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PRESS RELEASE

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Jupiter's atmosphere still contains water supplied by the Shoemaker-Levy 9 impact

Based on the article "Spatial distribution of water in the stratosphere of Jupiter from Herschel HIFI and PACS observations", by Cavalié et al.

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***Astronomy & Astrophysics* is publishing *Herschel* observations of water in Jupiter's stratosphere. It is a clear remnant of the Shoemaker-Levy 9 impact on Jupiter nearly twenty years ago.**

In July 1994, the comet Shoemaker-Levy 9 (SL9) hit Jupiter and left visible scars on the Jovian disk for weeks. This spectacular event was the first direct observation of an extraterrestrial collision in the solar system, and it was followed worldwide by professional and amateur astronomers.

SL9 was discovered orbiting Jupiter by astronomers David Levy and Carolyn and Eugene M. Shoemaker on March 24, 1993. It was the first comet observed orbiting a planet rather than the Sun. SL9 was found to be composed of 21 fragments. Soon after that, orbital studies showed that the comet had passed within Jupiter's Roche limit in July 1992. Inside this limit, the planet's tidal forces are strong enough to disintegrate a body held together by its own gravity, thus explaining SL9's fragmentation. Even more interestingly, the studies showed that SL9's orbit would pass within Jupiter in July 1994 and that the comet would then collide with the planet, with impacts in the southern hemisphere near 44°S latitude.

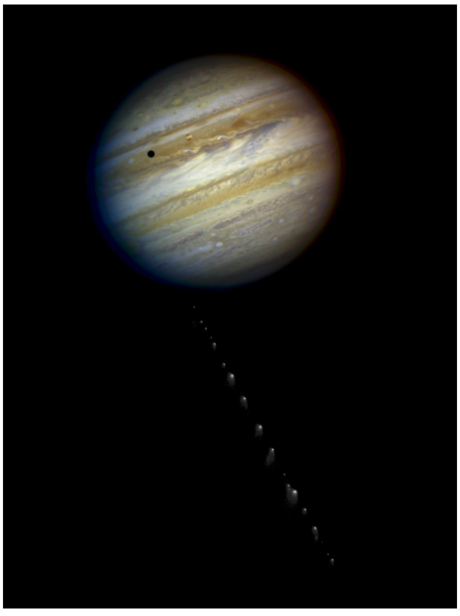

Fig. 1. Hubble composite image of Jupiter and comet SL9.

Credit: NASA, ESA, H. Weaver and E. Smith (STScI) and J. Trauger and R. Evans (Jet Propulsion Laboratory).

The SL9 impact and its subsequent scars on Jupiter were observed for weeks, but its chemical impact on Jupiter's atmosphere lasted even longer. Emission from water vapor was observed during the fireball phase of the SL9 impacts, but from that observation, it was difficult to assess how this would modify Jupiter's composition on the long term. In 1997, the ESA Infrared Space Observatory (ISO) detected water vapor in the stratosphere of Jupiter. At that time, astronomers suspected that it might be a consequence of the SL9 impact because comets are known to be water-rich bodies. However, there were other possible sources of water: interplanetary dust particles produced by cometary activity and asteroid collisions, icy rings, or one of the 60 Jovian satellites.

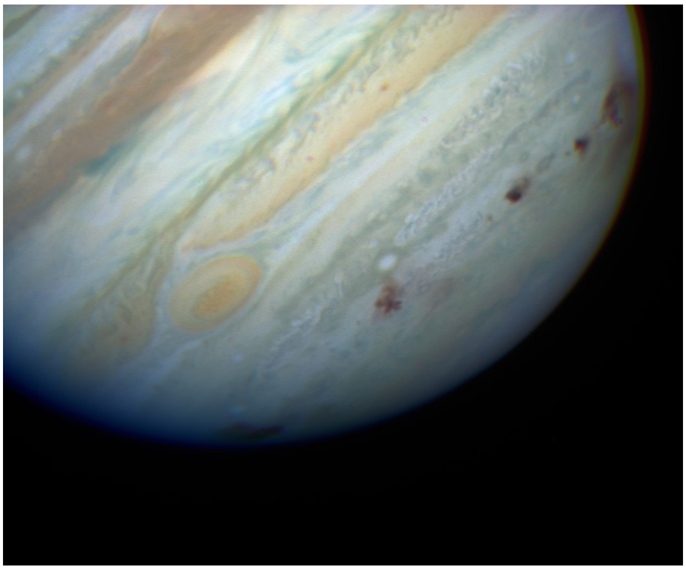

Fig.2. Hubble view of the impact sites, a few days after the impacts.

Credit: Hubble Space Telescope Comet Team and NASA.

Nearly twenty years after this major impact, astronomers are still observing its consequences on Jupiter. T. Cavalié and his colleagues [1] observed Jupiter with the ESA *Herschel* Space Observatory, which is sensitive enough to map the abundance of water vs. latitude and altitude in the Jovian stratosphere. These observations, which have now been published in *Astronomy & Astrophysics*, show a clear north-south asymmetry in the distribution of water, with more water in the south. They indicate that 95% of the water currently observed on Jupiter comes from the comet.

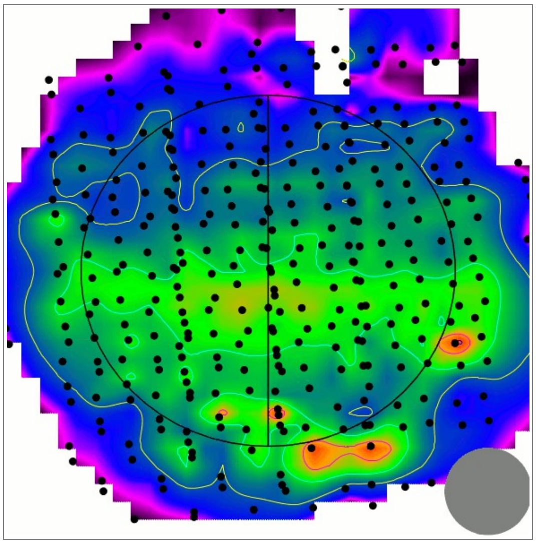

Fig. 3: Abundance of water in Jupiter's stratosphere. The north-south asymmetry is clearly observed. The green and red areas correspond to the highest abundances.

[1] The team includes T. Cavalié, H. Feuchtgruber, E. Lellouch, M. de Val-Borro, C. Jarchow, R. Moreno, P. Hartogh, G. Orton, T. Greathouse, F. Billebaud, M. Dobrijevic, L. Lara, A. Gonzalez, and H. Sagawa.

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