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Direct dark matter detection

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Precision cosmology and detailed analysis of a wide variety of astronomical phenomena suggest that dark matter constitutes some 85% of the matter content of the Universe. While the evidence for its bulk existence is strong, an understanding of its particle nature remains elusive, and the requirement of an additional particle species to explain the dark matter provides compelling evidence for physics beyond the standard model of particle physics. The discovery of dark matter would therefore enlighten two of the outstanding problems of modern physics - the matter composition of the Universe and the extrapolation of the standard model.

Three particle signals of dark matter are being sought: production in colliders, detection of annihilation products, and direct scattering in underground searches. This talk will focus on the latter. Experiments search for characteristic energy depositions resulting from the scattering of dark matter particles from target nuclei. To hope to achieve this, backgrounds from known standard model processes must be sufficiently reduced to allow a signal to be observed, requiring deep underground operation to escape cosmic ray radiation and its consequences, shielding from known local sources of radiation, and construction from extremely radio-pure materials. In addition, novel design and analysis techniques are employed.

The latest results and plans of the worlds leading direct search projects will be presented. These include so-called Generation-2 instruments, with ton-scale target masses, and sensitivity sufficient for discovery under many current theoretical models. With these instruments, the solution to an 80 year old mystery, of fundamental importance to both particle physics and astronomy, may soon be at hand.

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