

# Magnetic field generation by the first cosmic rays

*Monday, July 12, 2021 6:00 PM (12 minutes)*

We recently proposed that cosmic rays are first accelerated at the redshift of  $z \sim 20$  by supernova remnants of first stars without the large scale magnetic field. In this talk, we are going to talk about the large scale magnetic field generation by the first cosmic rays. We show that even though the current and charge neutralities are initially satisfied, the current neutrality is eventually violated if there is an inhomogeneity, so that the magnetic field is generated. In addition, we propose a new driving mechanism for the Biermann battery in an inhomogeneous plasma with streaming cosmic rays. We demonstrate the new generation mechanisms of the magnetic field by conducting three-fluid plasma simulations and particle in cell simulation. We propose that the first cosmic rays generate the magnetic field with a large scale at the redshift of  $z \sim 20$ .

## Keywords

Generation of magnetic fields, effects of cosmic rays

## Collaboration

## other Collaboration

## Subcategory

Theoretical Results

**Primary author:** OHIRA, Yutaka (The University of Tokyo)

**Presenter:** OHIRA, Yutaka (The University of Tokyo)

**Session Classification:** Discussion

**Track Classification:** Scientific Field: CRI | Cosmic Ray Indirect