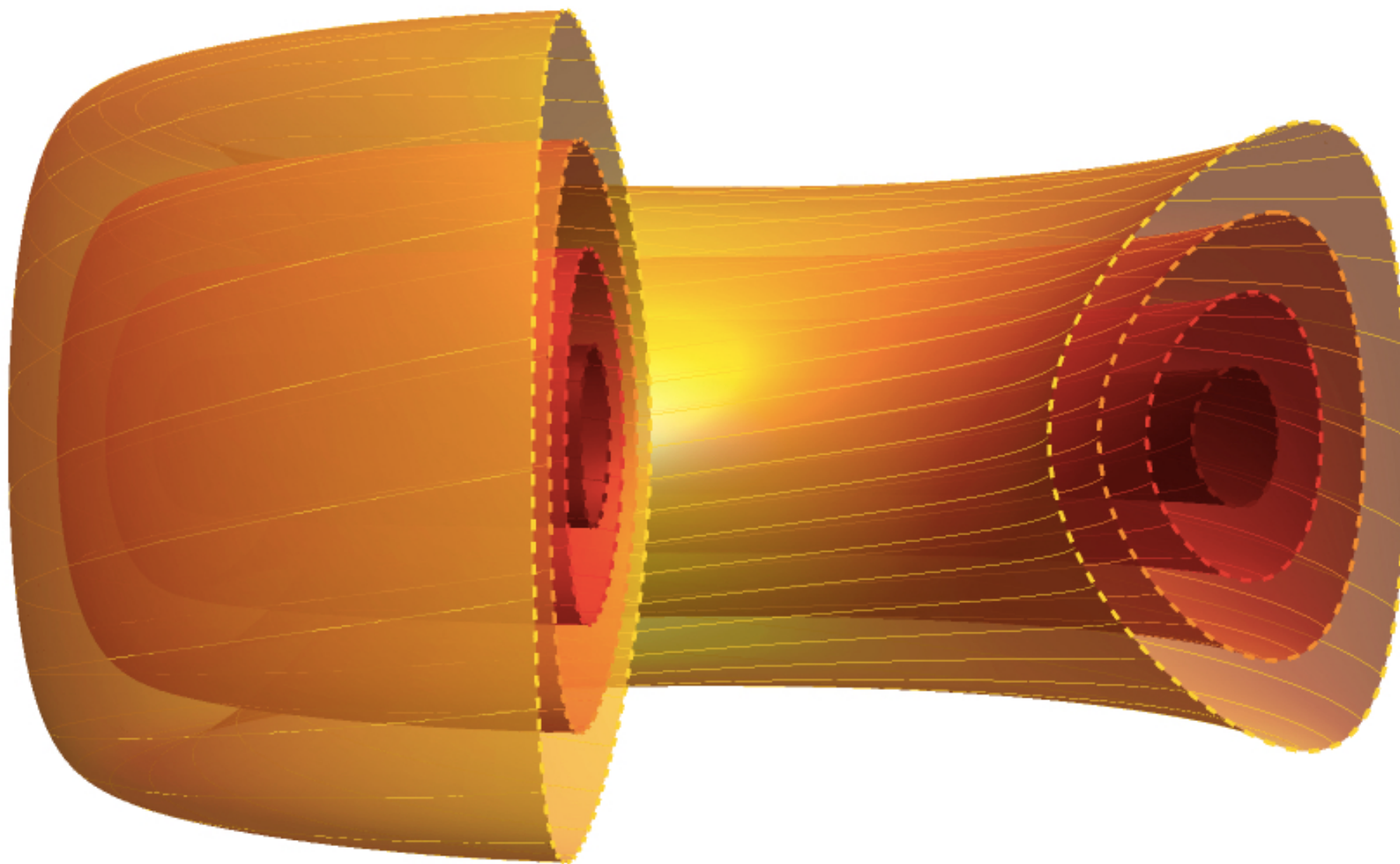


State of the art: MHD & fast particles summary discussion



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Alfvén eigenmodes

P. Oyola, et al. *IAEA* (2023).

A. Karpushov, et al. *EPS* (2023).

M.A. Van Zeeland, et al. *Nucl. Fusion* (2019).

G. Wei, et al. *arXiv:2508.14622* (2025).

- Fast particle-driven Alfvén eigenmodes seem either unaffected^[Mishchenko] or stabilized^[Oyoda] in NT, which appears consistent with experiment^[Oyoda,Karpushov, VanZeeland]
- Fast ion losses resulting from Alfvén eigenmodes are smaller^[Oyoda], which appears consistent with some TCV^[Oyoda,Karpushov], but not DIII-D^[VanZeeland]
- More significant effect of triangularity seen by linear eigenvalue code^[Wei]
- Density and safety factor profile effects might be the most important?

Pedestal ballooning stability

S.Yu. Medvedev, et al. *Nucl. Fusion* (2015).

A. Merle, et al. *PPCF* (2017).

S. Saarelma, et al. *PPCF* (2021).

O. Nelson, et al. *Nucl. Fusion* (2022).

O. Nelson, et al. *PRL* (2023).

J. Parisi, et al. *PoP* (2024).

- Experimentally NT plasmas don't transition to H-mode
- A lot of work on pedestal stability^[Medvedev,Merle,Saarelma,Nelson,Parisi]
- Can be understood through infinite-n ballooning stability^[Ant,Oli,Saarelma,Nelson], which is affected by the local magnetic curvature^[Oli,Nelson]
- If the maximum in the local magnetic shear can reach the good curvature region, then access to the 2nd region of ballooning stability is possible, enabling the transition to H-mode^[Oli,Nelson]
- A NT spherical tokamak is calculated to have much steeper edge pressure gradients^[Parisi]

Stability limits

J. Song, et al. *Nucl. Fusion* (2021).
E. Rodriguez. *JPP* (2023).
S. Guizzo, et al. *PPCF* (2024).

- Considerable work on vertical stability^[Stef,Song,Rodriguez,Guizzo]
- Calculations indicate NT will be limited to lower elongation^[Stef,Song,Rodriguez,Guizzo], reducing performance
 - May be alleviated by passive conducting stabilizing plates^[Guizzo]
- Density limit higher in NT DIII-D experiments^[Oli]

Discussion

- Consistency for impact of Alfvén eigenmode stability between *Wei et al.* and prior work (Oyoda)?
- Consistency of impact of infernal modes between Valeria's work and M. Coste-Sarguet?
- Are subtle changes in shape (transcending δ) important in understanding the AUG results?
- Thoughts on how use gyrokinetics to study of lack of H-mode in NT?