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The thinnest current sheets in the solar wind

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We present 50 current sheets (magnetic field discontinuities) with spatial scales below a few ion inertial lengths (crossed faster than 4 seconds) observed by the Cluster spacecraft in the solar wind. The local coordinate system of a current sheet is determined using the combination of the MVA (Minimum Variance Analysis) and the time delay (timing) methods. Using these methods we have selected locally one-dimensional current sheets and computed the propagation velocity of a current sheet in the satellite reference frame, the current densities and the current sheet spatial scale. The analysis has shown that the thinnest current sheets in the solar wind are commonly force-free, i.e. the current density is predominantly parallel to the magnetic field. We provide statistical distributions of the current density amplitude, spatial scale and characteristic plasma parameters (density, temperature, plasma beta) and argue that ions should be non-gyrotropic. The thinnest current sheets have current density amplitudes from a few tens up to 50 nA/m̀2 that makes them important factor for particle heating in the solar wind.