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A study of radio frequency spectrum emitted by high energy air showers with LOFAR

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The LOw Frequency ARay (LOFAR) is a multipurpose radio antenna array aimed to detect radio signals in the frequency range $10-240$ MHz, covering a large surface in Northern Europe with a higher density in Northern Netherlands.

The detection of the radio signal emitted by cosmic ray induced air showers allows to reconstruct the geometry of the observed cascade. Thus, several properties of primary particles (e.g. arrival direction, mass composition) can be inferred.

We describe a study of several geometrical parameters of the radio signal emitted by extensive air showers propagating in the atmosphere, and their correlation with the observed radio frequency spectrum. In order to find the best parameters which describe the correlation between primary cosmic ray information and the emitted radio signal, a cross-check between real data and simulations has been done.

Regarding real data, cosmic ray radio signals detected by LOFAR since 2011 have been analyzed. For the simulation of the radio signals, the CoREAS code, a plug-in of the CORSIKA particle simulation code, has been used.

The final aim of this study is to find a method to infer information of primary cosmic rays in an independent way from the well-established fluorescence and surface detector techniques, in view of affirming the radio detection technique as reliable method for the study of high energy cosmic rays.

Collaboration

– not specified –

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