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# The neutrinoless double beta decay experiment LEGEND- R&D on wavelength shifting materials for the liquid argon instrumentation

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The neutrinoless double beta decay is a process beyond the Standard Model of particle physics, in which a nucleus undergoes a double beta decay without any neutrinos in the final state. If this reaction is observed, the Majorana nature of the neutrino will be established (a fermion is a Majorana particle if it coincides with its own antiparticle). Moreover, this reaction would have important implications for the neutrino absolute mass scale and ordering, for the lepton number violation and would provide hints on the matter-antimatter asymmetry observed in the Universe.
Located at the Gran Sasso National Laboratories, LEGEND (Large Enriched Germanium Experiment for Neutrinoless double beta Decay) has the goal of searching for this reaction in high-purity germanium (HPGe) crystals enriched in 76Ge. In five years of data-taking, the first phase LEGEND-200 is expected to reach a sensitivity to the half-life of the 76Ge neutrinoless double beta decay of 10^(27) years, and of 10^(28) yr in the second phase, LEGEND-1000, in ten years of data-taking. LEGEND set-up consists in HPGe crystals contained in a cryostat filled with liquid argon, which cools the detectors to 87 K, acts as both passive and active veto. Indeed, liquid argon scintillates when a particle releases energy in it. LEGEND is equipped with the so-called liquid argon instrumentation, consisting in several structures of wavelength-shifting materials surrounding the HPGe crystals and optical sensors, with the goal of collecting the scintillation light from the argon. This is important for the signal-background discrimination, considering that a neutrinoless double beta decay releases all its energy inside one HPGe detector, without any energy deposition in the liquid argon.
In my poster I am going to present the experimental designs of the two LEGEND phases and explain the R&D on the wavelength-shifter materials for the liquid argon instrumentation of LEGEND-1000 I am carrying on at the University of Zürich.

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