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Lorentz invariance violation from gamma-ray bursts

Wednesday 28 November 2018 16:30 (25 minutes)

I will talk the recent works of my group on the speed variations of high energy photons and neutrinos from gamma-ray bursts. By combining high energy photons from a number of GRBs with known redshifts, we reveal a regularity that several high energy photons from different GRBs fall on a same line to indicates a tiny light speed variation at the Lorentz violation scale of 3.6x10^{17} GeV. We also made the first proposal to associate the IceCube PeV scale events with GRB candidates. We found that all four IceCube events of PeV scale neutrinos can associate with GRBs falling on a straight line to indicate a Lorentz violation scale of 6.5x10^{17} GeV, which equals to that determined by Amelino-Camelia et al. from TeV scale neutrino events. We also found that two events are time advanced and the other two events are time delayed. It is hard to expect that a same kind of particle can have two different propagation properties. As the IceCube detector cannot distinguish between neutrinos and anti-neutrinos, we propose that neutrinos and anti-neutrinos have different propagation properties, i.e., one is superluminal and the other is subluminal. This can be explained by the Lorentz violation due to the CPT odd feature of the linear Lorentz violation. We thus reveal the CPT violation between neutrinos and anti-neutrinos, or an asymmetry between matter and anti-matter.

Content of the contribution

Theory

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