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# A Peculiar ICME Event in August 2018 Observed with the Global Muon Detector Network

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We demonstrate that global observations of high-energy cosmic rays contribute to understanding unique characteristics of a large-scale magnetic flux rope (MFR) causing a magnetic storm in August 2018. Following a weak interplanetary shock on 25 August 2018, a MFR caused an unexpectedly large geomagnetic storm. It is likely that this event became geoeffective because the MFR was accompanied by a corotating interaction region (CIR) and compressed by high-speed solar wind following the MFR. In fact, a Forbush decrease was observed in cosmic-ray data inside the MFR as expected, and a significant cosmic-ray density increase exceeding the unmodulated level before the shock was also observed near the trailing edge of the MFR. The cosmic-ray density increase can be interpreted in terms of the adiabatic heating of cosmic rays near the trailing edge of the MFR, as the corotating interaction region prevents free expansion of the MFR and results in the compression near the trailing edge. The second order anisotropy observed during the density increase clearly indicates an intensity enhancement of cosmic rays with approximately 90 degree pitch angle as expected from the betatron acceleration. A northeast-directed spatial gradient in the cosmic-ray density was also derived during the cosmic-ray density increase, suggesting that the center of the heating near the trailing edge is located northeast of Earth. This is one of the best examples demonstrating that the observation of high-energy cosmic rays provides us with information of the three-dimensional macroscopic picture of the interaction between coronal mass ejections and the ambient solar wind, which is essential for prediction of large magnetic storms.

## Keywords

Space Weather; galactic cosmic rays in ICME; cosmic ray observations with muon detectors and neutron monitors

## Collaboration

other (fill field below)

## other Collaboration

## Subcategory

Experimental Results

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