

Inverse Energy Dispersion of Energetic Ions Observed in the Magnetosheath

*Sun Hee Lee¹, David G. Sibeck¹, Kyoung-Joo Hwang^{1,2}, Yongfu Wang³, Marcos V. D. Silveira¹, Mei-Ching Fok¹, Barry Mauk⁴, Cohen J. Ian⁴, Mike Ruohoniemi⁵, Naritoshi Kitamura⁶, Jim Burch⁷, Barbara Giles¹, Roy Torbert⁸, Christopher T. Russell⁹, Mark Lester¹⁰

1. NASA Goddard Space Flight Center, 2. Goddard Planetary and Heliophysics Institute, University of Maryland, Baltimore County, Baltimore, MD 21228, USA., 3. Institute of Space Physics and Applied Technology School of Earth and Space Sciences, Peking University, Beijing 100871, China, 4. The Johns Hopkins University Applied Physics Laboratory, 11100 Johns Hopkins Rd., Laurel, MD 20723, USA., 5. Bradley Department of Electrical and Computer Engineering, Virginia Polytechnic Institute and State University, Blacksburg, Virginia, USA., 6. Institute of Space and Astronautical Science (ISAS), Japan Aerospace Exploration Agency (JAXA) 3-1-1 Yoshinodai, Chuo-ku, Sagami-hara, Kanagawa, Japan., 7. Southwest Research Institute, San Antonio, TX, USA., 8. University of New Hampshire, Durham, NH, USA., 9. University of California, Los Angeles, CA, USA., 10. Department of Physics and Astronomy, University of Leicester, Leicester, LE1 7RH, United Kingdom.

We present a case study of energetic ions observed by the Energetic Particle Detector (EPD) on the Magnetospheric Multiscale (MMS) spacecraft in the magnetosheath just outside the subsolar magnetopause that occurred at 1000 UT on December 8, 2015. As the magnetopause receded inward, the EPD observed a burst of energetic (~50-1000 keV) proton, helium, and oxygen ions that exhibited an inverse dispersion, with the lowest energy ions appearing first.

The prolonged interval of fast antisunward flow observed in the magnetosheath and transient increases in the H components of global ground magnetograms demonstrate that the burst appeared at a time when the magnetosphere was rapidly compressed.

We attribute the inverse energy dispersion to the leakage along reconnected magnetic field lines of betatron-accelerated energetic ions in the magnetosheath and a burst of reconnection has an extent of about 1.5 R_E using combined Super Dual Auroral Radar Network (SuperDARN) radar and EPD observations.