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Wake modes in a supersonic flow

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When an object moves at supersonic speed, it creates a wake in the downstream region in the medium in which it propagates. In addition to the wake, that is, a region of depleted density, the supersonic flow also excites waves or normal modes, both downstream and upstream of the object. These modes can correspond to "surface modes"and, when the medium is a plasma, "cavity modes"can also be excited in the wake region. Results from a theoretical and computational study of these modes, associated with the wake region of a satellite in low Earth orbit (LEO) are presented. The study makes use of a decomposition of plasma fluctuations near a spacecraft, using the method of empirical eigen functions. Both the spatial and temporal structures of the perturbations are analyzed. The effects of photoemission and of the angle between the local geomagnetic field and the direction of the plasma flow velocity are also considered.

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