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Solid State Detectors for Low-Mass Dark Matter Searches

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We are faced with convincing evidence that approximately a quarter of the universe is composed of something whose gravitational effects can be seen in a variety of astrophysical phenomena, but which we have been unable to detect and identify in the laboratory. The majority of physicists agree that this "dark matter" (DM) consists of as-yet-undiscovered subatomic particle(s) that are not included in our Standard Model of particle physics; the quest to discover its exact nature is among the foremost missions in modern physics and the greatest treasure hunts in history. Direct DM searches over the past few decades have been largely focused on Weakly Interacting Massive Particles with masses much greater than that of the proton. The absence of any conclusive discovery, along with various theoretical developments and certain astrophysical observations, has recently motivated the direct detection community to broaden our experimental program to search for DM candidates in lower mass ranges. Solid-state detectors provide many advantages for such searches. This talk will summarize recent advances in phonon- and ionization-based semiconductor crystal experiments, cryogenic scintillating calorimeter experiments, Charge-Coupled Device experiments, and R&D for future new solid-state detector technologies. It will also discuss future prospects and discovery potential for solid-state detectors with respect to various low-mass DM candidates, including dark photons, axion-like particles, and lightly-ionizing particles.

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