

Ionospheric Bow Wave Induced by Moon Shadow Ship

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A moon shadow of the total solar eclipse swept through the continent of United States (CONUS) from west to east on 21 August 2017. Massive total electron content (integration of electron density from 0 km to 20,200 km altitude) observations from 2,255 ground-based Global Navigation Satellite System receivers show that the moon shadow ship generates a great ionospheric bow wave front which extends ~1,500 km away from the totality path covering the entire CONUS. The bow wave front consists of the acoustic shock wave due to the supersonic/near-supersonic moon shadow ship and the significant plasma recombination due to the reduction in solar irradiation within the shadow area. The deep bow wave trough (0.02 total electron content unit (1 TECU = 10^{16} el/m²) area) nearly coincides with the 100% obscuration moving along the totality path over the CONUS through the entire eclipse period. The supersonic moon shadow ship induces a bow wave crest in front of the ship (~80% obscuration). It is the first time to find the acoustic shock wave-formed bow wave trough and crest near the totality.

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