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The transition between anti-parallel and component magnetic reconnection at the Earth's dayside magnetopause

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Magnetic reconnection at the Earth's magnetopause is discussed and has been observed at times as anti-parallel and as component reconnection. While anti-parallel reconnection occurs between magnetic field lines of (ideally) exactly opposite polarity, component reconnection (also known as the tilted X-line model) has classically predicted the location of the reconnection line to be anchored at the magnetopause standoff location, extending continuously along the dayside magnetopause. The ratio of the IMF By to Bz components determines the tilt of the X-line relative to the equatorial plane.
A reconnection location prediction model known as the Maximum Magnetic Shear Model combines these two scenarios. The connection points between the anti-parallel and the component reconnection lines are known as 'Knee' regions. Using a MMS data base of confirmed magnetopause X-line locations from Phase 1a of the mission, this study shows that the location of the Knee region depends strongly on the local draping conditions of the IMF across the magnetopause. From these locations, we conclude that magnetic reconnection at the Earth's dayside magnetopause preferentially occurs in the anti-parallel locations, and only occurs along component reconnection line segments when the draped IMF field lines no longer have contact to an anti-parallel reconnection region at the magnetopause.