Contribution ID: **175** Type: **not specified**

XLZD: The low-background observatory for astroparticle physics

The XLZD underground rare event observatory based on liquid xenon technology will address some of the most important open questions in fundamental physics and cosmology: the nature of dark matter, which drives the formation of structures in the universe such as galaxies and clusters, and the fundamental nature of neutrinos, which is closely tied to the puzzling matter-antimatter asymmetry in the universe. XLZD will conduct highly sensitive measurements with its quiet, massive detector, offering an unrivaled low energy threshold and background level required to tackle these mysteries. Additionally, XLZD will perform precision measurements of solar neutrinos, search for solar axions, and watch for neutrinos from supernovae in our cosmic neighborhood. With its rich scientific program, XLZD will thus be a true multi-purpose observatory in astroparticle physics, poised to make a global impact.

In its nominal design, XLZD is an observatory with a target mass of 60 tonnes of cryogenic liquid xenon in its central detector, as xenon is an ideal medium for detecting ultra-rare particle interactions. It will operate as a dual-phase time projection chamber, a technology which revolutionized the field of direct dark matter searches about 20 years ago with its highly scalable detection principle, which has since led the field. XLZD is being pushed forward by the leading teams in this area: XENON and LZ, which currently operate the largest liquid xenon detectors, with target masses of 5.9 tonnes and 7.0 tonnes, respectively, and DARWIN conducting R&D towards a multi-ton liquid xenon detector.

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