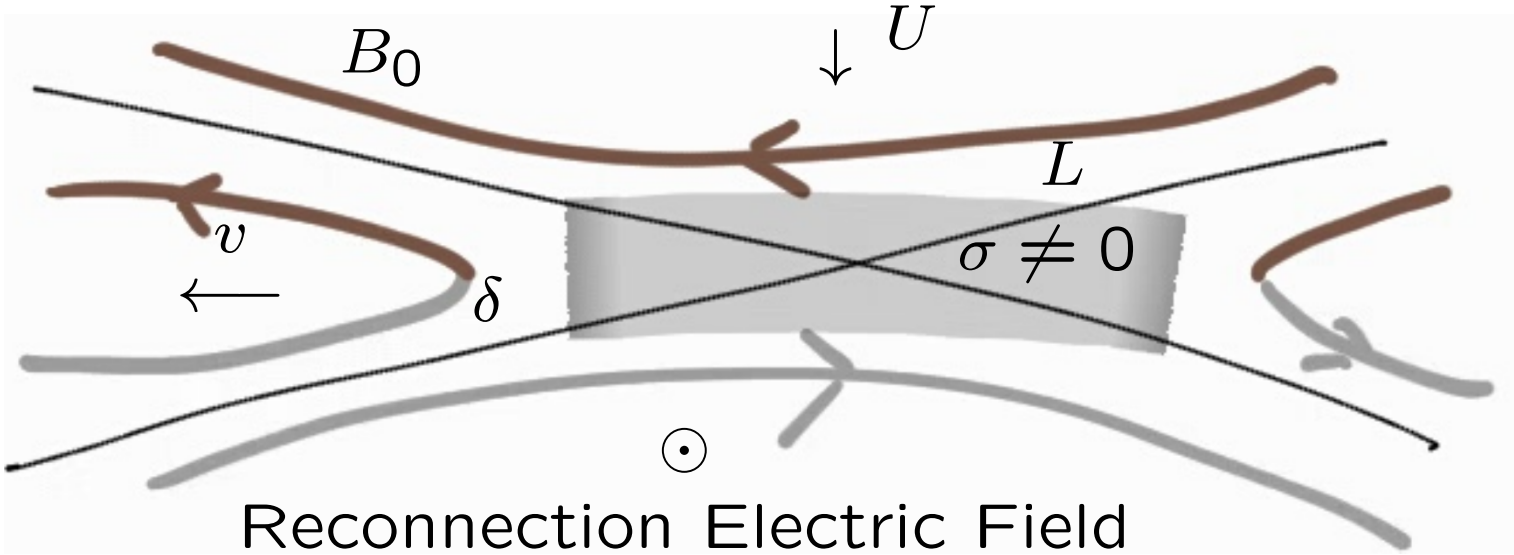
Reconnection converts Mag. energy into Kin. energy



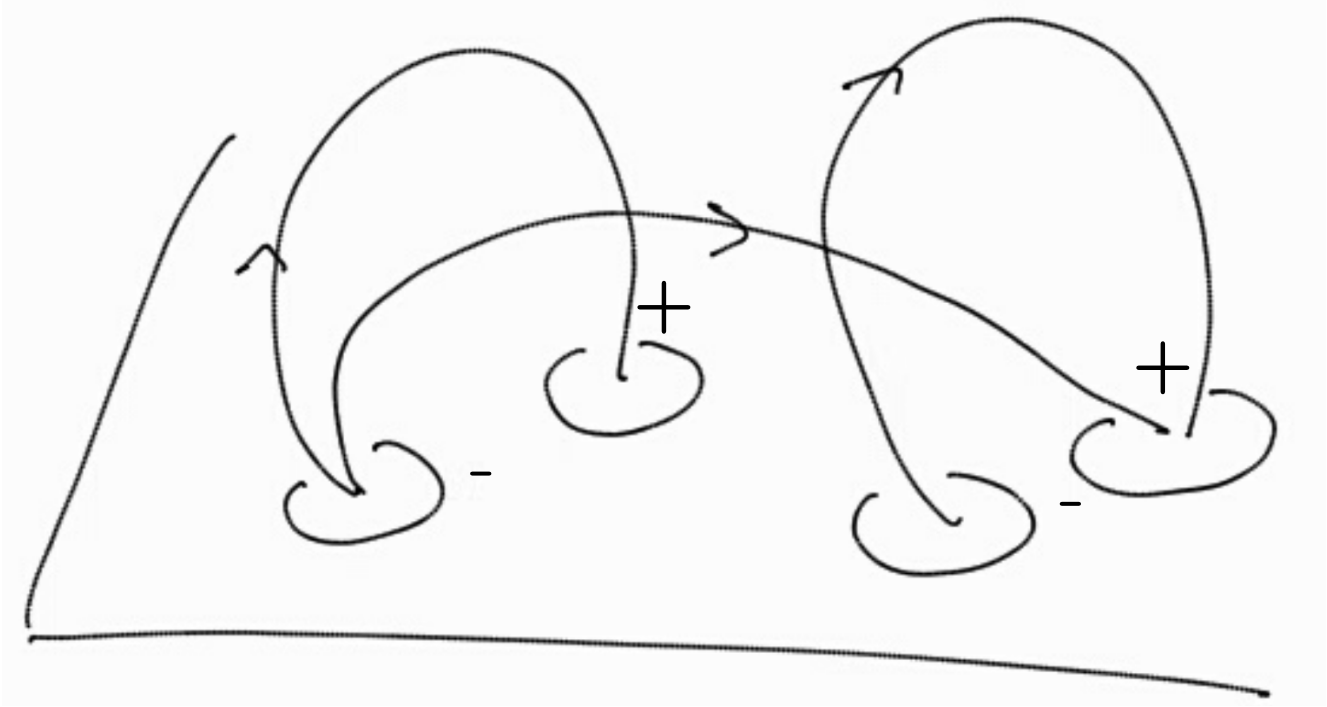
Reconnection Electric Field

Sweet-Parker model needs resistivity : slow

Petschek model : needs a fast shock

$\longrightarrow$ quite "simple" picture in 2D

Solar prominence merging [Aulanier et al., ApJ 2005]



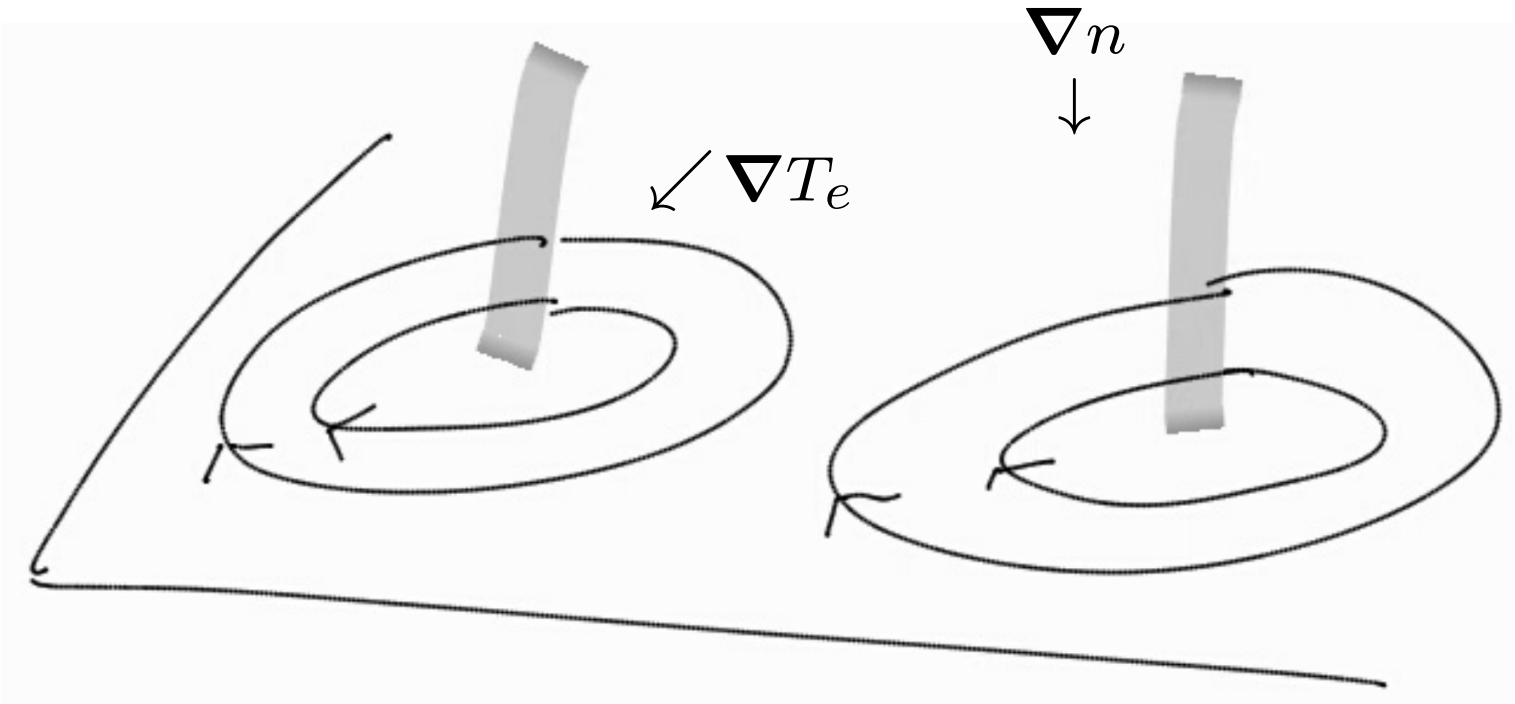
Cold dense tube in hot tenuous coronna, $\beta \sim 10^{-2}$

$\longrightarrow$ 3D geometry : complicated for "sleepy reconnection"

Orders of magnitude

	HED Plasmas	Solar corona
Magnetic field	100 T	0.01 T
density	10^{27} m^{-3}	10^{14} m^{-3}
Temperature	400 eV	20 eV
Resistivity (Spitzer)	10^{-7} m^2.s^{-1}	1 m^2.s^{-1}
Lundqvist Numb.	200	10^{10}
Beta parameter	100	10^{-3}
Ion cyclotron freq.	1.7 GHz	1 MHz
Ion skin depth	10 μm	20 m
Alfvén speed	20 km.s^{-1}	2000 km.s^{-1}
Sound speed	200 km.s^{-1}	2 km.s^{-1}
Ion thermal speed	300 km.s^{-1}	3 km.s^{-1}

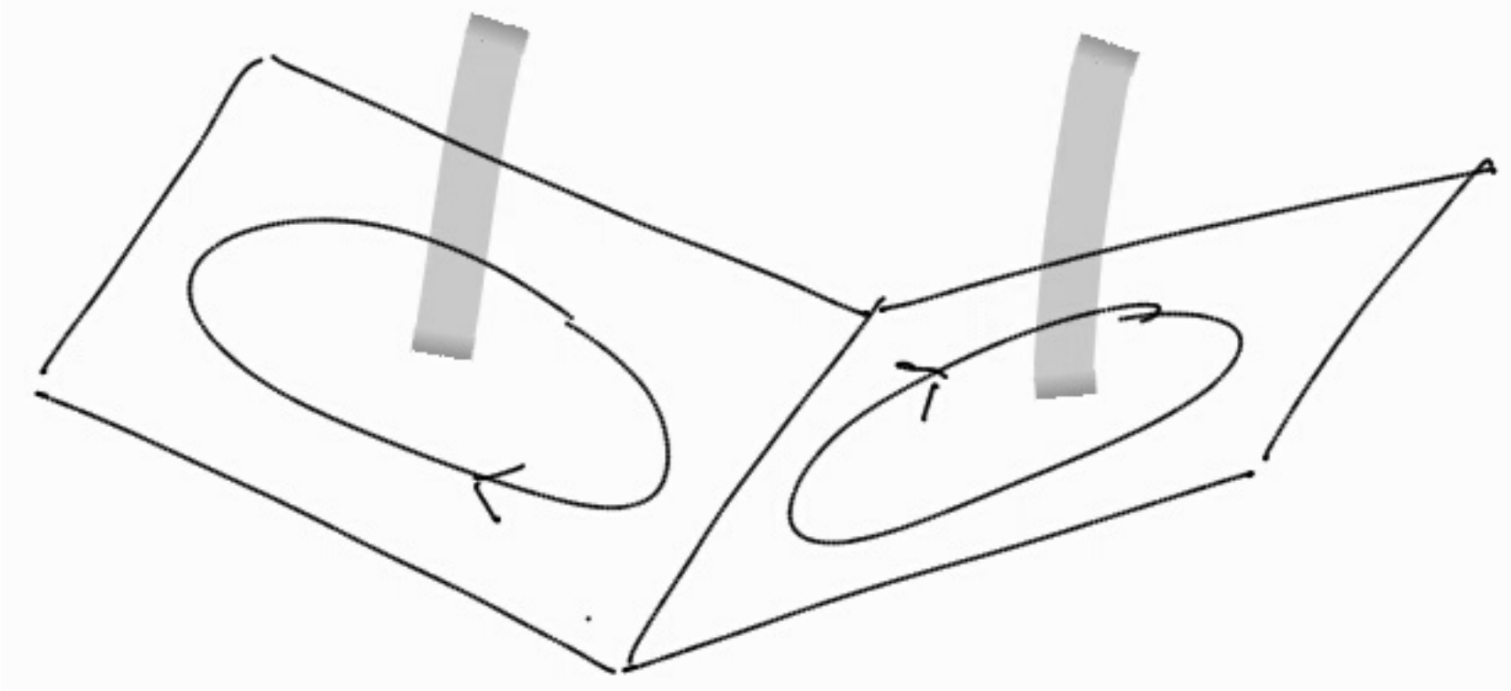
With high-intensity Lasers... [Nielson et al., 2006]



2 hotspots on solid target (Au foils of few μm thickness) :

$\rightarrow$ 2 anti-parallel Magnetic loops (Biermann-Battery effect)

When folding targtets [Smets et al., 2014]

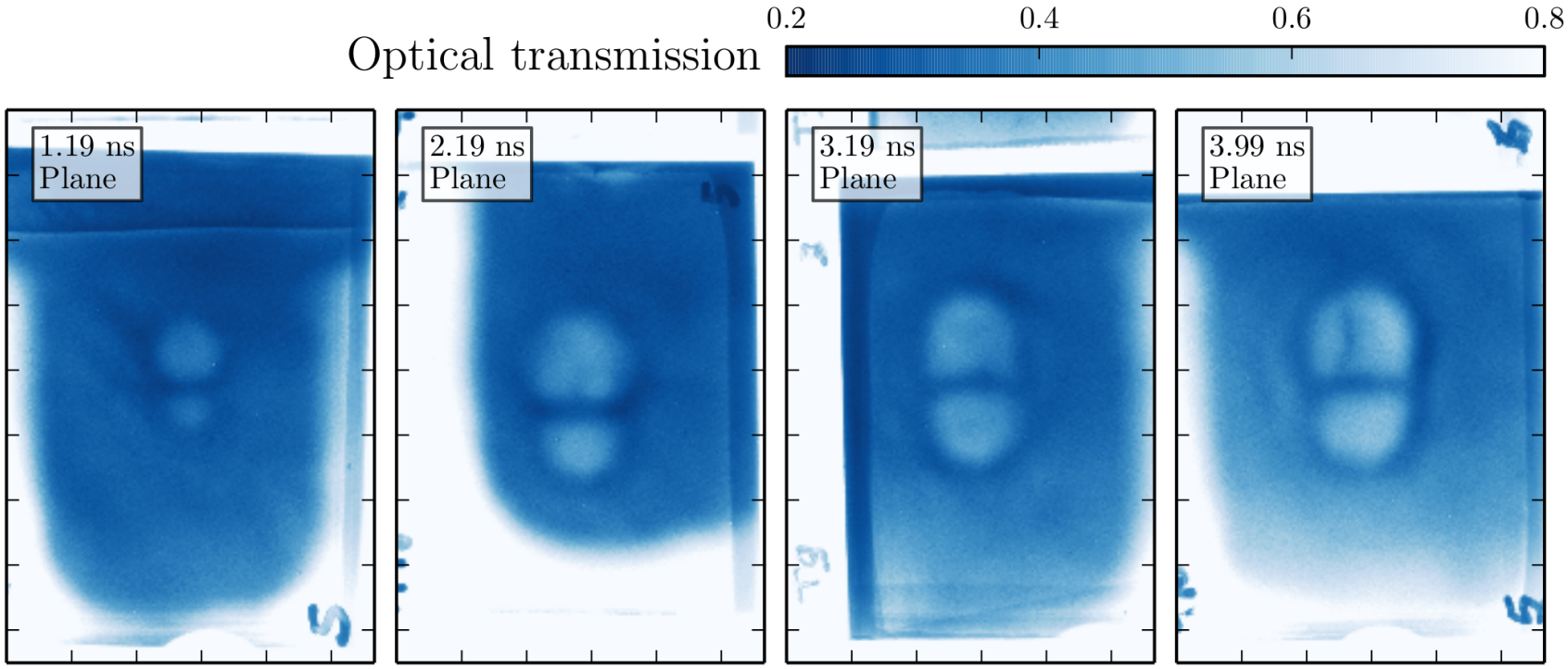


Initial out-of-plane magnetic field : Quadripolar structure

$\rightarrow$ Reconnection rate depends on sallient/reverse angle

$\rightarrow$ 6 shots scheduled on LMJ/PETAL : end of 2017

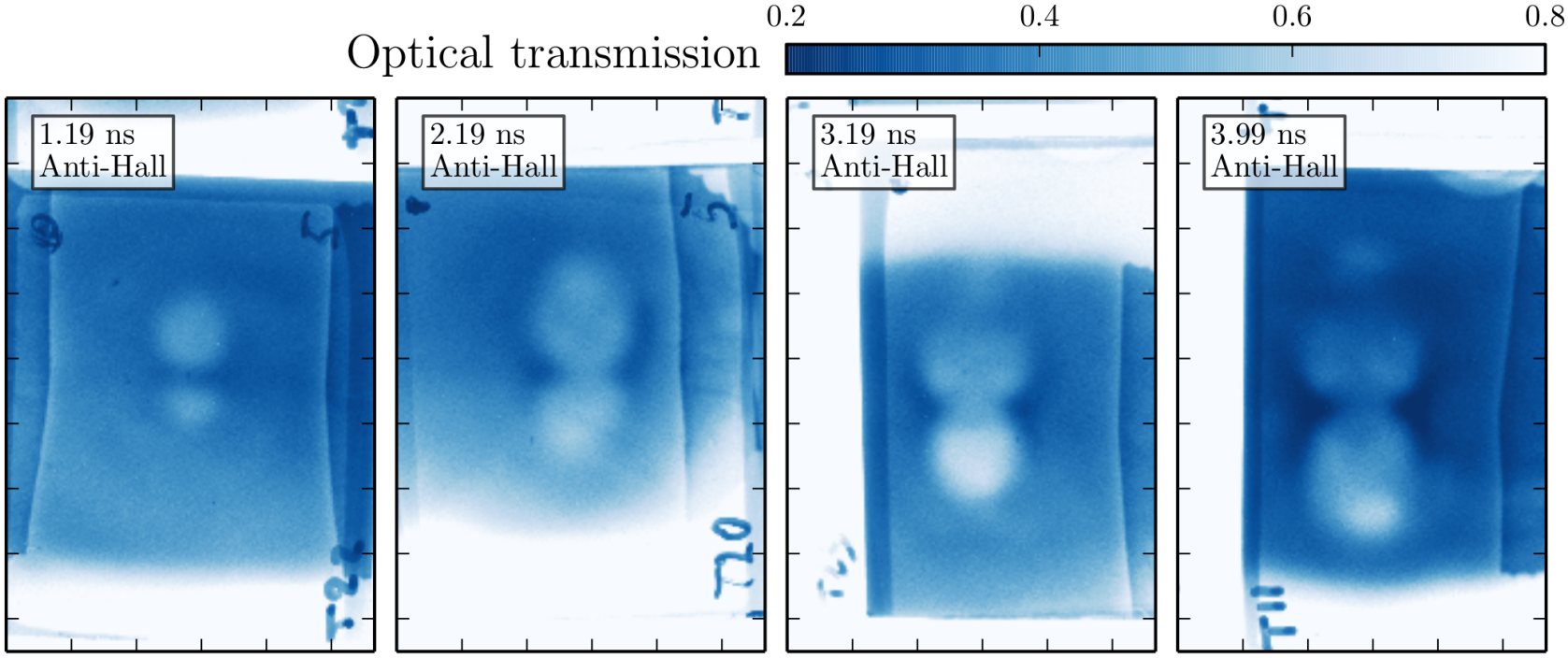
LULI 2000 : 2 beams with 200 J & 4.0 ns each



→ The 2 magnetic shells get compressed and get flat

→ On the reconnection sheet, protons are weakly scattered

LULI 2000 : 2 beams with 200 J & 4.0 ns each



→ No more flat sheet betweens the 2 shells

→ Reconnection inhibited ?

LMJ/PETAL shots end of 2017

- 12 kJ, 5 ns with 4 quads
- Increase magnetization & shorten reconnection process
- High Z target decreases the β value down to ~ 1
- Proton radiography (PETAL+ 300 J, 0.7 ps)

$\rightarrow$ Get (integrated) E & B fields at different times

- DP1 X-ray imager : 12 images with resolution of 130 ps

$\rightarrow$ a sequence of 2D images

- DMX Spectrometer : X-rays spectra resolved in time

$\rightarrow$ measure the black-body spectrum of $T \sim 100$ eV plasma