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Galactic distribution of chirality sources of organic molecules

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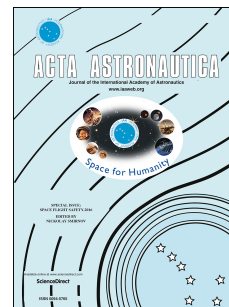
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1 Galactic Distribution of Chirality Sources of Organic Molecules

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9 Abstract

10 Conceptualizing planetary habitability depends on understanding how living organisms originated and
11 what features of environments are essential to foster abiogenesis. Estimates of the abundance of life's
12 building blocks are confounded by incomplete knowledge of the role of chirality and racemization in
13 organic compounds in the origination of living organisms. Chirality is an essential feature of enzymes
14 as well as many lock-and-key type structures. There are four known processes that can act on complex
15 organic molecules to promote racemization for abiogenesis: quantum-tunneling effects; selection via
16 interaction with circularly polarized light (CPL); templating processes; and interactions with electrical
17 and magnetic (EM) fields. These occur in different places, respectively: cold interstellar space; regions
18 of space with energetic photons, dust and/or magnetic fields; and mineral surfaces (for both templating
19 and EM fields). Chirality as a feature of terrestrial life suggests neither a special place for local
20 development of homochirality nor for extra-terrestrial enrichment and delivery. The presence of these
21 molecules in three competing scenarios for life's origin—chemical gardens, geothermal fields, and ice
22 substrates—relies on a framework of hypothesis and estimation. An easily-modified worksheet is
23 included in the supplemental material that allows a user to generate different scenarios and data related
24 to the distribution of chiral organic molecules as building blocks for living organisms within the galaxy.
25 A simple hypothetical mechanism for planetary magnetic field reversals, based on a high-density
26 plasma inner core, is also presented as a means to aid in estimating field polarity and hence the
27 orientation of racemization processes based on planetary magnetic fields.

28
29 Keywords30 origin of life; chirality; geomagnetic reversal; chemical garden; CPL; racemization.
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