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Reconstruction of the History of Galactic Cosmic Rays via In Situ Production of ^{14}C in Antarctic Ice

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Galactic Cosmic Rays (GCR) are a common background for measurements of solar activity. Measurements of long-lived isotopes in meteoritic data indicate the GCR flux has been constant for several Myr, but these measurements have relative systematic uncertainties exceeding 30%. By using deep-ice carbon-14 extracted from the Antarctic ice sheet at Dome C, we can reconstruct changes in the GCR flux over the past ~ 7 kyr with much higher precision than previously achieved. We present a model of the relationship between cosmic rays at the top of the atmosphere and ^{14}C formed in Antarctic ice using atmospheric and in-ice particle cascades, measurements of muon interaction cross-sections, and ice flow models to track the formation and accumulation of carbon-14. We will describe future applications of the model to ^{14}C measurements obtained at Dome C in early 2025 and forecast constraints on the recent history of the GCR flux.

Collaboration(s)

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