Edge Plasma Parallel vs Perpendicular Transport Studies at Major US Facilities

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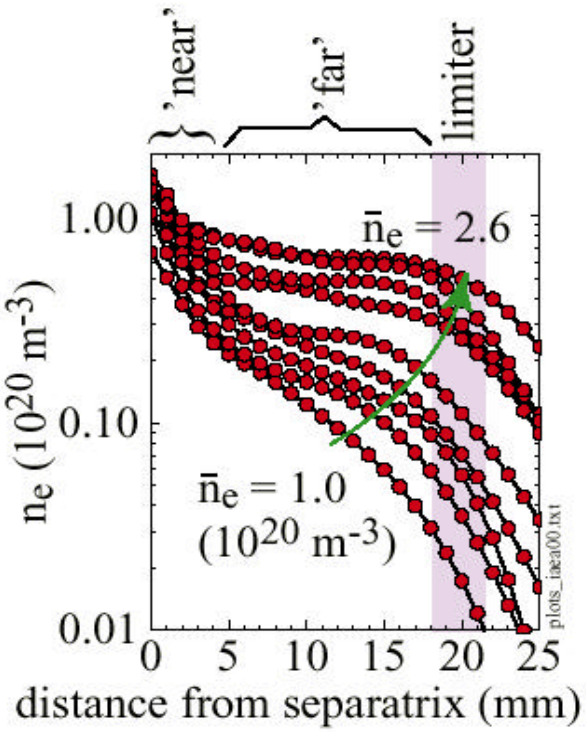
Boundary Physics Edge Transport Session
NSTX 5 Year Planning Ideas Forum
Princeton, NJ
June 24-26, 2002

Edge, SOL and divertor transport studied at C-MOD and DIII-D

- Cross-field transport largest focus of C-MOD edge program
  - two-zone SOL structure
  - transport bursty, not diffusive in far SOL
  - perpendicular heat convection can dominate over parallel conduction in far SOL
- DIII-D focuses on X-point transport
  - role of flows across private-flux region
  - installing divertor CER system
- NSTX can contribute though GPI; what else?

Edge Plasma Transport - perpendicular transport



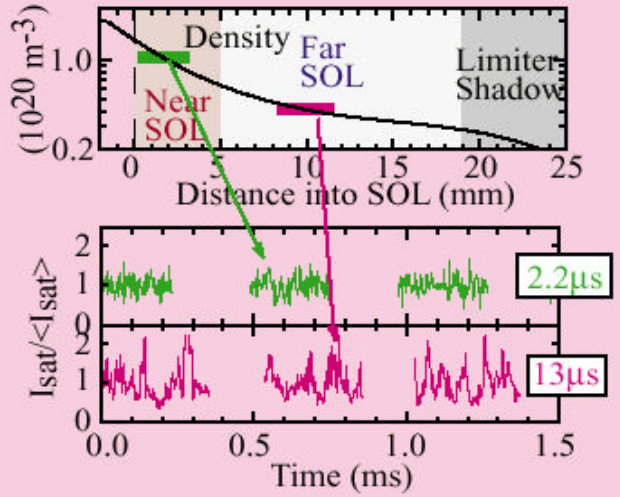
- SOL has a two-zone structure (C-Mod, ASDEX-Upgrade, DIII-D)
  - 'near' to separatrix - sharp gradient
  - 'far' layer - broad, out to limiter
- $n_{e,lim}$, Γ_{lim} , $P_{midplane} \propto \bar{n}_e^3$.
  - ⇒main chamber sources for fueling and impurities
  - ⇒⊥ particle transport stronger than thought (5x Bohm in far SOL) - 'bursty'.
  - ⇒diffusive description does not appear to be the proper representation.
  - ⇒⊥ heat convection can dominate over parallel conduction!

- Does radial transport play a role in the density limit?
- Can we quantitatively link the observed tubulence with measured steady-state fluxes?

B. Lipshultz, C_MOD/DIII-D 5 year Plan Workshop June 2002

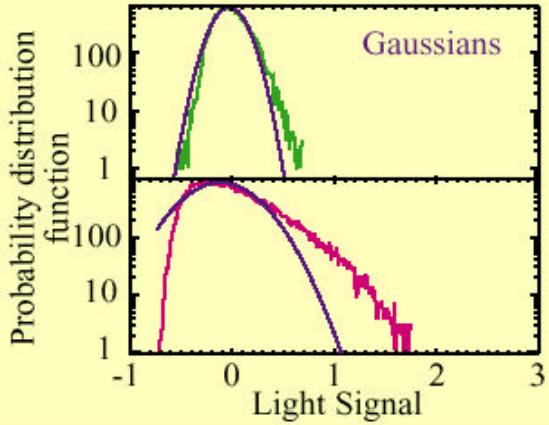
Edge Plasma Transport: Turbulence

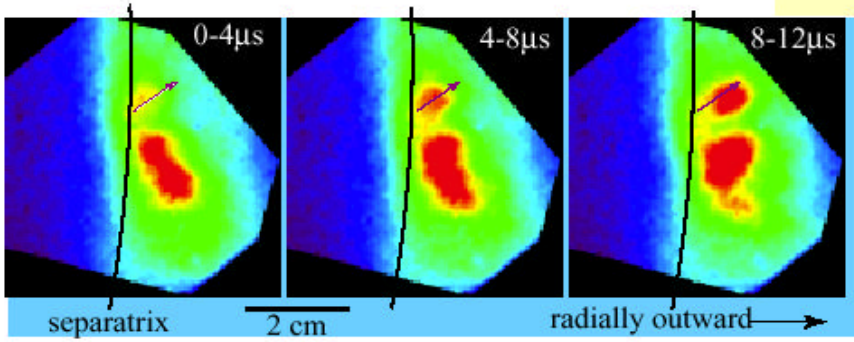
Probe data: 'bursty' transport prominent in far SOL



Dα data:

- 'bursts' have non-Gaussian statistics
- phasing shows radial propagation
- $v_{radial} \leq 500$ m/sec





(S. Zweben, J. Terry)

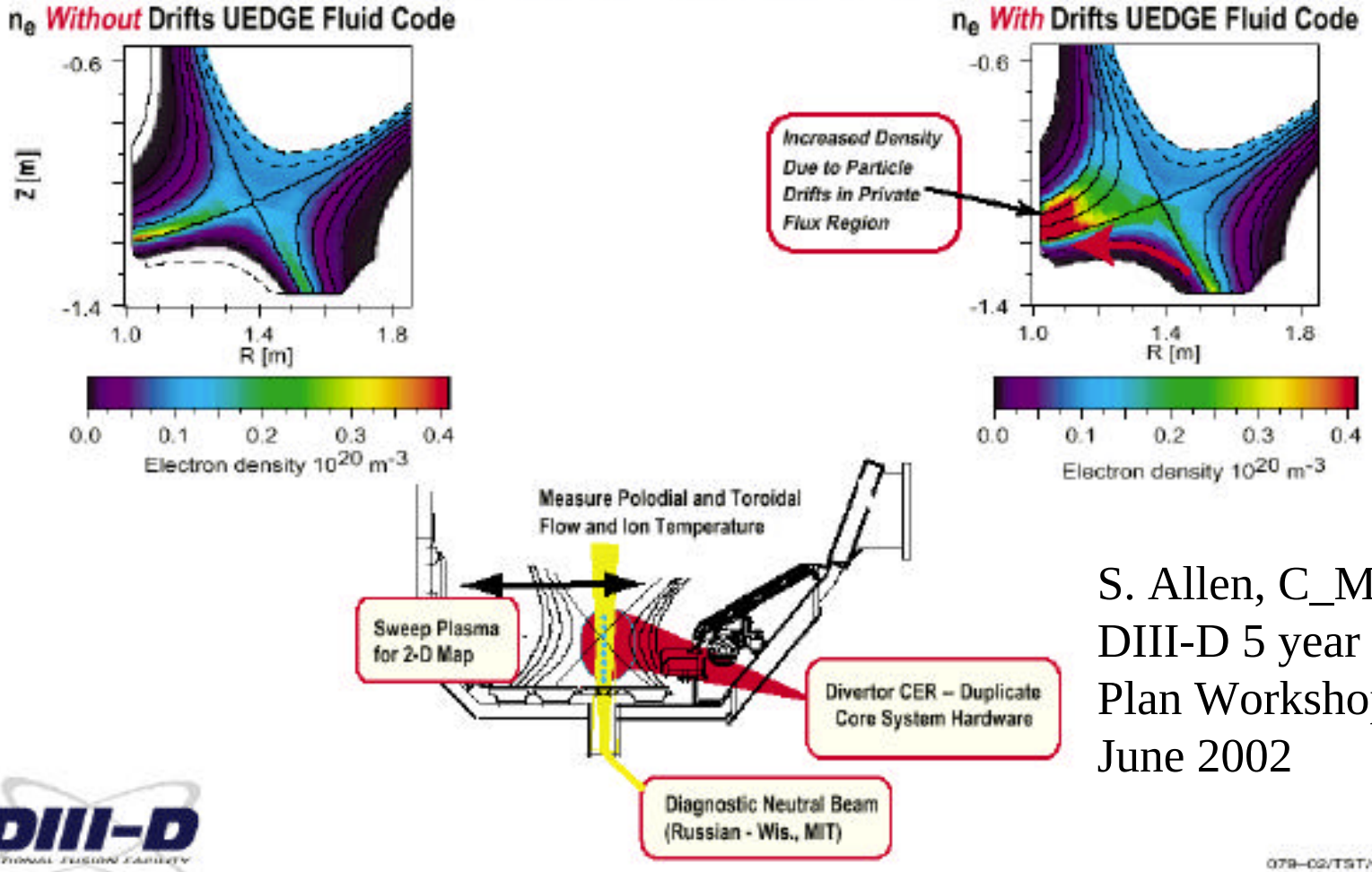
Gas puff imaging of Dα:

- movement of 1 cm size 'blobs',
- velocity same as 'bursts'
- 'bursts' and 'blobs' appear to be the same.

Divertor & Edge Physics, National tokamak workshop June 10-12, 2002

BOUNDARY SCIENCE KEY PHYSICS TOPIC: PARTICLE DRIFTS AND FLOWS

- UEDGE fluid modeling shows particle drifts increase density at inner strike point
- Measurements of particle drifts are a key component for physics understanding



S. Allen, C_MOD/ DIII-D 5 year Plan Workshop June 2002