Pedestal fueling variation in a closed divertor configuration at DIII-D


1. Motivation
- **GOAL:** determine the impact of particle source location on pedestal structure
- Different fueling schemes can vary the particle source profile:
  - NBI + pellet injection vs. NBI + ECH + gas puff
- Pedestal structure and stability affected

2. Experimental methods
- Vary particle input for different types of fueling:
  - Pellets and gas puff used to vary the neutral fueling rate from 12 torr/s to 42 torr/s
- Heating held constant throughout all the shots
  - switched from dominant NBI to dominant ECH heating to avoid core fueling with gas shots
- Generation of kinetic equilibria with CAKE [1]
- Profile analysis: OMFIProfiles [2]
- Filtering of ELM cycles and pellet injection time

3. Analysis
- Pellets and gas puff used to vary the neutral fueling rate from 12 torr/s to 42 torr/s
- Heating held constant throughout all the shots
- Generation of kinetic equilibria with CAKE [1]
- Profile analysis: OMFIProfiles [2]
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4. Pellet fueling changes the temperature gradient
- Increased fueling at constant pressure (limited by energy): decrease in temperature
  - NBI + pellets
  - ECH + gas puff
- Increased fueling at constant energy: increase in density
  - NBI + pellets
  - ECH + gas puff
- Increased pellet injection:
  - Increases the pedestal top density
  - Flattens the temperature gradient
  - [more cold particles are deposited farther in]
- Increased gas puff:
  - Shifts the density profile radially outwards
  - [more cold particles are deposited farther out]
- Pellets have a larger effect on pedestal gradient and width, which leads to denser core plasmas

5. Increased fueling decreases ELM size
- Higher fueling leads to higher ELM frequency
  - Decrease in size of large ELMs
  - Increase in frequency of small ELMs
- NBI-fueled cases have higher $W_{\text{MHD}}$
  - Slightly different base plasma for the two fueling scans
  - NBI-fueled cases have a larger PW-stability region
  - NBI responsible for better confinement, need to find other fueling scans

6. Fueling Profile Comparison
- Pellets shift the neutral fueling profile inwards:
  - More screening/flushing/recycling of Carbon
- Must consider recycling + gas puff losses in SOL

7. Fueling reduces impurities
- Impurity ion temperature and density both decrease with increased fueling
- Higher density leads to cleaner plasmas
  - More screening/flushing/recycling of Carbon

8. Conclusions
- At constant pressure and stored energy, a wide range of different fueling rates is shown to lead to different pedestal gradients
  - Different neutral fueling may change the transport
- Pellets fuel further inside of the plasma
  - Steeper and wider pedestals allow for greater fueling (higher density at constant pressure)
- Further work necessary:
  - Determination of transport properties from fueling profiles
  - Investigation of ion confinement
- SOLPS modeling: UP11.00040 (Thursday)

Corresponding author: anelson@pppl.gov

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