CEMM Mtg: Model Development And Closures Workshop?

- ***Extensions* of MHD computer models? — code *status*, *hybrid* models**
- ***Status* of M3D, NIMROD codes (need "simple, implementable" models):**

  Ideal and resistive MHD — well developed, working well

  Two-fluid and gyroviscosity — being implemented, tested

  Next frontiers — hybrid fluid/kinetics: δf, continuum kinetic-based dissipative closures

- ***Hybrid* MHD/kinetics approaches are being explored in various ways:**

  Continuum drift-kinetics $\Longrightarrow$ $q_\parallel$, $\pi_\parallel$ closures — E. Held

  Add δf energetic particle effects to MHD codes — G. Fu, C. Kim

  Add magnetic field and fluid effects to gyrokinetic δf codes — S. Parker

  More precise classical, neoclassical gyro, $\perp$ viscosities — P. Catto, A. Simakov

  Multi-scale initiatives, e.g., magnetic islands plus microturbulence — various

  Careful drift-kinetic/fluid ordering for ECCD effects on NTMs (SWIM) — J. Ramos

  Transport equations from fluid equations with kinetic-based closures — J. Callen

  ...

Different Communities Have Different Perspectives

- **MHD:**

  Solve for $\vec{B}(\vec{x},t)$ field, obtain current from $\mu_0\vec{J} = \vec{\nabla}\times\vec{B}$; nonlinear phenomenologies.

  Need to add self-consistent kinetic-based closures to access near transport time scales.

- **Gyrokinetics:**

  Solve for $\tilde{\phi}(\vec{x},t)$ from Poisson's equation, add $\tilde{\vec{A}}_{\|}$ effects; micro-turbulence.

  Extending time scale toward transport time scale (growing weight, algorithm issues).

  Ultimately they expect to include "everything" — so they don't need other groups.

- **Sources & sinks (NBI, RF):**

  Determine transport-level mom. ($\vec{J}$), energy inputs to plasma with limited feedback.

- **Integrated modeling:**

  Mainly explore transport time scales, include all quantifiable models.

- **KEY QUESTION: How can we "integrate" all these models in an FSP? — when a rigorous, self-consistent "hybrid" theoretical model does not exist?**

Is Closures Or Physics Integration Workshop Needed?

- **Last "Closures Workshop" was held at ORNL, March 22-24, 2006.**

- **Should we have another closures workshop?**

  focus?

  timing?

  where?

  who makes meeting arrangements?

- **Should we encourage an "physics integration" workshop?**

  focus?

  timing?

  where?

  who makes meeting arrangements?

- **What's really needed to move MHD codes forward? — toward FSP?**