Behaviour of High-Z Impurities in NSTX-U

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BACKGROUND:

- core and boundary transport of high-Z impurities at low aspect ratio has not been thoroughly investigated
- open questions for NSTX-U high-Z PFC selection and future scenario and diagnostic planning/optimization

GOAL: gain 0^{th} order knowledge of high-Z impurity impact through Kr and Xe gas puffing

Experimental Approach

- **establish NBI-heated ELMy H-mode scenario and seed with varying levels of Kr (Z=36) and Xe (Z=54) [separately]**
  - recycling impurity, fueling location irrelevant
  - **low**: non-perturbing, contamination only seen on spectroscopy
  - **med**: radiation perturbations, weak non-linear effects (ELM freq.)
  - **high**: strong non-linear effects (T_e profile, MHD, disruption)
- **would like to test HHFW effects (modulate in above shots)**
  - sustain high-T_e, (offset radiation) prevent non-linear regime?
  - examine impact of wave heating on core and boundary transport
- **would like to test ELM control techniques (3D field, LiG)**
- **analyze 0D level via spectroscopy, AXUV diodes, ME-SXR**

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- **proceed responsibly through high-Z seeding strategy**
  - judge impact of retention at low seeding levels
    - metal machines ~ 1/10th retention of recycling gas shot-to-shot
  - schedule time for 'clean-up shots' (between Kr/Xe and other XPs)
  - consider in wider experimental scheduling w/r/t BZN, Li, etc.

Expected Contributions

- **possibly help inform high-Z PFC selection (TZM vs. W)**
  - is behavior of Kr and Xe significantly different indicating Mo (Z=42) PFCs would not be a good proxy for W (Z=74)?
    - is this expected based on achieved q/m, T_e-radiation physics?
- **begin demonstration of high-Z mitigation strategy**
  - are NSTX-U H-modes sensitive to on-axis core accumulation?
  - if so, does HHFW, ELM-control provide means to mitigate this?
- **contribute to future diagnostics for high-Z physics**
  - can the existing diagnostic set manage with the 2D n_z variation?
  - show (expected) insufficiency of AXUV diodes for power balance
  - provide critical impurity levels as input for future diagnostic design focused on quantitative core transport studies