Dayside Magnetopause/Magnetosphere and Aurora: When the Solar Wind Ram Pressure Intensely Increased

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Abstract

Global signatures of the aurora caused by sudden and gradually increases in the solar wind ram pressures have been studied in recent years using ultraviolet imager data from polar orbiting spacecraft. When a pressure discontinuity impinges on the dayside magnetopause, the auroral signatures include an initial appearance near local noon followed by anti-sunward propagation along the auroral oval at very high speeds (~6 - 11 km/s). When the magnetopause and magnetosphere are gradually, but greatly compressed by increasing pressures, dawn and dusk auroras occur. This paper uses observations by near-Earth FAST and DMSP satellites and ground-based magnetometers and radars to focus upon the mechanisms of auroral particle precipitation. Mechanisms of pressure pulse generated dayside aurora are speculated to be adiabatic compression and some dynamic processes occurring on the dayside magnetopause, such as magnetic shearing, magnetopause perturbation, magnetic reconnection and Alfvén wave generation. The dawn and dusk auroras are thought to be generated by magnetic shearing and some form of viscous interaction occurring on the magnetopause flanks, such as the Kelvin-Helmholtz instability or by the magnetosphere/magnetotail compression caused by the intense ram pressure.