

Anomalous deformation of the Earth's bow shock in the lunar wake: Multi-spacecraft observations by Chang'E-1 and SELENE

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Because the solar wind (SW) flow is usually super-sonic, a fast-mode bow shock (BS) is formed in front of the Earth's magnetosphere, and the Moon crosses the BS at both dusk and dawn flanks. On the other hand, behind of the Moon along the SW flow forms a tenuous region called lunar wake, where the flow can be sub-Alfvénic (and thus sub-sonic) because of its low-density status. Here we report, with multi-spacecraft in-situ measurements by Chang'E-1 and SELENE, that the Earth's BS surface is locally deformed in the lunar wake. Despite the quasi-perpendicular shock configuration encountered at dusk-flank under the Parker-spiral magnetic field, no clear shock surface can be found in the lunar wake, while instead gradual transition of the magnetic field from the upstream to downstream value was found for a several-minute interval. This finding suggests that the 'magnetic ramp' is highly broadened in the wake where a fast-mode shock is no longer maintained due to the lowest density.