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PROJECT FOR CONSTRUCTION OF COSMIC RELIC NEUTRINO TELESCOPE

Abstract

Relic neutrinos are the participants and witnesses to the events in the Universe 13.6 billion years ago. Detection of relic neutrinos has great importance for obtaining invaluable information on the early Universe and the understanding of the many mysteries of cosmology and physics.

We propose the initial project for the construction of the telescope for the detection of relic neutrino background. The proposed project requires the formation of international collaboration in this field.

1. The telescope consists of two underground laboratories: laboratory A is on one side of the Earth and laboratory B is on the other side of the Earth. Both laboratories are situated under two different mountains at a distance of about 12000 km. The corresponding distances from the top of the mountain and from the foot of the mountain to the underground laboratory should not be less than 1.5 km for protection against cosmic ray background.

2. The sufficiently dense beam consisting of the transversely polarized electrons accelerated using the linear electron accelerator of the length of about 30 km up to the energies of several hundred GeV passes through the single crystal possessing a strong internal electrostatic field (eg, tungsten, diamond) along its crystal axis or plane.

3. The abovementioned single crystal is cooled permanently.

4. The average value of the third component of the momentum of the electrons in the final state and the cross-section of the process are measured in the experiment in laboratory A.

5. The energy of the scattered neutrinos is amplified up to energies of several hundred GeV. The neutrinos in the final state scatter at extremely small angles with respect to the plane perpendicular to the effective magnetic field (of the single crystal) direction. The strong focus property of the scattered high-energy neutrinos enables us to direct them to laboratory B on the other side of the Earth.

6. The neutrinos directed from laboratory A collide with the target of the detector of laboratory B. The neutrinos are registered by the radiochemical method (inverse beta-decay). Perchloroethylene, gallium, or “white spirit” etc. can be used as a target substance. The scattering of high-energy neutrinos by neutrons of the target results in the production of a proton and an electron (a muon or a tauon). The production of argon (germanium) in the case of perchloroethylene (gallium) is evidence for the detection of a relic neutrino whose energy is amplified in laboratory A.