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Dayside local structure of Earth's bow shock deduced from Cluster magnetic measurements

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In this paper, we determine the geometrical configuration of Earth's bow shock based on Cluster 4-point magnetic field measurements. We first determine the normal of the bow shock by using a new approach, which is based on the assumption that the normal of the bow shock is in the opposite direction of the gradient of the magnetic pressure within the shock front that can be deduced from the 4-point magnetic field measurements of Cluster. Applying this method, we calculate the normal of the bow shock for the 21 Cluster crossing events during February and March of 2001. Then we deduce the geometrical structure of the bow shock based on the observed relationship between the directional angles of the radius vector and the corresponding normal. We found that the average configuration of the dayside bow shock can be approximated by a conical section with the eccentricity being about 0.1 and the mean standoff distance of the subsolar point being about 14.4 RE. This new method based on the angle relationship is also sensitive to the fine structure of the bow shock. Some features of the local fine geometrical structure of the dayside bow shock in GSM coordinates are revealed. The formula of the noon-midnight longitude line and equatorial latitude line has been obtained. The noon-midnight longitude line for |lambda|$<$50 degrees is about a circle with a small outward extension as |lambda| increasing, and its curvature radius at the subsolar point is about 17.3 RE. The equatorial latitude line has an east-west asymmetry and its shape is similar to a spiral curve. The equatorial latitude line near the noon have an angle of about 83 degrees with the radius vector. The postnoon bow

shock is more distant from the Earth than the prenoon one. The curvature radius of the equatorial latitude line at the subsolar point is about 15.8 RE. It is revealed that the dayside bow shock is north-south versus east-west asymmetric, and the north-south dimension exceeds the east-west dimension.