Organic 'building blocks' discovered in Titan's atmosphere

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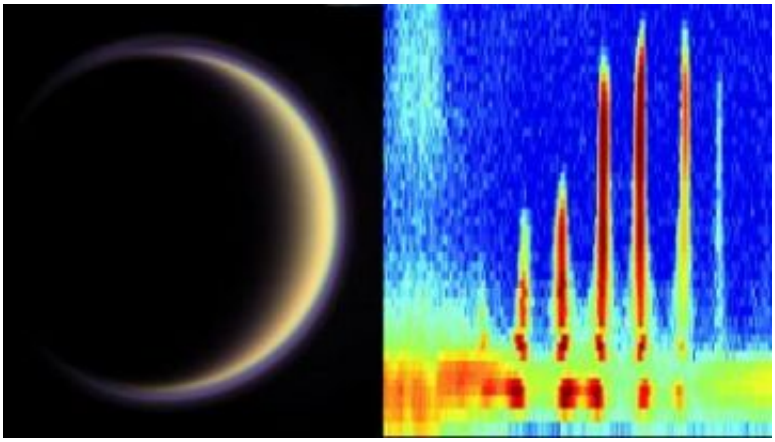

Saturn's moon Titan is the second largest in the solar system -- and the only one with a dense atmosphere. The atmosphere, nitrogen and methane, resembles that of the early Earth. NASA's Cassini spacecraft peered through the atmosphere, imaged the haze layers -- and ESA's Huygens probe landed on the surface. UCL-built equipment on the orbiter detects an unexpected component in Titan's high atmosphere -- extremely heavy hydrocarbon-based negative ions. Their mass is at least 10,000 times that of a hydrogen atom, detected at 953 km above the surface; about the distance from London to Milan. The image shows Titan's haze and the heavy ions. These are part of the haze in the atmosphere, and may fall towards Titan's surface as organic gunk. They are Carl Sagan's tholins; a brown residue appearing in the Miller-Urey experiment, where a spark excites a mixture of gases resembling that of Earth's early atmosphere. The right hand side of the image shows the negative ion signature at 4 different encounters, including T16 where we see the 10,000 amu ions. The vertical stripes show the ions seen as the instrument is scanned through Cassini's direction of travel and increasing numbers of ions are seen as they ram into our sensor. Credit: Titan image courtesy NASA/JPL/Space Science Institute

Scientists analysing data gathered by the Cassini spacecraft have confirmed the presence of heavy negative ions in the upper regions of Titan's atmosphere. These particles may act as organic building blocks for even more complicated molecules and their discovery was completely unexpected because of the chemical composition of the atmosphere (which lacks oxygen and mainly consists of nitrogen and methane).

The observation has now been verified on 16 different encounters and findings will be published in *Geophysical Research Letters* on November 28.

Professor Andrew Coates, researcher at UCL's Mullard Space Science Laboratory and lead author of the paper, says: "Cassini's electron spectrometer has enabled us to detect negative ions which have 10,000 times the mass of hydrogen. Additional rings of carbon can build up on these ions, forming molecules called polycyclic aromatic hydrocarbons, which may act as a basis for the earliest forms of life.

"Their existence poses questions about the processes involved in atmospheric chemistry and aerosol formation and we now think it most likely that these negative ions form in the upper atmosphere before moving closer to the surface, where they probably form the mist which shrouds the planet and which has hidden its secrets from us in the past. It was this mist which stopped the Voyager mission from examining Titan more closely in 1980 and was one of the reasons that Cassini was launched."

The new paper builds on work published in *Science* (May 11) where the team found smaller tholins, up to 8,000 times the mass of hydrogen, forming away from the surface of Titan.

Dr Hunter Waite of the South West Research Institute in Texas and author of the earlier study, said: “Tholins are very large, complex, organic molecules thought to include chemical precursors to life. Understanding how they form could provide valuable insight into the origin of life in the solar system."

Source: University College London