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Noble liquid detectors for dark matter.[1]

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Experiments based on noble liquid targets are now providing competitive sensitivities in the race for the direct detection of particle dark matter. Theoretical estimates, based on supersymmetric models predict dark matter interaction rates from the best sensitivity of existing direct detection experiments of $\sim$1 evts/kg/month, down to rates of $\sim$1 evts/100 kg/yr, and below this. Current noble liquid experiments for dark matter searches, range in scale from 10 to 1000 kg, and are designed to rise to this challenge. Ar, Ne and Xe targets permit the discrimination of electron recoils, coming from gamma ray and beta backgrounds, versus nuclear recoils, characteristic of WIMP events. This is done using scintillation light pulse shapes, and/or the ratio of ionization to scintillation generated in the target by the interaction. The detectors are also able to significantly reduce backgrounds through the use of position resolution in large volumes, combined with active self-shielding, to reach very low levels in inner fiducial volumes. A growing understanding of how to exploit these characteristics, and construct larger detectors, will allow further significant improvements in the sensitivity of noble liquid experiments. Current and future noble liquid detector experiments include: ArDM, LUX, (mini)CLEAN/DEAP, WARP, XENON, XMASS, XMASS-DM, ZEPLIN

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