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## A statistical picture of low frequency waves from the upstream to the downstream region of the terrestrial bow shock - Cluster observations

Y. Narita (1), K.-H. Glassmeier (1), K.-H. Fornaçon (1), I. Richter (1), S. Schäfer (1), U. Motschmann (2), I. Dandouras (3), H. Rème (3), and E. Georgescu (4)

(1) Institut für Geophysik und extraterrestrische Physik, Braunschweig, Germany, (2) Institut für Theoretische Physik, Braunschweig, Germany, (3) CESR/CNRS, France, (4) Max-Planck-Institut für extraterrestrische Physik, Garching, Germany (y.narita@tu-bs.de)

A comprehensive study of waves upstream and downstream of the Earth's bow shock is presented using Cluster spacecraft observations. The study reveals the following wave properties when going from the upstream to the downstream region: (1) smooth changes of the propagation direction and the correlation between magnetic field pressure and the plasma mass density; (2) a persistent phase velocity at about the Alfvén speed in the plasma rest frame; (3) a large scale propagation pattern divergent around the shock and convergent toward the magnetopause; (4) mirror mode saturated plasma in the magnetsheath. These results are almost independent of the shock being quasiparallel or quasi-perpendicular and indicate the presence of fast mode like waves in the upstream region, mirror mode and ion cyclotron type waves in the outer magnetosheath (near the shock), and mirror mode waves in the inner magnetosheath (near the magnetopause). The mirror mode may be coupled to the density gradient or the large scale structure of the magnetosheath. While other studies indicate that the excitation and propagation of upstream and downstream waves dependent on the shock structure and dynamics, our results suggest that the large structure of the bow shock and the magnetosheath are as essential as local wave processes.