The Asymmetry of Life

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What is responsible for the emergence of life’s homochiral biopolymers – DNA/RNA and proteins – where all the constituent monomers exhibit the same handedness? Based on in-situ observations and laboratory studies, we propose that this handedness occurs when chiral biomolecules are synthesized asymmetrically through interaction with circularly polarized light (cpl) in interstellar space.\[1\] Previous experimental results on the asymmetric photolysis of amino acids,\[2\] as well as the absolute asymmetric synthesis from achiral interstellar ice precursor molecules,\[3\] revealed polarization- and energy-controlled induced enantiomeric enrichments. The recent detection of sugar molecules in interstellar analogue ices\[4\] (Fig. 1) suggests that the molecular building blocks of the genetic material are abundant in interstellar environments and potentially present in comets and small bodies, such as asteroids and interstellar dust particles. I will therefore highlight a few significant results on our ongoing cometary ice simulation experiments, the chiroptical properties of targeted sugar molecules in the UV using circularly polarized synchrotron light and present future strategies towards furthering understanding the origin of asymmetric prebiotic molecules.

\textbf{Figure 1} Ribose forms in the icy mantles of interstellar dust grains from simple precursor molecules (water, methanol, and ammonia) under high energy radiation.

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\section*{REFERENCES}