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Effect of Long-lived Strongly Interacting Relic Particles on Big Bang Nucleosynthesis[1] MOTOHIKO KUSAKABE, University of Tokyo, TOSHITAKA KAJINO, National Astronomical Observatory of Japan, TAKASHI YOSHIDA, University of Tokyo, GRANT MATHEWS, University of Notre Dame
— Some particle theories beyond the standard model predict that relic long-lived strongly interacting massive particles (SIMPs or X particles) could exist in the early universe. We study effects of such long-lived SIMPs on big bang nucleosynthesis (BBN). The interaction strength between an X particle and a nucleon is assumed to be similar to that between nucleons. We then calculate BBN in the presence of the unstable neutral charged X0 particles taking account of the capture of the X0 particles by nuclei to form X-nuclei. We find that SIMPs form bound states with normal nuclei during a relatively early epoch of BBN. This leads to the production of heavy elements. Constraints on the abundance of X0 particles are derived from observational limits on the primordial light element abundances. Particle models including long-lived colored particles with lifetimes longer than 200 s are rejected based upon these constraints.

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