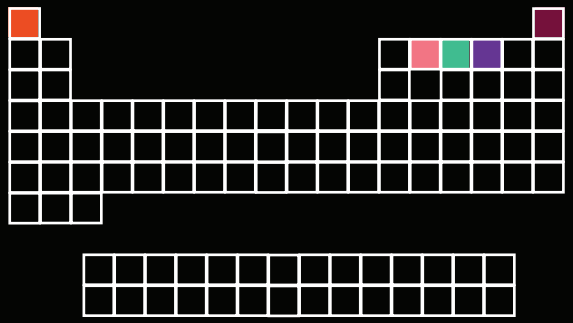
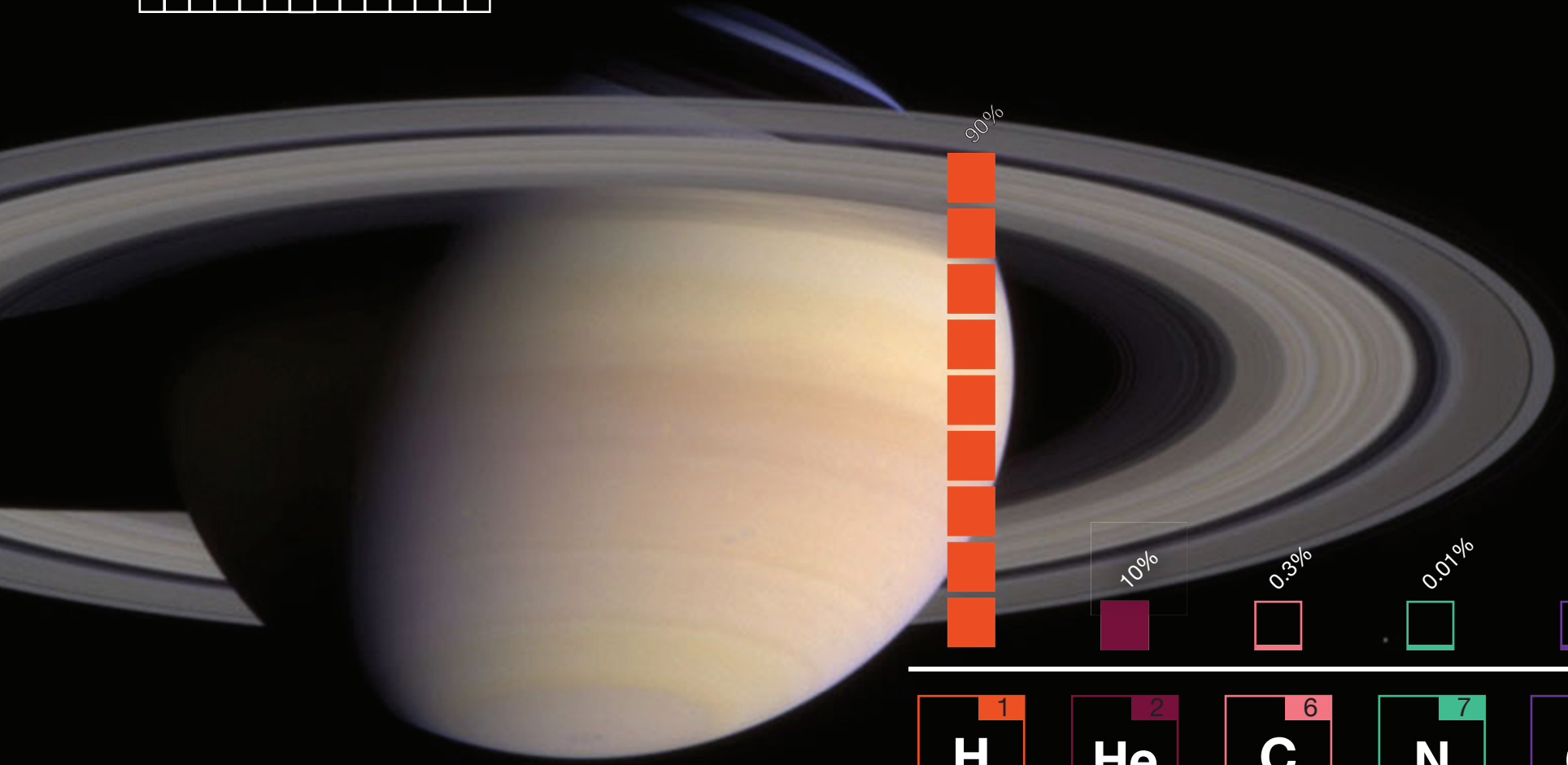


TOP 5 ELEMENTS IN THE ATMOSPHERE OF SATURN

LUNAR AND PLANETARY INSTITUTE

2019 IYPT

International Year of the Periodic Table of Chemical Elements

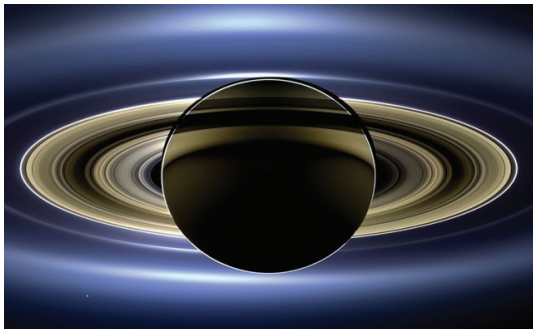


Credit: NASA

Sources:
Atreya et al. (2018). Saturn in the 21st century, Cambridge: Cambridge University Press.
Cavalié et al. (2017). Icarus, Vol. 291.

SATURN

Saturn is the second largest planet in the solar system, after Jupiter, and is the only planet that is less dense than water. It is a gas giant, in the sense that most of its mass is made of gas. Its observable atmosphere comprises about 90% hydrogen and 10% helium. Other elements like carbon and nitrogen are present in traces (about 0.3% and 0.01%, respectively). One of the great mysteries, however, resides in the deep composition of the planet, which remains largely unknown. It is likely that Saturn's interior contains lots of water, and thus oxygen, possibly at the same proportion as helium. An atmospheric probe plunging deep in the planet could unveil the bulk composition of Saturn and enable scientists to better understand its formation. Saturn has been visited by four spacecraft so far — Pioneer 11, Voyagers 1 and 2, and Cassini — but none of them probed the deep layers of the planet. Among other incredible discoveries, Cassini found that Enceladus, one of Saturn's small icy moons, vents out water from plumes into the Saturn system, forming the diffuse E ring. Some of this water eventually rains onto the planet, as recently demonstrated with Herschel Space Observatory measurements. During its final orbits just above the uppermost layers of Saturn's atmosphere, Cassini detected that the ring system is a source of methane, ammonia, water, and organics for Saturn. The atmosphere of Saturn is thus a complex system in which its primordial composition is contaminated by external influences, which render this planet chemically unique in the solar system.



This image was taken by the Cassini spacecraft during a solar eclipse by Saturn. The eclipse geometry hides Saturn and highlights the ring system, including the diffuse E and F rings (in bluish color). This image shows the complexity of the Saturn system. Credit: NASA/JPL-Caltech/SSI.

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.THIBAULT CAVALIÉ

French National Center for Research (CNRS)

Dr. Thibault Cavalié is a planetary scientist for the French National Center for Research (CNRS) at Laboratoire d'Astrophysique de Bordeaux in Pessac, France. He is also affiliated with the Laboratoire d'Etudes Spatiales et d'Instrumentation en Astrophysique (LESIA) of the Paris Observatory. Thibault's research interests lie in the formation and evolution of solar system giant planets. He has expertise in submillimeter observations with groundbased radio telescope arrays (ALMA) and spacebased observatories (Herschel), as well as in radiative transfer, photochemical modeling, and thermochemical modeling. With observations and modeling, Thibault seeks to unveil the deep composition of the giant planets, which is key to how they formed within the protoplanetary disk. He also contributes to proposals for missions to the ice giants Uranus and Neptune. With observatories like Herschel and ALMA, he tries to better capture how the atmospheric chemistry of giant planets is influenced by their local or more distant environment, such as their icy rings and satellite systems. Jupiter, which was impacted by a comet in 1994, and Saturn, with its phenomenal rings and tiny moon Enceladus that vents water in the whole system, are his favorite playgrounds when it comes to using the complementarity of mapping and long-term monitoring observations and photochemical modeling. Thibault is also keen on supervising young promising students. He gives several public conferences every year and is involved in a number of outreach programs, regularly visiting elementary schools and high schools to encourage young people to embrace science.

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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