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Magnetic reconnection at the magnetopause: Low-energy ions and modification of the Hall physics

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We use statistics from the Cluster spacecraft and 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 ExB drift together. We investigate magnetic reconnection separatrices at various magnetopause locations, using MMS and Cluster spacecraft observations. We verify that when a mixture of ions of very different temperatures is present in reconnecting plasmas, the microphysics related to the Hall effect is significantly modified.