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Direct Dark Matter Detection with the XENON and DARWIN experiments

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The XENON1T detector, currently under construction at the Gran Sasso Underground Laboratory (LNGS) in Italy, is a dual-phase (liquid-gas) xenon time-projection chamber (TPC) for particle detection. It is the successor of XENON100, which reached its sensitivity goal with the last limits on spin-independent WIMP-nucleus interaction (2e-45 cmˆ2 at 55GeV/cˆ2), the world-leading result at the time of publication. The construction of the water tank, to be employed as a shield for environmental radiation and as a Cerenkov muon veto, has ended at LNGS in 2013, most other subsystems are currently under construction. The total amount of xenon to be housed in the XENON1T cryostat is 3t, with a fiducial mass of about 1t. In order to detect the prompt and proportional VUV scintillation light from particle interactions with the xenon target, two arrays of 3-inch Hamamatsu R11410 photomultiplier tubes will be installed on the top and bottom of the TPC. The assembly of the inner detector components is planned for late 2014, and the science goal can be reached after two years of continuous operation by 2017. The next step in the XENON dark matter search program is the XENONnT project. It will double the amount of xenon in the sensitive volume (˜6t), which would allow to fiducialize the target to ˜4t. The XENONnT TPC with the inner cryostat vessel will be constructed while XENON1T is taking data, and will be installed in the same outer vessel and the water shield as XENON1T. The exploration of the entire experimentally accessible WIMP parameter space, down to a region where solar neutrino interactions become an irreducible background (and eventually provide a possibility to precisely measure their low-energy spectrum in real-time), is foreseen with an ultimate experiment at the 20 ton scale. The design and R&D works for such a project were initiated by the DARWIN (DArk Matter WImp search with Noble Liquids) consortium. In this talk, the current status and the plans of the XENON collaboration will be presented, with focus on the design details of the XENON1T experiment, as well as on the future multi-ton DARWIN project.

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