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On the origins of life's homochirality: study of the potential enantiomeric excess of sugars and amino acids in astrophysical samples

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The search for evidence of life beyond our planet relies on our understanding of terrestrial biology and the processes and conditions that allowed its origin on Earth. Homochirality, the almost exclusive presence of D-sugars and L-amino acids in functional biopolymers – DNA/RNA and proteins – is a key feature of all living organisms whose origin remains a mystery. Due to its central role in biology, strong evidence supports the hypothesis that the emergence of life on Earth, and potentially on other planets, is intrinsically linked to symmetry breaking events that led to enantiomeric excesses (*ee*s) of L-amino acids and D-sugars that became thus available for the evolution of primitive metabolic pathways [1,2]. Given that a major source of these enantiomer-enriched molecules may have been the continuous bombardment of early Earth by interstellar bodies [1,2], in which several chiral organic compounds have already been detected, our ability to accurately quantify them in artificial and authentic extra-terrestrial samples is crucial to elucidate the events that led to biological homochirality [1-4]. Several studies have already reported consistent L-excesses for numerous proteinogenic and non-proteinogenic amino acids in meteorites, however, due to significant analytical challenges, an *ee* has not yet been established for monosaccharides in any astrophysical sample [1,2]. In an effort to fill this gap, this work presents the results of the application of an integrative methodology for the reliable and simultaneous enantioselective analyses of chiral amino acids [5] and sugars in interstellar ice analogues and meteorite samples. The results of this research are decisive to build a unified view of the potential role of circularly polarized light (CPL), the most promising source to trigger molecular asymmetry under extra-terrestrial conditions [2,4], in the origin of biological homochirality.

[1] D. P. Glavin, et al. (2020), *Chem. Rev.* 120, 4460-4689.
[2] A. D. Garcia, et al. (2019), *Life* 9, 1-21.
[3] Y. Furukawa, et al. (2019), *PNAS* 116, 24440-24440.
[4] C. Meinert,et al. (2014), *Angew. Chem. Int. Ed.* 53, 210-218.
[5] R. Pepino, et al. (2022), *J. Sep. Sci.* 45, 4416-4426.