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Condensed Matter Physics and the Nature of Dark Matter in the Universe

BERNARD SADOULET, University of California, Berkeley

The nature of dark matter, which may be 6 times more abundant than ordinary matter in the universe and make up a quarter of the energy density, remains a profound mystery. A leading hypothesis is that dark matter is made of Weakly Interactive Massive Particles (WIMPs), which may result from supersymmetry or additional spatial dimensions. If these WIMPs exist, we should be able to observe their elastic scattering on suitable targets, provided that we can recognize the nuclear recoils they are expected to produce among a background of electron recoils. Expected event rates are small (a few events /kg per year) and the energy deposition should be of the order of 15 keV. I will explain how we are trying to harness condensed matter physics at low temperature (physics of charge carriers, athermal phonons, quasiparticles in superconductors) to detect such events. Such efforts are currently led by our Cryogenic Dark Matter Search (CDMS II) experiment, which is currently ten times more sensitive than any other WIMP search in the world and we hope to obtain another factor ten in the coming two years. This effort is squarely at the intersection of condensed matter, low temperature physics, cosmology and particle physics and provide a good testimony of the Unity of Physics. CDMS II is supported by the National Science Foundation and the Department of Energy.