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Neutrinoless Double Beta Decay of 136Xe by KamLAND

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There is, presently, strong evidence from recent neutrino experiments that neutrinos undergo flavor oscillations, and hence must have finite masses. The oscillation results can provide differences between squares of neutrino mass eigenvalues, but cannot determine the absolute mass scale nor its origin. So far only neutrinoless double beta($0\nu\beta\beta$) decay measurement offers a realistic opportunity to establish the Majorana nature of neutrinos and give the absolute scale of the effective neutrino mass. Global analyses of the oscillation results imply the effective neutrino mass could have a minimum value as large as a few tens of meV for the inverted hierarchy of the neutrino mass spectrum. Next generation $0\nu\beta\beta$ decay experiments are currently proposed to achieve such mass sensitivity. The KamLAND detector is located in the Kamioka mine, and is filled with 1,000 tons of liquid scintillator. The detector is very sensitive to low energy neutrinos from nuclear reactors and the Earth. We are currently working on reducing backgrounds in the KamLAND to detect very low energy solar neutrinos produced by the ^{7}Be reaction in the Sun. We have proposed upgrading the KamLAND detector into a huge $0\nu\beta\beta$ decay experiment by adding ^{1}36Xe to the detector volume. Since the sensitivity of the $0\nu\beta\beta$ experiment is determined by the available source amount and the background rate, the KamLND detector is suitable for this purpose. We mainly present the currect status of the development for upgrading the KamLAND detector toward the $0\nu\beta\beta$ decay experimnt.