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Thermal Shocks as a Detection Method for Heavy Exotic Particles in neutrino telescopes

Many well-motivated extensions of the Standard Model predict the existence of extremely heavy particles, such as nuclearites, Q-balls, and magnetic monopoles. However, detecting electrically neutral or non-relativistic particles remains an experimental challenge.

As these nearly macroscopic particles traverse matter, such as ice, they deposit energy through friction, heating the medium to plasma temperatures. The resulting black-body radiation can be detected using generic light sensors, yet the plasma light yield in media, such as water and ice, is subject to considerable theoretical uncertainties.
Rare particle searches benefit from large detector volumes, and the world's largest instrumented detectors are neutrino telescopes.

To investigate the feasibility of this detection method, we simulated plasma production in ice by exposing it to an intense laser beam. We present measurements of the resulting light yield, time evolution, and emission spectrum, discussing their implications for exotic particle searches in neutrino observatories.

Collaboration(s)

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