

Physics Analysis – NSTX Team Mtg (7/23/03)

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- **Implementing equilibrium solutions with strong toroidal flow**
 - EFIT (Sabbagh): magnetics reconstruction/free boundary
 - Ability to use CHERS T_i , v_ϕ , TRANSP $p(r)$ as constraints
 - Ready for testing
 - FLOW (Guazotto): fixed boundary solution using thermal $p(r)$, fast $p_\perp, p_\parallel$ profiles
 - Solution with v_ϕ , pressure anisotropy
 - Integrating into TRANSP
 - Plan to benchmark codes for individual cases
- **Neoclassical theory (Wang)**
 - Developed framework valid for finite Δ_b/r near axis, large ρ/L (GTC-NEO)
 - Includes bootstrap current as well as transport coefficients with self-consistent E-field dynamics
 - Finds non-local transport near axis (heat flux independent of local T_i gradient)
 - Ready for testing on specific NSTX equilibria

- **Resistive wall modes**

- Parallel version of M3D upgraded to include resistive wall in vacuum region (Strauss, Breslau)
- Benchmarking underway for $n=0$ mode; will then extend to $n=1$

- **Kinetic effects on MHD**

- M3D-K upgraded to include realistic energetic particle distributions
- Will be used to model low- n TAE modes

- **RF**

- Differences found between HPRT and CURRAY simulations of NSTX
 - Further benchmarking plus a critical comparison of absorption models will be pursued (Mau)
- CQL3D/GENRAY code used to model fast ion distributions in combined HHFW/NBI exp'ts. (Rosenberg, Harvey)
 - Reasonable agreement with NPA observations
- Work underway with ORNL to include non-Maxwellian species in AORSA (through SCIDAC)
- HHFW power partitioning to electrons and ions altered significantly by anisotropic fast ions
 - Dumont invited talk at RF conference, May 2003

- Toric IV implementation
 - Standalone version being parallelized, benchmarked against AORSA at MIT (Wright)
 - Install on PPPL cluster later this summer
 - Progress on integrating into TRANSP (McCune): need additional input from Brambilla's group
- **CHERS data regenerated and transport analyses rerun**
 - Additional atomic physics effects implemented
 - Carbon density profile for $Z_{\text{eff}}(r)$
 - TRANSP gives 10-15% lower stored energy than EFIT
 - Power balance “well-behaved” for the most part
 - Still some regions of negative χ_i near edge (6 out of 40 times examined in 25 runs)
- **Presentations and Publications**
 - 1 invited/9 contributed presentations at EPS
 - R. Maingi IAEA paper accepted for publication in Nuclear Fusion
 - “L-H transitions in NSTX” by S. Kaye et al. accepted for publication in Physics of Plasmas