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Cold ions at the magnetopause: Effects at small and large scales

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Statistics from the Cluster spacecraft show that low-energy ions with energies less than tens of eV originating from the ionosphere are common just inside the magnetopause. During magnetopause magnetic reconnection events, these low-energy ions remain magnetized down to smaller length-scales than the hot (keV) magnetospheric ions, introducing a new scale. When magnetized low-energy ions are present, the Hall currents carried by electrons can be partially cancelled by these ions. The electrons and the magnetized low-energy ions EB drift together. We use MMS spacecraft observations of magnetic reconnection separatrices to verify that when a mixture of ions of very different temperatures is present in reconnecting plasmas, the Hall effect is significantly modified. In addition, at smaller scales, the relative drift between hot (unmagnetized) ions and cold (magnetized) ions can cause lower hybrid waves, heating the initially cold ions. However, some of the cold ion populations can remain at low temperature. At larger scales, jets of cold ions can be observed hundreds of ion inertial lengths from the reconnection X-line. We discuss recent observations and conclusions concerning the effects of cold ions at the magnetopause.