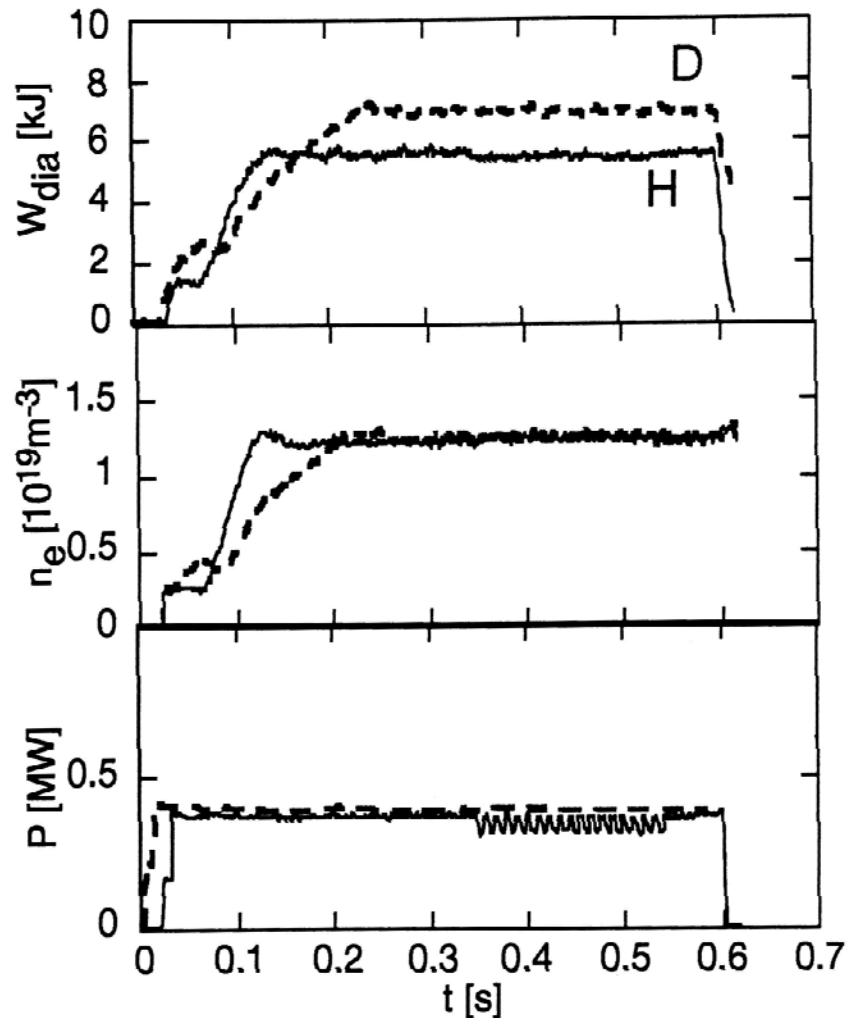


Promotion of Deuterium Experiments on TJ-II and Heliotron J

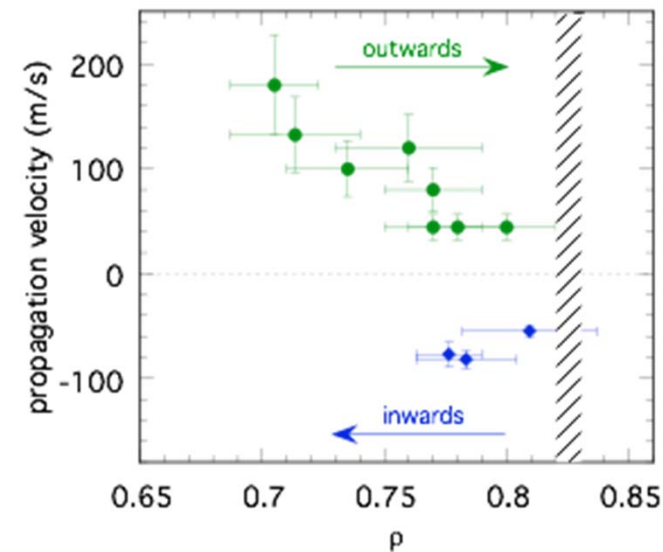
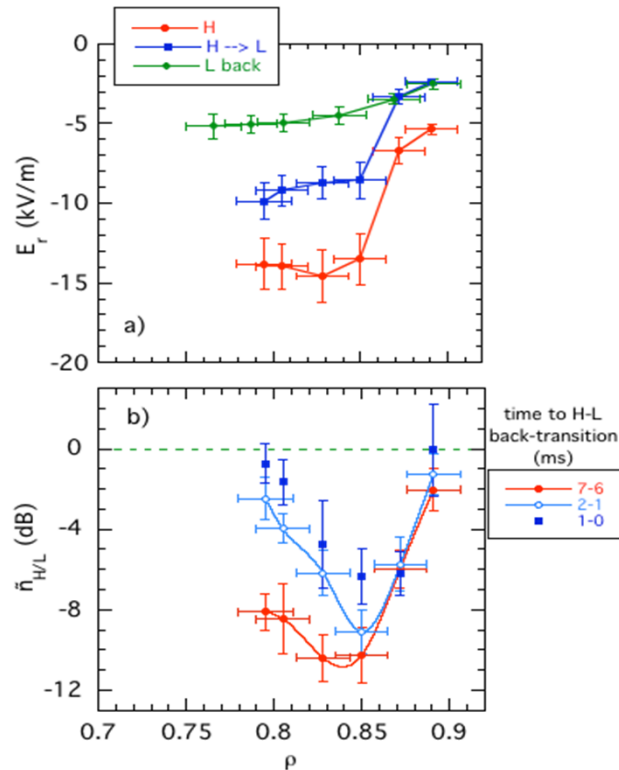


**Isotope effect is
an unresolved mystery
critical to prospect burning
plasmas**

*Now we have fancy references
to challenge this issue !*

TJ-II has been particularly active and successful in the physics of the L-H transition

Turbulence spreading and spatiotemporal dynamics of turbulence and flows at the L-H transition in TJ-II



The radial propagation velocity decreases as the oscillation pattern approaches the E_r shear position at $\rho = 0.82$.

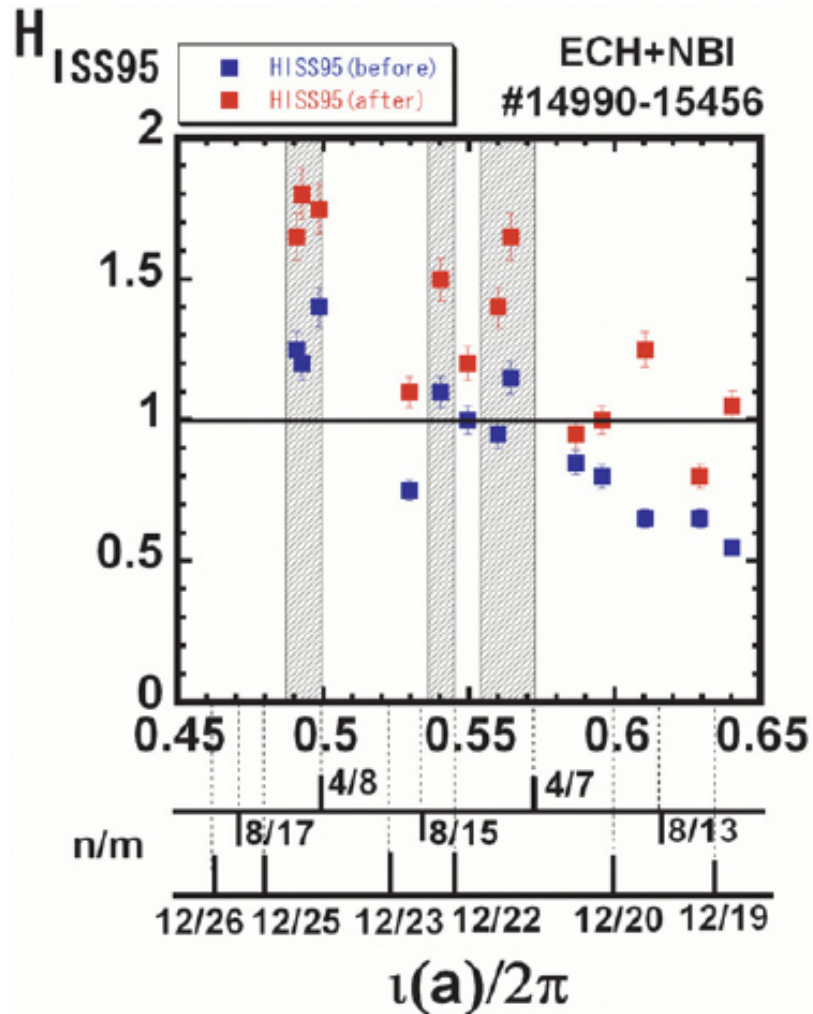
Depending on the shearing rate level, turbulence can penetrate transport barriers with the subsequent impact on transport barrier width.

T. Estrada *et al.*, NF **51**, 032001 (2011)

The results show the need of approaching L-H transition studies within a one-dimensional spatio-temporal framework.

T. Estrada *et al.*, PRL **107**, 245004 (2011)

Heliotron J has shown peculiar windows
for H-mode transition (like W7-AS)



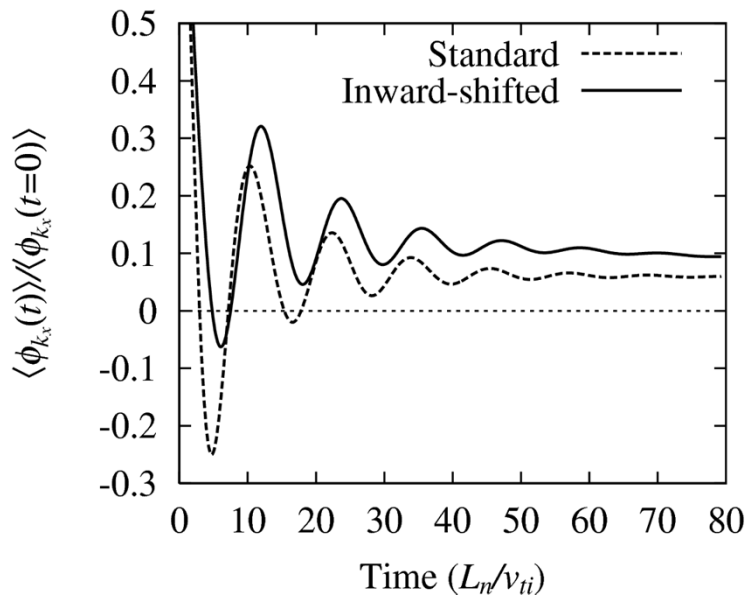
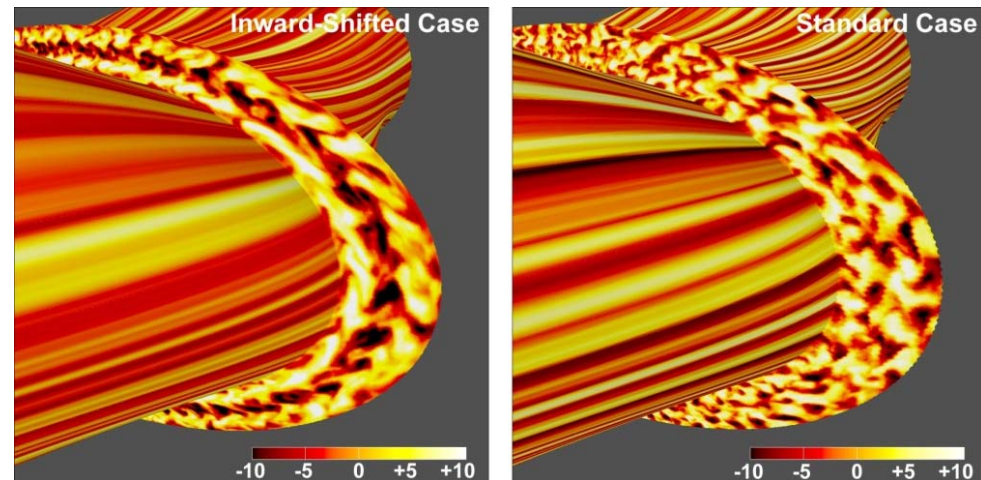
related to poloidal viscosity ?

3-D Effects on Zonal Flow

- Zonal flow response in tokamak (Rosenbluth & Hinton)
- Zonal flow response (collisionless) in 3-D is correlated with neoclassical transport

Collisionless long-time response of zonal flow

$$K \equiv \frac{\langle \phi_{k_x}(t = \infty) \rangle}{\langle \phi_{k_x}(t = 0) \rangle} = \frac{1}{1+G} \approx \frac{1}{1+1.6q^2/\epsilon^{1/2}}$$



Reduced helical ripples (reduced 3-D neoclassical transport) → large residual zonal flow

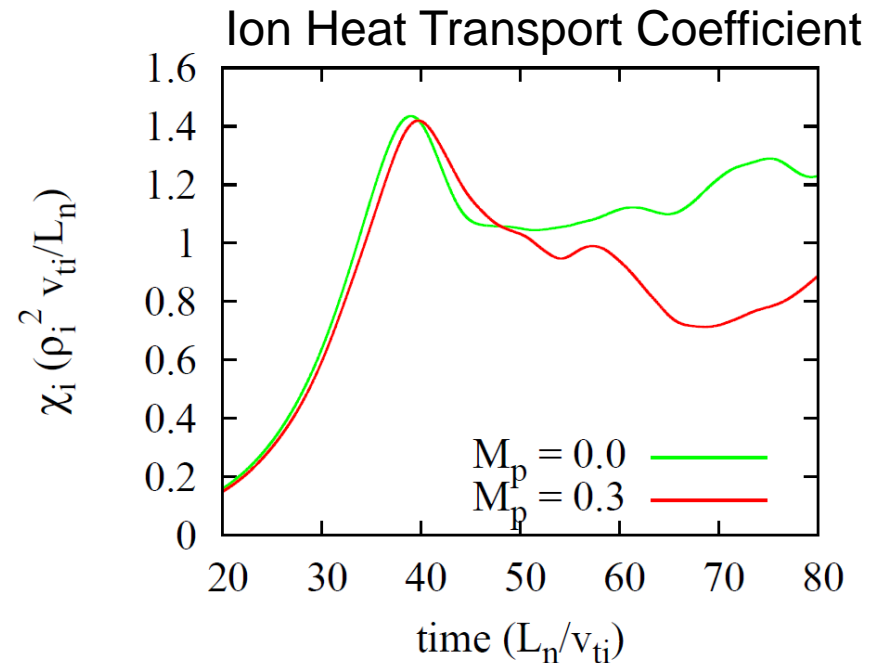
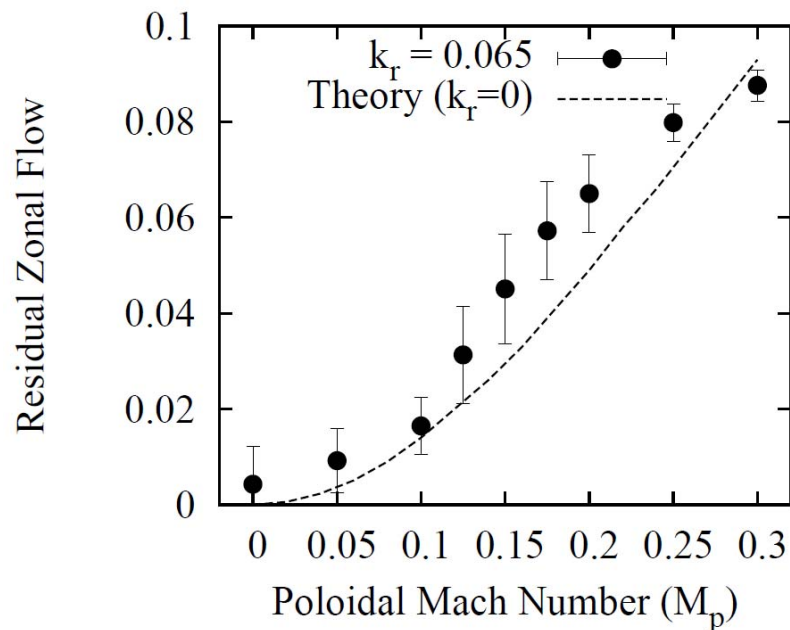
GKV simulation results for the standard and inward- shifted LHD configurations
(T.H.Watanabe *et al.*, Phys. Rev. Lett. 2008)



Poloidal Rotation Amplifies Zonal Flow Response in 3-D (LHD)

- Residual ZF amplitude increases with poloidal Mach number M_p
- M_p increases E_r

$$M_p = \left| \omega_\theta \frac{R_0 q}{v_{ti}} \right|, \quad \omega_\theta = -\frac{cE_r}{r_0 B_0}$$



$$\phi(t) = \frac{\phi(0)}{1 + G_p + G_t + M_p^{-2}(G_{ht} + G_h)(1 + T_e/T_i)}$$

(Sugama & Watanabe, Phys. Plasmas 2009)

After saturation of the ITG instability growth, the heat flux in case with $M_p=0.3$ is more effectively reduced, where the effective zonal flow generation is observed