UNIDAD DE CULTURA CIENTÍFICA

PRESS RELEASE

Sugar in interstellar space

A recent study led by the Centro de Astrobiología (CAB, CSIC-INTA) reports the first detection of a sugar in the interstellar medium. The sugar, ***erythrulose****, is a four-carbon sugar ($C_4H_8O_4$, or $HOCH_2CH(OH)COCH_2OH$). The detection of erythrulose demonstrates that molecules relevant to the origin of life can form in interstellar space, expanding the inventory of organic material that may have been available for the synthesis of the first nucleic acids on the early Earth.*

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Sugars are key biomolecules in living organisms, as they form the backbone of DNA and RNA and play a fundamental role in metabolic processes. In theories of the origin of life, sugars are also essential for the synthesis of the first nucleic acids. Despite their importance, one of the major questions in origin-of-life research is how the first sugars formed on Earth, since laboratory experiments show that they do not form in enough quantities under prebiotic conditions. Sugars such as ribose and glucose have previously been detected in meteorite and asteroid samples, suggesting that some of these molecules may have originated in the primordial molecular cloud from which our Solar System formed. However, until now, no sugar had ever been directly detected in the interstellar medium.

An international team led by CAB researcher Izaskun Jiménez-Serra has now identified the first sugar in interstellar space: erythrulose. This molecule is the only possible four-carbon ketose, and on Earth it is commonly found in raspberries and sunless tanning products. Erythrulose was detected toward the molecular cloud G+0.693−0.027, located near the centre of our Galaxy, the Milky Way. The discovery was made possible by ultra-sensitive, broadband spectroscopic surveys carried out with the 40-m Yebes radio telescope and the 30-m telescope of the Institute for Radio Astronomy in the Millimeter Range (IRAM).

The team identified 12 spectral lines matching the laboratory spectrum of erythrulose measured at the University of the Basque Country. The study also shows that this sugar is at least eight times more abundant than similar three-carbon sugars, none of which were detected in the same region. “This finding was unexpected, as the prevailing view in astrochemistry is that interstellar molecules grow in size through the sequential addition of carbon atoms”, says Izaskun Jimenez Serra (CAB), leading author of this work.

Working in collaboration with chemists from the University of Extremadura and Radboud University (the Netherlands), the CAB team discovered that erythrulose can form within interstellar ices from simpler two-carbon alcohols and aldehydes.

Based on the abundance of erythrulose measured in the G+0.693−0.027 molecular cloud, the researchers estimate that between 0.5 and 50 million tonnes of this sugar could have reached Earth's surface during the Late Heavy Bombardment, which occurred approximately 4.1 to 3.8 billion years ago. The presence of erythrulose in

interstellar space therefore provides an alternative source of sugars that may have contributed to the emergence of the first metabolic and replication processes on the early Earth.

"The detection of erythrulose is very exciting because it opens up the possibility of discovering in space other sugars such as ribose, which is part of RNA, and other important molecules for the origin of life," says Carlos Briones, co-author of the study.

More information

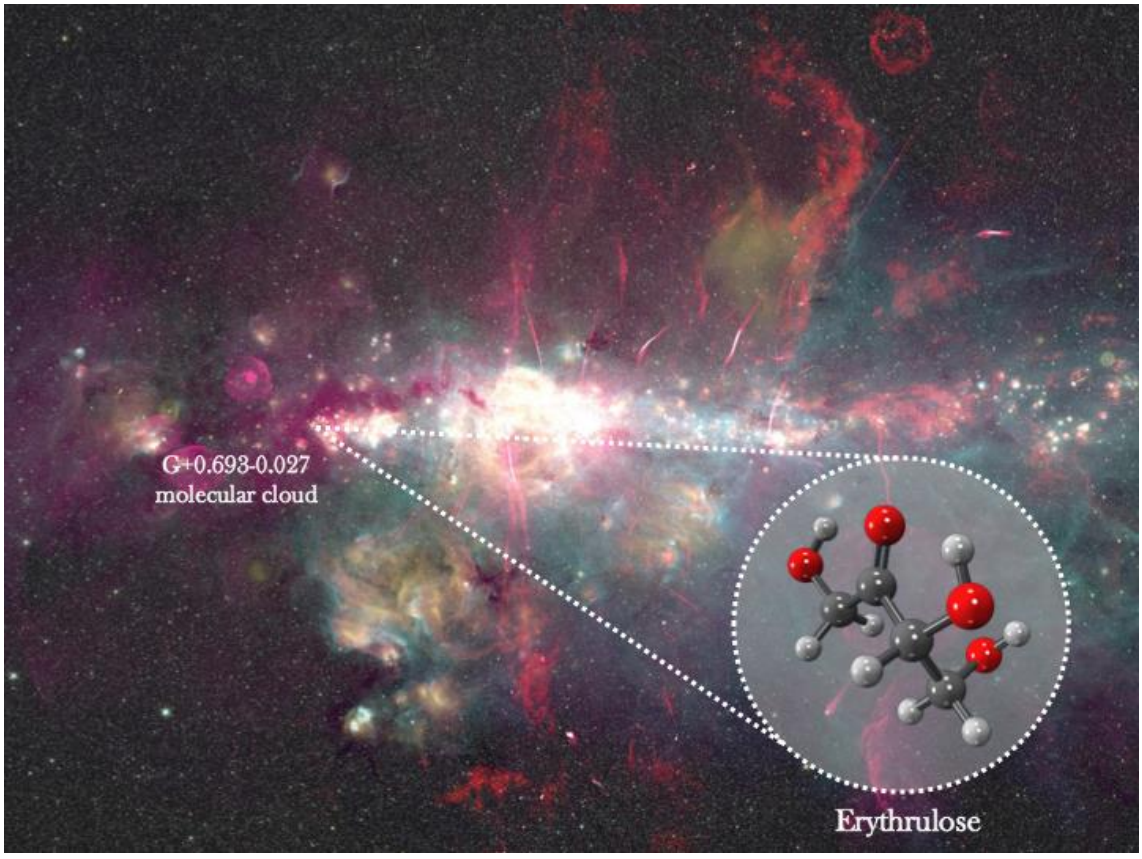

Figure. Composite image from the Galactic Center. Green and yellow: 8 μm and 24 μm emission observed with Spitzer (Churchwell et al. 2009; Carey et al. 2009). Red: 20 cm emission imaged with MeerKAT (Heywood et al. 2019, 2022) and the Green Bank Telescope (GBT; Law et al. 2008). Image adapted from Henshaw et al. (2023; doi: 10.48550/arXiv.2203.11223) and Longmore et al. (2026; 10.48550/arXiv.2602.20340). Credits: Ashley Barnes/Izaskun Jiménez-Serra/Juan García de la Concepción

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About CAB

The Centro de Astrobiología (CAB) is a joint research center of INTA and CSIC. Created in 1999, it was the first center in the world dedicated specifically to astrobiological research and the first non-US center associated with the NASA Astrobiology Institute (NAI), currently the NASA Astrobiology Program. It is a multidisciplinary center whose main objective is to study the origin, presence, and influence of life in the universe through a transdisciplinary approach. In 2017, the CAB was awarded by the Ministry of Science and Innovation as a "María de Maeztu" Unit of Excellence.

The CAB has led the development of the REMS, TWINS y MEDA instruments, operational on Mars since August 2012, November 2018, and February 2021, respectively; as well as the science of the RLS and RAX Raman instruments, which will be sent to Mars at the end of this decade as part of the ExoMars mission and to one of its moons in the MMX mission, respectively. In addition, it is developing the SOLID instrument for the search for life in planetary exploration. The CAB also co-leads, together with three other European institutions, the development of the PLATO space telescope, and participates in various missions and instruments of great astrobiological relevance, such as MMX, CARMENES, CHEOPS, BepiColombo, DART, Hera, the MIRI and NIRSpec in JWST, and the HARMONI in ESO's ELT (Extremely Large Telescope).

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