

Chemical and isotopic properties of interstellar comet 3I/ATLAS

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Comets are fingerprints of the formation of the Solar System. The passage of a bright comet-like interstellar object in the solar neighborhood has long been awaited to investigate the physical, chemical and isotopic properties of icy planetesimals in other planetary systems.

The interstellar comet 3I/ATLAS was discovered on a highly hyperbolic orbit ($e = 6.1$) on July 1, 2025, as it was at 5 au from the Sun. Subsequent studies have revealed a rapid increase of its gaseous activity as it approached the Sun, making detailed investigations possible. It passed its perihelion on 29 October 2025 at 1.36 au from the Sun. Comet 3I/ATLAS was observed worldwide from numerous observatories, including both ground-based facilities and space-based instruments and space missions.

In this talk, I will present the main observational results, with particular emphasis on spectroscopic results obtained in the infrared and millimeter wavelength ranges with the JWST, ALMA, and IRAM-30m telescopes, and with MAJIS/Juice. The nucleus ices of 3I/ATLAS exhibit compositional and isotopic properties that differ from those of Solar System comets, suggesting that its natal planetary system formed in a different galactic environment from our own.