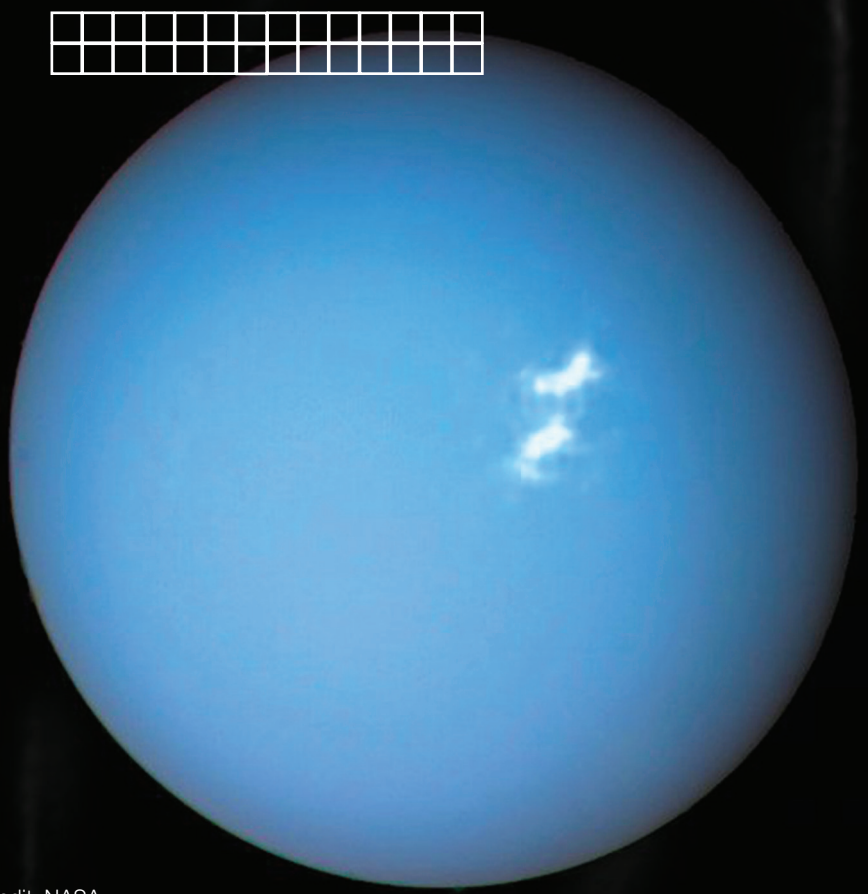
TOP 5 ELEMENTS IN THE ATMOSPHERE OF URANUS

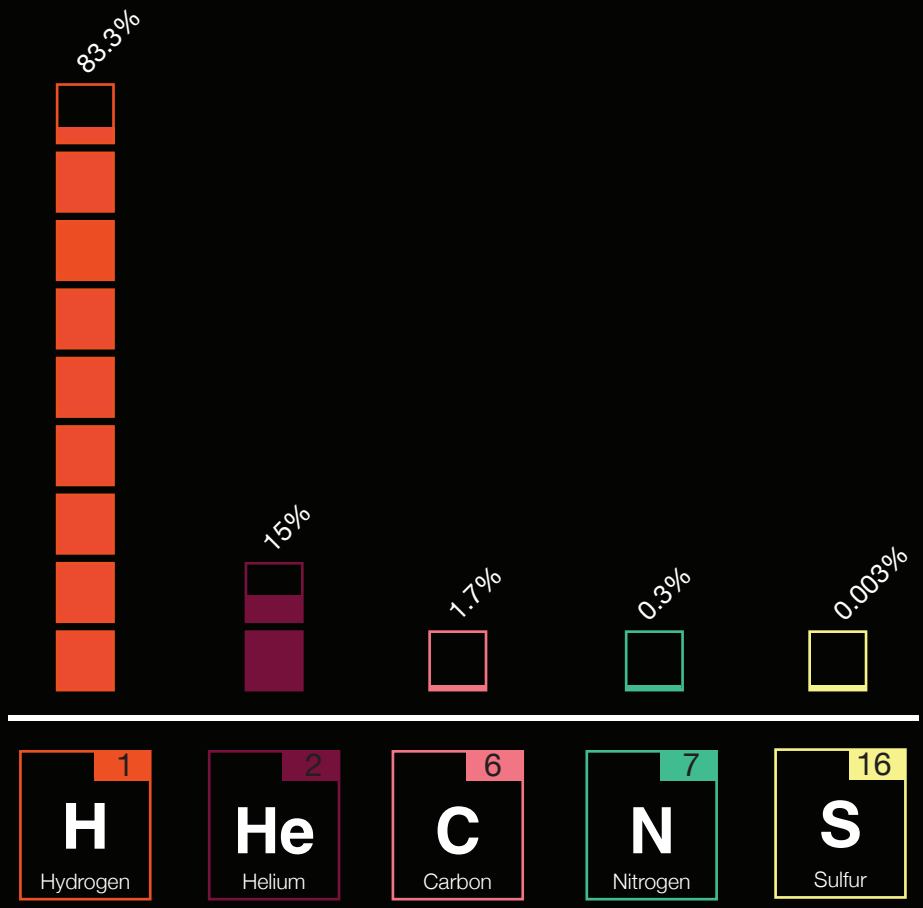
LUNAR AND PLANETARY INSTITUTE

2019 IYPT

International Year of the Periodic Table of Chemical Elements



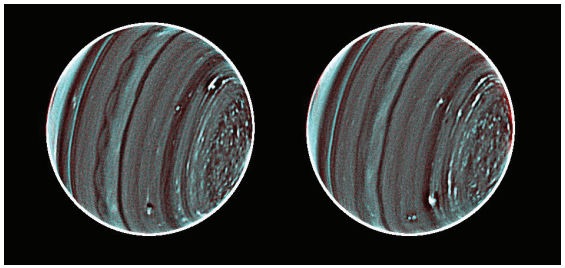
Credit: NASA



Source:
Irwin (2009). Giant planets of our solar system: Atmospheres, composition, and structure, Chichester, UK: Praxis Publishing Ltd.

URANUS

Uranus is an ice giant, meaning that its chemical makeup differs from Jupiter and Saturn, with strong enrichment in elements like carbon, nitrogen, sulfur, and oxygen, mixed with an atmosphere of hydrogen and helium. These elements were likely mixed into Uranus as it was forming billions of years ago, while being bombarded by the ice-rich building blocks in the outer solar system. All of these key elements are found as molecules in a reduced form (i.e., combined with hydrogen) to form methane, ammonia, hydrogen sulfide, and water. To make matters even more complex, the atmosphere of Uranus is so cold that these gases condense to form clouds. The topmost clouds, seen in rare uranian storms and atmospheric outbursts, comprise methane ice crystals. Beneath the methane ice clouds, we find a main cloud deck of hydrogen sulfide ice. We can see the impacts of the hydrogen sulfide in our astronomical data, but if you had the misfortune to fly through the uranian clouds, you'd be quickly overwhelmed by a pungent "rotten egg" smell. Deeper into the interior, we'd expect to find water clouds — but these are so deep down that no spacecraft or groundbased telescope have ever been capable of detecting them. The water might be in the form of an exotic hot and black ice, which might be the most common form of water in our solar system. Its properties remain very mysterious, and future missions to the ice giants are needed to explore this exotic mixture of chemical elements.



Two views of Uranus in the infrared as observed by the Keck telescopes in 2012 showing clouds of methane ices above a main cloud deck of hydrogen-sulfide ice. Uranus exhibits a banded structure, just like the other giant planets of our solar system. Credit: NASA/ESA/L. A. Sromovsky/P. M. Fry/H. B. Hammel/I. de Pater/K. A. Rages.

United Nations Educational, Scientific and Cultural Organization

2019 IYPT International Year of the Periodic Table of Chemical Elements

The year 2019 marks the 150th anniversary of Dmitri Mendeleev's development of the Periodic System and has been proclaimed the "International Year of the Periodic Table of Chemical Elements" (IYPT2019).

www.iypt2019.org

DR. LEIGH FLETCHER

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Dr. Leigh Fletcher is a planetary scientist specializing in the exploration of our solar system's giant planets via robotic missions and groundbased astronomy. He is a Royal Society University Research Fellow (URF) and Associate Professor in Planetary Sciences at the University of Leicester. He earned a Natural Science degree from Cambridge and a Ph.D. in Planetary Physics from Oxford, and has since worked as a NASA fellow at the Jet Propulsion Laboratory and as a Research Fellow at Oxford. His research uses spectroscopy of planetary atmospheres from the ultraviolet to the infrared and microwave, using the unique signatures of atmospheric gases and clouds to determine the global patterns of temperature and composition and how their climates vary with time. This research can reveal the atmospheric dynamics, chemistry, and origins of these diverse giant planets. Fletcher received the 2016 Harold C. Urey prize from the Division for Planetary Sciences of the American Astronomical Society for outstanding achievements in planetary science by an early career scientist. He is a Co-Investigator on the Cassini mission to Saturn and the JUpiter ICy moons Explorer (JUICE) mission to Jupiter, and is a passionate advocate for future exploration of the distant ice giants. He currently leads a planetary atmospheres team at the University of Leicester, funded by the Royal Society, the Science and Technology Facilities Council (STFC), and the European Research Council. You can follow his research on Twitter (@LeighFletcher).

LPI

Founded at the height of the Apollo program in 1968, the Lunar and Planetary Institute (LPI) is an intellectual leader in lunar and planetary science. LPI's mission is to advance understanding of the solar system by providing exceptional science, service, and inspiration to the world. The research carried out at LPI supports NASA's efforts to explore the solar system.

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