Contribution ID: **124** Type: **not specified**

Cosmological implications of particle dynamics and general relativity stemming from special relativity with a privileged frame

Wednesday 28 August 2019 11:00 (30 minutes)

The theory termed 'special relativity (SR) with a preferred frame' \cite{burde1, burde2} incorporates the preferred frame into special relativity while retaining the fundamental space-time symmetry which, in the standard SR, manifests itself as Lorentz invariance. In this paper, the theory is extended to particle dynamics and general relativity based on the concept of the 'modified spacetime symmetry' which allows to use the apparatus of the standard relativity but with properly transformed spacetime variables. To calculate physical effects, an inverse transformation to the 'physical' time and space intervals is applied.
On the basis of the extended particle dynamics the dispersion relation for free particles is derived. The modified dispersion relation is applied for calculating the
Greisen-Zatsepin-Kuzmin (GZK) limit due to the photopion production
in collisions of ultra high energy cosmic rays (UHECRs) off the cosmic microwave background (CMB) photons which, in the last years, is considered as providing a test of the validity of SR (see, e.g., \cite{A}). It is found that, in the particle dynamics of relativity with a privileged frame, a position of the GZK cutoff in the energy spectrum should depend on the distance to the source. This effect might be confirmed if the data could be sorted according to an event responsible for the UHECR's burst.

The modified general relativity (GR), like the standard GR, is based on
the equivalence principle but with the properly modified space-time local symmetry in which an invariant combination differs from the Minkowski interval of the standard SR.
Applying the modified GR to cosmology yields the luminosity distance – redshift relation corrected such that the observed deceleration parameter can be negative as it is obtained from the data for type Ia supernovae. Thus,
the observed negative values of the deceleration parameter can be explained within the matter-dominated Friedman-Robertson-Walker cosmological model of the universe without introducing the dark energy.
A number of other observations, such as Baryon Acoustic Oscillations and Cosmic Microwave Background,
%that are commonly considered as supporting the late-time cosmic acceleration and the existence of dark energy,
also can be well fit to the cosmological model arising from the GR based on the SR with a privileged frame.

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Session Classification: Workshop on Astro-Cosmo-Gravity