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Polarized muons and the origin of biological homochirality

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While biologists have not yet reached a consensus on the definition of life, biological homochirality seems to be strongly linked to life's emergence. The unraveling of its origin require interdisciplinary research, by exploring each of fundamental physics, chemistry, astrophysics and biology. In this talk, I will focus on the origin of biological homochirality in the context of astrophysics and particle physics. The weak force, one of the fundamental forces operating in nature, is parity-violating. Cosmic rays, high energy particles coming from outer space, induce showers of billions of secondary particles when they interact with atoms in the atmosphere. On Earth, at ground level, most of our cosmic radiation dose comes from polarized muons formed in a decay involving the weak force. I will show how the spin-polarization is transmitted in cosmic showers in several different environments where life could have started. I will also show how this polarization could have induced a biological chiral preference and I will discuss the implications for the search of life in other worlds.

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