

A NEW MODEL OF THE CHEMISTRY OF IONIZING RADIATION IN SOLIDS

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Cosmic rays are a form of high energy radiation found throughout the galaxy that can cause significant physio-chemical changes in solids, such as interstellar dust grain ice-mantles. These particles consist mostly of protons and can initiate a solid-state irradiation chemistry of significant astrochemical interest. In order to better understand the chemical effects of long-term exposure to ionizing radiation, we have written a new Monte Carlo model, CIRIS: the Chemistry of Ionizing Radiation in Solids, which is, to the best of our knowledge, the first successful program of its kind to follow the damage and subsequent chemistry of an irradiated material over time. In our code, two distinct regimes are considered. One is dominated by the atomic physics of track calculations in which both the irradiating proton and the subsequently generated secondary electrons are followed on a collision by collision basis. The other regime occurs after the ion-target collision, in which mobile species are free to randomly hop throughout the bulk of the ice and react via a diffusive mechanism. Here, we will present an initial test of our code in which we have successfully modeled previous experimental work. In these simulations, we are able to reproduce the measured abundances and predict the approximate ice thickness used in that study.