Near-Term Plans for Modeling NSTX HHFW Discharges

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CompX Modeling Plans (Bob Harvey)

- Complete ion first order finite-orbit-width addition to CQL3D
- Control room application of GENRAY & CQL3D for near inter-shot interpretation of NSTX HHFW+NBI discharges
- Completion of the full guiding center finite-orbit-width modification of CQL3D coupled to AORSA and GENRAY:
  - Modification of the synthetic diagnostics
  - Calculations of modified HHFW/NBI deposition, driven electron current, spectrum of ion losses to chamber wall, coupled power and momentum to the SOL

MIT Modeling Plans (Paul Bonoli)

- Investigate surface wave excitation in NSTX using the TORIC solver:
  - TORIC simulations for NSTX discharges with good core heating efficiency, perform 3-D field reconstructions, and confirm good core penetration of HHFW power
  - TORIC simulations for NSTX discharges with poor heating efficiency and significant surface wave excitation, perform 3-D field reconstructions, and confirm poorer penetration of HHFW power and surface wave excitation
  - Develop plans for any modifications to the scrape off layer model in TORIC that would be needed to reproduce the surface wave excitation results in NSTX

GA Modeling Plans (Myunghee Choi)

- Both NSTX NB-only & NB + HHFW shots indicated similar peaks of FIDA signals in measurements, while ORBIT-RF/AORSA simulations indicated more outward shifts due to accelerated beam ions up to a few hundred keV

- Plan to generalize Monte Carlo quasi-linear (MC QL) operator in ORBIT-RF/AORSA by including parallel acceleration and spatial diffusion associated with finite $k_{//}$ (In current MC QL operator, only perpendicular acceleration is included):

  - Rerun analysis of previously analyzed NB + HHFW shots (128739 & 128741) to see how these two effects affect the results

- Also planning to analyze more NSTX HHFW+NBI shots (including H-modes 134909 & 134911)

Modeling Plans (Cynthia Phillips) - I

- Resolve issues related to slow mode excitation in full wave simulations of NSTX discharges (with Fred Jaeger, Paul Bonoli, Lee Berry, David Green & David Smithe)
- Verify accuracy and consistency of ion absorption models in TORIC, AORSA and GENRAY (with Paul Bonoli, John Wright, Fred Jaeger, David Green, Lee Berry, Bob Harvey & Yuri Petrov)
- Continue work on generalizing the HHFW version of TORIC to include non-Maxwellian ions (with Paul Bonoli & John Wright)
- Begin development of routine to couple HHFW version of TORIC to CQL3D (with Paul Bonoli, John Wright, Bob Harvey & Yuri Petrov)

Modeling Plans (Cynthia Phillips) - II

- 1st year grad student, Joshua Burby, will work with Ernie Valeo and Cynthia on evaluating possibility of stochastic ion heating due to cyclotron resonance overlap for energetic ions in NSTX. (Bob Harvey, Yuri Petro & Gerrit Kramer will also be involved in these studies)

- Ernie Valeo is developing a variable mesh finite element code for modeling the rf fields in the edge (and maybe the core) of NSTX:
    - Examine possibility for reformulating the plasma dielectric response

ORNL Modeling Plans (David Green) - I

- Investigate impact of HHFW-induced edge localized eigenmodes seen in AORSA modeling of NSTX H-modes:
  - Do these waves exist in NSTX?
  - If so, how do they impact power absorption and heating efficiency?
  - Compare with experimental loading observations for co- and counter-scenarios (since these waves are predicted for only co- scenarios)
- Develop variable/adaptive mesh hot-plasma code capable of resolving both the core plasma and the antenna/Faraday shield:
  - Do not have a variable mesh hot-plasma code due to incompatibilities of the standard Stix dielectric tensor with standard variable/adaptive resolution frameworks
  - This could make possible a quantitative comparison of the edge wave fields with experiment

ORNL Modeling Plans (David Green) - II

- Examine the impact of finite ion orbits on HHFW simulation using the sMC/AORSA iterative coupling:
  - Utilizes a quasi-linear RF heating Monte-Carlo (MC) operator that correctly represents the wave-number spectrum of the wave-field solution, including the up-shift due to the poloidal field
  - This is in contrast to the standard MC approach which uses the Stix "kick" operator and assumes a single wave number from the cold plasma dispersion and ignores up-shift.
  - Simulation results will be compared to FIDA measurements
- Continue integration of the above AORSA-derived RF quasi-linear RF operator into NUBEAM & TRANSP