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## NSTX-U Waves & Energetic Particles

# EP Theory/Experiment joint research topics

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**NSTX-U WEP TSG Meeting**

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## Goal: identify 2 (+1) EP topics for Theory/Experiment joint research

- Provide initial guidance for Theory/Experiment joint research topics on Energetic Particles in preparation for next NSTX-U Brainstorming Meeting (March 2012) and 5-year Plan:

***“Identify key theory and modeling needs  
in support of the NSTX-U research program. Address key issues  
from the perspectives of both experiment and theory  
(including modeling/Computational Plasma Physics Group)”***

- 2 topics need to be identified for “Waves” – contact G. Taylor
  - 1 topic will be in common between Waves and EP:
    - *E.g., “Develop improved models for fast ion interactions with RF waves” [draft]*
- > **EP group needs to identify 2 topics – THIS MEETING**

# List of possible topics – EP research

| <u>Topic</u>   | <u>Description</u>  | <u>Notes</u>  |
|--|---|---|
| Improve stability calculations for Alfvénic modes                  | Validate and improve existing models for *AE stability calculation, with emphasis on ST geometry (low aspect ratio). Example: NOVA code, import $F_{nb}$ from NUBEAM? M3D-K, validate against NSTX data.  | Very important for R(14-2)  |
| Include externally-driven fields in numerical codes                | Develop tools to include externally-driven perturbations to existing codes. Perturbations range from sub-kHz (from external coils) up to CAE/GAE frequency range (from ad-hoc CAE/GAE antennae), including TAE band. Examples: couple IPEC to SPIRAL and/or M3D-K, or include *AE antenna models in RF codes and M3D-K. | Some aspects in common with Macro-TSG (e.g. IPEC code). Very general tool for NSTX-U.   |
| Validate quasi-linear models for AE-induced fast ion transport     | Apply quasi-linear models to NSTX data, compare with experiments, use for predictions of *AE-induced transport on NSTX-U.   | Might be very useful tool for R(14-2). Perhaps not general enough?                      |
| Implement constraints on fast ion distribution evolution in TRANSP | Use experimental data from fast ion diagnostics (NPA, ssNPA, FIDA, neutrons, sFLIP) to constrain the evolution of the fast ion distribution in TRANSP/NUBEAM.   | Powerful tool for TRANSP analysis. Good topic for collaborations with other facilities. |

---- **Other ideas?** ----