Multiscale Nature of the Magnetotail Reconnection Onset

- In this study we combined for the first time in 3D PIC simulations multiple features of the pre-onset magnetotail: magnetic flux accumulation and ion-scale thin current sheet formation earthward of it (inferred from mining substorm data), solar wind driving and negative charging of the current sheet with electrons being the dominant current carriers.

- The obtained multiscale onset description reveals a new feature, electron and ion watersheds (WSs): diverging flows forming before the topology changes and likely driving those changes; electron WSs are embedded into a single ion WS.

- PIC simulations of embedded WSs agree with MMS observations.

Embedded electron and ion watersheds are important precursors of the magnetotail reconnection onset that also reveal its multiscale nature.