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Paleo-detectors to investigate the flux of cosmic rays in the past

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Interactions between secondary cosmic rays and nuclei in natural minerals can cause nuclear recoils that leave tracks in the material structure. Such defects, which can also be caused by other astroparticles, can be preserved for up to some Gyr, making these useful "time machines"for the study of the history of astrophysical messengers. These so-called "Paleo-detectors" have been proposed as alternatives to standard rare-events detectors as they feature huge accumulated exposure times even for small masses of material. We here present a different approach: trying to use them as probes for past fluxes of cosmic rays. In particular, we will show the case study of the Messinian salinity crisis, a period of draining of the Mediterranean Sea which is interestingly coincident with the estimated age of the Fermi Bubbles, around 5.5 Myr ago, when our Galaxy might have been active. Greatly increased cosmic ray acceleration near the Galactic Center could have left traces in the evaporites, mainly Halite, created with the evaporation of the sea and exposed directly to secondary cosmic rays. These mineral structures were then covered during the sudden reflooding of the Mediterranean basin 5.3 Myr ago; the cosmic ray flux information then remained frozen due to the shielding of the massive body of water, possibly retaining information on the flux of particles at ground at that epoch.

Summary

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