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The progress of ALETHEIA, a project hunting for low-mass dark matter with LHe TPCs

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DM direct detection aims to test the cross-section between galactic DM particles and an underground detector's nucleons. Although Weakly Interacting Massive Particles (WIMPs) is the most discussed DM candidate, the null-WIMPs conclusion has been consistently addressed by the most convincing experiments in the field. The low-mass WIMPs region (100s MeV/cˆ2 - 10 GeV/cˆ2), however, has not been fully exploited compared to high-mass WIMPs (10 GeV/ˆ2 - 1 TeV/ˆ2). The ALETHEIA (A Liquid hElium Time projection cHambEr In dArk matter) experiment aims to hunt for low-mass WIMPs with liquid helium-filled time projection chambers (TPCs). The project was officially launched in 2020 and has made significant progress ever since. So far, we have verificed all of the key technoligies to build a single-phase LHe TPC; the R&D on a dual-phase detector is still underway. I will introduce the progress we have made in the past four years.

Primary author: Dr LIAO, Junhui (Brown / CIAE)

Presenter: Dr LIAO, Junhui (Brown / CIAE)

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