Summary of Plasma Edge/PMI modeling – Aug. '11 PFC Meeting

1. **PFC sputtering response modeling for NSTX, C-Mod, DIII-D; Brooks**
   - NSTX: Li surface has high erosion, low core concentration; inner Mo divertor surface changed in 1 sec by Li and C impingement, low core concentration
   - CMOD: tungsten tile analysis underway, indicates >90% redeposition
   - DIII-D: DiMES Mo expt. just performed, analysis begun

2. **Analysis of alternative divertor designs for reducing peak heat-flux; Rognlien, Rensink, Ryutov, Umansky**
   - NSTX: UEDGE analysis of snowflake divertor expt. shows heat flux reduction
   - TCV: Observed reduction in ELM surface power for snowflake partly length effect
   - SOL currents change ELM sheath potential; radiative divertor option for ACT-1

3. **Modeling of melt layer splashing and losses of PFC; Miloshevsky & Hassanein**
   - Viscosity shown to have destabilizing effect on Kelvin-Helmholtz instability
   - Adding boiling/vaporization stabilizes short wavelengths, destabilizes longer
   - Viscous potential flow model predicts fine structure ligaments in TEXTOR

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4. **Advanced integrated modeling of transient effects on tokamak PFCs; V. Sizyuk & Hassanein**
   - HEIGHTS further parallelized with gyrokinetic particles escaping core plasma
   - Incident PFC fluxes from ELMs and disruptions modeled in actual ITER geo.
   - HEIGHTS ready for full integrated simulation in 3D with real geometry

5. **Progress in empirical plasma reconstruction of the NSTX divertor; M.A. Jaworski, T.K. Gray, A. McLean et al.**
   - Non-local Langmuir probe interpretation indicates non-Maxwellian electron distribution functions in NSTX divertor
   - NSTX OEDGE modeling begun; comparison of probe interpretation and non-local method (NLM) shows latter gives better agreement with thermography
   - Further modeling planned to understand electron distribution; use for OEDGE

6. **Physics design calculations for the W7X divertor scraper element; J. Lore, J. Canik**
   - Added scraper surface reduces hot spots in W7X island divertors
   - Will use EMC3-EIRENE for full edge plasma/neutral modeling

Some key issues/needs

- **Scrape-off layer plasma behavior**
  - Predictable model of near-separatrix divertor heat-flux width
  - Predictable model of filamentary (blob) plasma incident on walls

- **Surface material interactions**
  - Resolving redeposition – reduced sticking, enhanced sputtering
  - Response to transient events: especially ELMs, disruptions
  - Hydrogen trapping and mixed material characterization

- **Dynamic coupled modeling of plasma and surface material**
  - Present status is hand-based data transfer via files; static
  - Materials SciDAC call offers opportunity for substantial progress