DARWIN-LXe: a dark matter and neutrino observatory at LNGS

DARWIN-LXe is an initiative to build a dark matter detector capable of exploring the entire experimentally accessible parameter space for weakly interacting massive particles (WIMPs), until neutrino interactions become an irreducible background. It will be based on a time projection chamber filled with the noble gas xenon in its liquid form, a concept that was successfully realised within the ZEPLIN, XENON, PandaX and LUX programs. The prompt scintillation light and the charge signals induced by particle interactions in the detection medium will be observed by sensitive, ultra-low background photosensors. DARWIN-LXe will have an excellent sensitivity to WIMP dark matter with masses above ~6 GeV/c2, probing spin-independent, spin-dependent as well as inelastic scattering channels. Exploiting the charge signal only will allow us to probe even lower WIMP masses as well as signatures of dark matter scattering off electrons. With its large mass, low-energy threshold and ultra-low background level, DARWIN-LXe will also be sensitive to other particles such as solar axions, galactic axion-like particles, sterile neutrinos with masses in the 100 keV range, as well as bosonic SuperWIMPs. DARWIN-LXe will be the first experiment to detect coherent neutrino-nucleus scattering from solar neutrinos and will provide a unique coherent neutrino detection channel for galactic supernova events. Finally, DARWIN-LXe will also be sensitive to the neutrinoless double-beta decay of 136-Xe, double-electron capture on 124-Xe, as well as other rare nuclear processes. We present the concept and science goal of the DARWIN-LXe project. We then discuss its technical challenges and risks, outline the costs, the requests to the laboratory, as well as the time scale of the project.