

EXPANDING ANTENNA ARRAYS FOR ENHANCED RADIO DETECTION OF COSMIC RAYS AT THE TIAN SHAN HIGH-ALTITUDE OBSERVATORY

*Shinbulatov S.K.^{*1,2}, Saduyev N.O.², Fedorov O.³, Bezyazykov P.³, Utey S.B.¹, Kalikulov O.A.², Baktoraz A.E.¹, Zhukov V.V.⁴, Shepetov A.⁴, Sopko I.I., Yerezhep N.O.², Sukharev A.⁴.*

¹Al-Farabi KazNU, Almaty, Kazakhstan

²Institute of Nuclear Physics, Almaty, Kazakhstan

³Irkutsk State University, Irkutsk, Russian Federation

⁴Tien Shan High-Altitude Scientific Station FIAS, Almaty, Kazakhstan

The article focuses on the study of radio emission resulting from extensive air showers (EAS), which are cascades of secondary particles generated by the interaction of cosmic rays with Earth's atmosphere. It examines the mechanism of radio wave generation caused by the acceleration of charged particles, such as electrons, in Earth's magnetic field. The paper details contemporary methods and technologies for observing radio emission from EAS at the Tien Shan High-Altitude Scientific Station, including the use of radio antenna arrays.

The article provides an in-depth discussion of the specifics of detecting radio emission, its correlation with the energy of primary cosmic particles, and the insights that this study offers into the mechanisms of cosmic ray acceleration. It also reviews successful research examples aimed at identifying characteristics and sources of ultra-high-energy cosmic rays through the expansion of the antenna array. The study emphasizes the importance of EAS radio emission for advancing astrophysics and cosmic ray physics, as well as for improving observation and analysis methods of high-energy atmospheric phenomena. Additionally, it discusses the anticipated scientific benefits of the upgraded equipment, such as enhanced sensitivity to cosmic ray events and improved event reconstruction and noise filtering capabilities, which are crucial for researching radio emission from EAS.