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Complex nitriles at the surface of TNOs revealed by DiSCo-JWST

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CN-bearing constituents in refractory organic residues have been reported across various regions of the Solar System, from the moons of the giant planets to the dark refractory material observed on some comets and in rare ultracarbonaceous micrometeorites recovered on Earth. These compounds form and evolve through thermal, photochemical, and irradiation-driven chemical pathways. Consequently, CN-bearing organics can unveil important information about the current and past physical conditions of the Solar System. Our work investigates a tentative detection of the CN functional group on trans-Neptunian objects (TNOs) observed as part of the DiSCo-TNOs program (#2418; P.I.: N. Pinilla-Alonso), mapping its distribution across the dataset and uncovering its molecular origin. We find the objects that formed in the outermost region of the protoplanetary disk exhibit the highest contribution of the CN feature, an indication the nitrogen distribution on TNOs may be tied to a primordial origin. Further, we show that the CN functional group likely belongs to an organic N-rich macromolecular structure. Our work has important implications for understanding the interconnection between small bodies in the Solar System and the chemical and physical conditions from which they evolved.

Astrophysics Field

Astrochemistry, tran-Neptunian objects, JWST

Author: CRYAN, Sasha (Institut d'Astrophysique Spatiale)

Co-auteurs: Dr GUILBERT-LEPOUTRE, Aurelie (Laboratoire de Géologie de Lyon: Terre, Planètes, Environnement); HÉNAULT, Elsa (IAS); Dr NOEMI, Pinilla-Alonso (Institute of Space Science and Technology of Asturias); BRUNETTO, Rosario (IAS)

Orateur: CRYAN, Sasha (Institut d'Astrophysique Spatiale)

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