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Simulations of radio signals produced by ultra-high and extremely high energy neutrino induced cascades in Antarctic ice and lunar regolith

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Abstract content

Radio signals produced in ice by electromagnetic cascades with energies up to 10^15 eV have been calculated. Simulations of cascades were performed using the SIMEX Code System. The simulation results in the matrix form, which described the charge excess evolution, were used to calculate coherent Cherenkov radio field from electromagnetic cascades. Comparison with results received in the frameworks of the GEANT-4 Code System was made.

A new algorithm was also developed to simulate radio signals produced by extremely high energy (up to 10^21 eV) electron-photon and electron-hadron cascades in dense media. The base of the algorithm is a multilevel numerical scheme. The Migdal cross-sections are used to take into account the Landau- Pomeranchuk-Migdal (LPM) effect. Initially a Monte Carlo approach is used at the single particle level. When number of particles in a cascade increases up to 100-1000 transport equations are used. The main goal is calculations of the source functions – numbers of electrons and photons with low energies (below some threshold energy, which may be chosen as 10 GeV) produced in EHE cascade. For these low energy particles, the 3-dimensional cascades should be simulated in advance by Monte Carlo method with the use of the GEANT-4 or SIMEX codes. The 3-dimensional cascade profiles and signal profiles should be estimated and stored in some data base library for maximal CPU efficiency. At the last step the lateral and angular distributions of negative and positive charges in the EHE cascade can be estimated as a sum of known charge distributions in low energy cascades taking into account the source functions. Finally, with the use of this sum the radio signal produced in the EHE cascade may be estimated.

If this papers is presented for a collaboration, please specify the collaboration

Summary

Reference

Proceedings of the 30th International Cosmic Ray Conference; Rogelio Caballero, Juan Carlos D'Olivo, Gustavo Medina-Tanco, Lukas Nellen, Federico A. Sánchez, José F. Valdés-Galicia (eds.); Universidad Nacional Autónoma de México, Mexico City, Mexico, 2008; Vol. 5 (HE part 2), pages 1535-1538

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