# Pluto has carbon monoxide in its atmosphere

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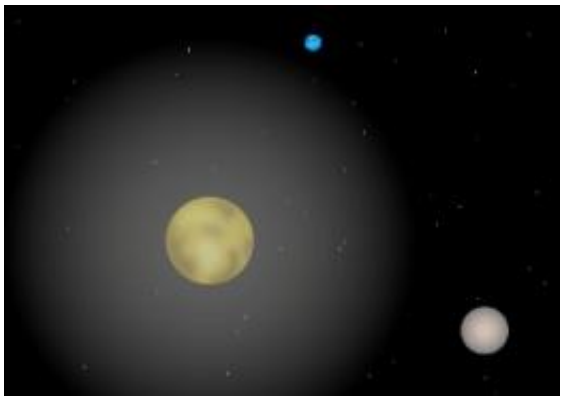

Artist's impression of Pluto's huge atmosphere of carbon monoxide. The source of this gas is erratic evaporation from the mottled icy surface of the dwarf planet. The Sun appears at the top, as seen in the ultra-violet radiation that is thought to force some of the dramatic atmospheric changes. Pluto's largest moon, Charon, is seen to the lower right. Credit: P.A.S. Cruickshank

A British-based team of astronomers has discovered carbon monoxide gas in the atmosphere of Pluto, after a worldwide search lasting for nearly two decades. Team leader Dr Jane Greaves of the University of St Andrews will present the new discovery in her talk on Wednesday 20 April at the National Astronomy Meeting in Venue Cymru, Llandudno, Wales.

Pluto was discovered in 1930 and then considered as the Sun's smallest and most distant planet. Since 2006 it has been regarded by astronomers as a 'dwarf planet', one of a handful of such bodies with sizes of hundreds of kilometres that orbit in the distant reaches of the Solar System, out beyond Neptune. Pluto is the only dwarf planet known to have an atmosphere, found in 1988 when it dimmed the light of a distant star before Pluto passed in front of it.

The new results, obtained at the 15-metre James Clerk Maxwell Telescope in Hawaii, show a strong signal of carbon monoxide gas. Previously the atmosphere was known to be over a hundred kilometres thick, but the new data raise this height to more than 3000 kilometres - a quarter of the way out to Pluto's largest moon, Charon. The gas is extremely cold, about -220 degrees Centigrade. A big surprise for the team was that the signal is more than twice as strong as an upper limit obtained by another group, who used the IRAM 30-metre telescope in Spain in 2000.

"It was thrilling to see the signal gradually emerge as we added in many nights of data", said Dr Jane Greaves, the team leader from the University of St Andrews, "The change in brightness over the last decade is startling. We think the atmosphere may have grown in size, or the carbon monoxide abundance may have been boosted." Such changes have been seen before but only in the lower atmosphere, where methane - the only other gas ever positively identified - has also been seen to vary.

In 1989 Pluto made its closest approach to the Sun, a comparatively recent event given that it takes 248 years to complete each orbit. The gases probably result from solar heating of surface ice, which evaporates as a consequence of the slightly higher temperatures during this period. The resulting atmosphere is probably the most fragile in the Solar System, with the top layers blowing away into space.

"The height to which we see the carbon monoxide agrees well with models of how the solar wind strips Pluto's atmosphere" commented team member Dr Christiane Helling, also of the University of St Andrews.

Unlike the greenhouse gas carbon dioxide, carbon monoxide acts as a coolant, while methane absorbs sunlight and so produces heating. The balance between the two gases, which are just

trace elements in what is thought to be a nitrogen-dominated atmosphere, is critical for its fate during the many-decades long seasons. The newly discovered carbon monoxide may hold the key to slowing loss of the atmosphere - but if the chilling effect is too great, it could result in nitrogen snowfalls and all the gases freezing out onto the ground. "Seeing such an example of extra-terrestrial climate-change is fascinating", says Dr Greaves. "This cold simple atmosphere that is strongly driven by the heat from the Sun could give us important clues to how some of the basic physics works, and act as a contrasting test-bed to help us better understand the Earth's atmosphere."

The data were obtained with the JCMT's 'receiver A', an instrument that has been in regular operation since the 1990s. Dr Per Friberg, who designed new observing modes and data analysis procedures for the team, commented "This shows how we can make the best use of telescopes and keep making unexpected discoveries." The JCMT is operated jointly by the UK, Canada and the Netherlands and is approaching its twenty-fifth anniversary. The team have another Pluto observing run scheduled at the JCMT for the end of April, and in the long-term, they hope to continue tracking the changes in the atmosphere at least up to the fly-by of NASA's New Horizons space probe in 2015.

Provided by University of St Andrews