Electron acceleration via interaction between the Earth's bow shock and an interplanetary shock

*Masaru Nakanotani[1], Christian Mazelle[2,3], Shuichi Matsukiyo[1], Tohru Hada[1]

1. Earth System Science and Technology, Kyushu University, 2. IRAP, CNRS, France, 3. IRAP, Univsersity of Toulouse, France

In space, two shock waves often approach and even collide with each other (we call a shock-shock interaction).
For example, it is commonly observed that an interplanetary (IP) shock interacts with planetary bow shocks or the heliospheric termination shock.
Beyond the heliosphere, shock-shock interactions can be seen in many astrophysical objects.

It is natural to consider that particle acceleration through a shock-shock interaction is more efficient than that occurring in a single shock wave.
However, we have little direct evidence of particle acceleration by a shock-shock interaction
Hietala et al.[2011] discussed ion acceleration between an IP shock and the Earth's bow shock by mainly using ACE, WIND and GEOTAIL data.
They argued that ions can be accelerated between the two shocks through a Fermi like acceleration mechanism.
Up to now, on the other hand, we do not still have a direct evidence of electron acceleration by a shock-shock interaction.

We report a Cluster observation representing electron acceleration due to the interaction between an IP shock and the Earth's bow shock.
It is confirmed that electron acceleration occurs when the IP shock and the bow shock are magnetically connected.
The electrons have a bi-directional pitch angle distribution implying that they come and go between the two shocks.
We discuss the acceleration mechanism in detail and compare its efficiency to the case of single shock acceleration (usual diffusive shock acceleration).

Keywords: The Earth's bow shock, Shock-shock interaction, Electron acceleration

