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The Underground Laboratory in South Korea : facilities and experiments

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We have developed underground physics programs for last 15 years in South Korea. The scientific and technical motivation for this initiative was the lack of local facility of a large accelerator in Korea. Thanks to the large underground electric power generator in Yangyang area, we could construct a deep underground laboratory (Yangyang Laboratory, Y2L) and has performed some pioneering experiments for dark matter search and double beta decay experiments. Since year of 2013, a new research center in the Institute for Basic Science (IBS), Center for Underground Physics (CUP), is approved by the government and Y2L laboratory is managed by CUP. Due to the limited space in Y2L, we are proposing to construct a new deep underground laboratory where we can host larger scale experiments of next generation. The site is in an active iron mine, and will be made in 1100 meter underground with a space of about 2000 m^2 by the end of 2019. I will describe the status and future plan for this underground laboratory. CUP has two main experimental programs. (1) Identification of dark matter : The annual modulation signal of DAMA/LIBRA experiment has been contradictory to many other experiments such as XENON100, LUX, and Super CDMS. Yale University and CUP (COSINE-100) experimentalists agreed to do an experiment together at the Y2L and recently commissioned a 100kg scale low background NaI(Tl) crystal experiment. In future, we will develop NaI(Tl) crystals with lower internal backgrounds and try to run identical detectors at both north and south hemisphere. Low mass WIMP search is also planned with a development of low temperature sensors coupled with highly scintillating crystals. (2) Neutrinoless double beta decay search : The mass of the lightest neutrino and the Majorana nature of the neutrinos are not determined yet. Neutrinoless double beta decay experiment can answer both of the questions directly, and ultra-low backgrounds and excellent energy resolution are critical to discover this ultra rare phenomena. AMoRE (Advanced Mo-based Rare phenomena Experiment) is a state-of-art experiment based on low temperature MMC sensor and ultra pure molybdate crystals containing highly enriched isotopes. With 200 kg of molybdate crystals running 3 years, Its sensitivity goal is reaching 10^{27} years of half-life and down to 15-30 meV neutrino mass. AMoRE-pilot experiment with 1.5 kg of enriched Mo-100 crystals is running at Y2L now. In addition to the two main physics program, CUP is doing NEOS short baseline neutrino experiment and also develops new experiments for new parameter search for dark photons, WIMPs, and double beta decay experiments.