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In-situ observations of collisionless shocks: A review of CLUSTER satellite observations of the Earths bow shock JONATHAN EASTWOOD, UC Berkeley — Of all the ways in which a magnetized collisionless plasma shock differs from its neutral fluid counterpart, one of the most striking is the fact that at a collisionless shock, particles are observed to stream from the shock back into the upstream region. The combination of the backstreaming particles together with the upstream core plasma distribution is subject to a number of instabilities that lead to the generation of waves and subsequent wave-particle interactions, all forming an integral part of the shock. The Cluster mission, launched in 2000 is a constellation of four identical spacecraft in polar orbit around the Earth. It is designed to resolve spatial and temporal variations in space plasmas, in particular at the Earths bow shock. Major results from the mission thus far relating to shocks are described. In particular, observations of shock structure, the cross-shock electric field and various ion beam wave instabilities are presented. Finally, we consider the open questions relating to collisionless shock physics, in particular concentrating on time-dependence introduced by variations in the upstream conditions, and describe the challenges facing the next generation of space missions.

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