RCNP SEMINAR

Research Center for Nuclear Physics, Osaka University

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Title The Ultra-High-Energy Neutrino Spectrum and the LPM Effect

Time&Date 11:00-, November 19, 2010

Place Lecture room, 4th floor , RCNP, Osaka University

Abstract

Measuring the Ultra-High-Energy neutrino (UHEv) flux, for energies above 10^{20} eV, might confirm the existence of the cosmic neutrino background and confirm or refute certain dark energy models. The interaction of the UHEv's with the cosmic neutrino background is expected to lead to sizeable absorption dips in the UHEv spectrum as UHEv's will be absorbed by neutrino – anti-neutrino annihilation on the Z-boson resonance. Observing such an absorption dip will support the existence of the cosmic neutrino background. An interesting possibility for a dark energy model is the Mass Varying Neutrino model, which proposes that the neutrino masses could depend on the redshift. This redshift dependence introduces distinctly different absorption dips into the UHEv spectrum. Therefore looking at the shape and position of such an absorption dip might tell us whether we are dealing with mass varying neutrinos.

An interesting way to observe these absorption dips is by using the moon as detector. The impact of an UHEv on the moon can initiate a particle shower which will emit coherent radiation through the Askaryan effect. This radiation can be detected on Earth by sensitive radio telescopes like LOFAR and SKA, which are currently under development. The cross section for electron bremsstrahlung and electron-positron pair production at these energies and thus the detection probability of the particle shower is however significantly reduced due to the LPM effect. In this presentation I will discuss how the LPM effect alters the particle showers and affects their detection probability. While considering the LPM effect the total number of counts expected in a realistic measurement can be determined, which is already significant for a 30 days measurement by LOFAR. The magnitude of the electric pulses measured at Earth is however only indirectly related to the initial energy of the UHE neutrinos. Considering this, I will as well get into the sensitivity of a realistic measurement to the absorption dips in the spectrum and show whether it will be possible to confirm the existence of the cosmic neutrino background or confirm or refute the Mass Varying Neutrino model in a realistic measurement.