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INVERTIGATING THE ORIGIN AND TRANSPORT OF WATER IN THE UNIVERSE USING SUBMILLIMETER AND MILLIMETER SPECTRAL LINES

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The formation of water in the Universe attracts significant scientific interest, as this molecule is fundamental to all known life. Water emissions are observed throughout the Universe: from our Solar System to distant high-redshift galaxies. Previous space-based infrared telescopes performed extensive observations of water emission lines, enabling researchers to identify the primary formation pathways for both water and its isotopes. Thanks to the high spatial (hundreds to thousands of AU) and spectral (resolutions up to $\sim 10^7$) resolution of these observations, we have been able to pinpoint specific regions where water forms in galactic star-forming environments and constrain the physical conditions governing this process. Results obtained from studying nearby objects are now being extrapolated to distant high-redshift galaxies.

With ground-based telescopes we can only study emission lines from less abundant isotopes of water including deuterated species. In this conference contribution, we will present the current paradigm of water's life cycle in the Universe and share our findings on the abundance of deuterated water in star-forming regions.