

Search for exotic neutrino interactions by XMASS-I detector

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XMASS is multi-purpose experiment using liquid xenon and is located at the Kamioka Observatory in Japan. The detector consists of a liquid xenon with a single-phase of 832 kg active volume and has a low energy threshold, low backgrounds and large target mass. In XMASS, it is possible to verify the topics of low energy neutrino physics which would give hints on models beyond SM. Now we have searched for exotic neutrino-electron interactions that could be produced by a neutrino millicharge, by a neutrino magnetic moment, or by dark photons using solar neutrinos in XMASS. We analyzed the data between November 2013 and March 2016 for 711days dataset. No significant signals have been observed with predicting the backgrounds in detector. We obtained an upper limit of neutrino millicharge of $5.4 \times 10^{-11}e$ for all flavors of neutrino. We also set individual flavors to be $7.3 \times 10^{-12}e$ for ν_e , $1.1 \times 10^{-11}e$ for ν_μ , and $1.1 \times 10^{-11}e$ for ν_τ . The limits for ν_μ and ν_τ are the best direct experimental limits. We also obtain an upper limit for the neutrino magnetic moment of $1.8 \times 10^{-10} \mu_B$. In addition, we obtain upper limits for the coupling constant of dark photons in the $U(1)_{B-L}$ model of 1.3×10^{-6} if the dark photon mass is $1 \times 10^{-3} \text{ MeV}/c^2$, and 8.8×10^{-5} if it is $10 \text{ MeV}/c^2$. In particular, we almost exclude the possibility to understand the muon $g - 2$ anomaly by dark photons.

Keywords

neutrino; millicharge; magnetic moment; dark photon; low background; liquid xenon.

Collaboration

other (fill field below)

other Collaboration

XMASS

Subcategory

Experimental Results

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