

Absolutely calibrated edge neutral inferences on MAST-U and first comparisons with edge models

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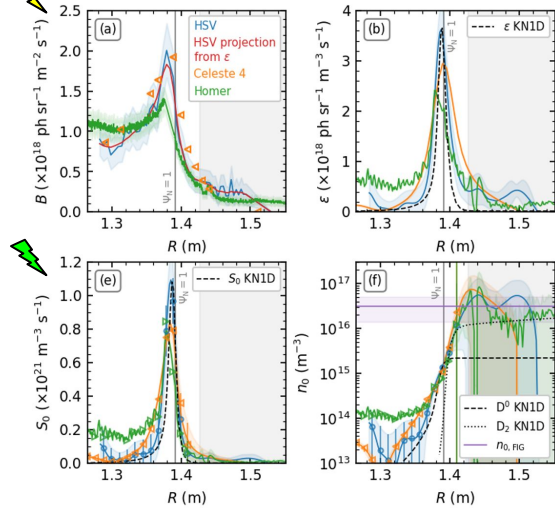
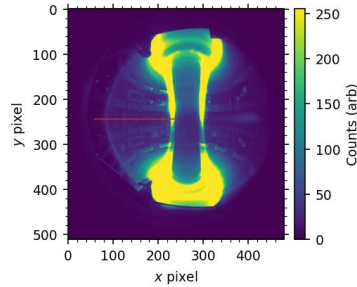
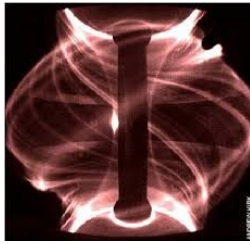
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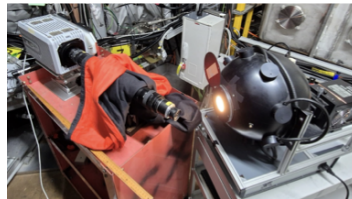
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HSV - high speed video diagnostic



$$S_0 = 4\pi\epsilon \frac{\text{SCD}_{3 \rightarrow 2}(T_e, n_e)}{\text{PEC}_{3 \rightarrow 2}^{\text{EXC}}(T_e, n_e)}$$

$$n_0 = \frac{4\pi\epsilon - \text{PEC}_{3 \rightarrow 2}^{\text{REG}}(T_e, n_e)n_i n_e}{\text{PEC}_{3 \rightarrow 2}^{\text{EXC}}(T_e, n_e)n_e}$$



High speed video (HSV) is a **2D, high frame rate visible camera** with a **D α optical filter**

- >30kHz sampling rate, ~5mm edge resolution



HSV measures line-of-sight integrated **brightness** B

- Absolute calibration - $\text{ph sr}^{-1} \text{m}^{-2} \text{s}^{-1}$
- Signal inverted gives **emissivity profile** - ϵ



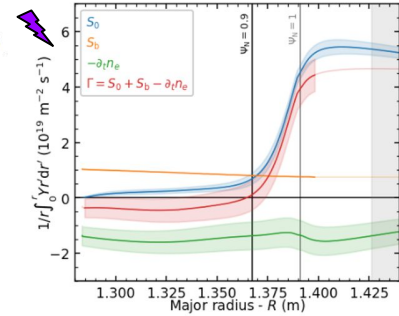
ϵ used with n_e and T_e to infer **ionisation source rate** - S_0 and **neutral density** - n_0 profiles



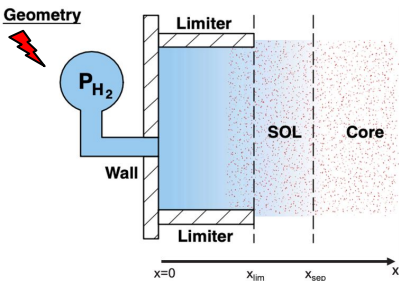
Assuming 1D (radial) transport, S_0 can be used to infer **plasma Flux** - Γ

$$\Gamma(r, t) = \frac{1}{r} \left[\int_0^r S_0(r', t) r' dr' + \int_0^r S_b(r', t) r' dr' - \frac{\partial}{\partial t} \left(\int_0^r n_e(r', t) r' dr' \right) \right]$$

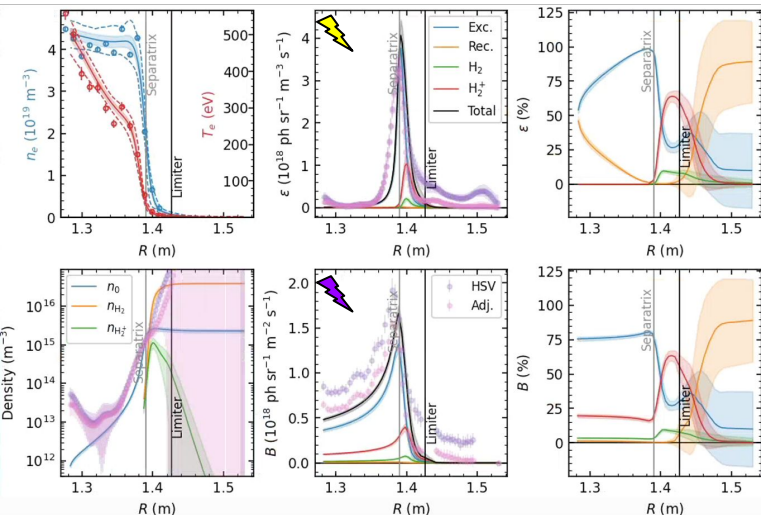
- S_b - beam neutrals
- $\partial_t n_e$ - density time derivative



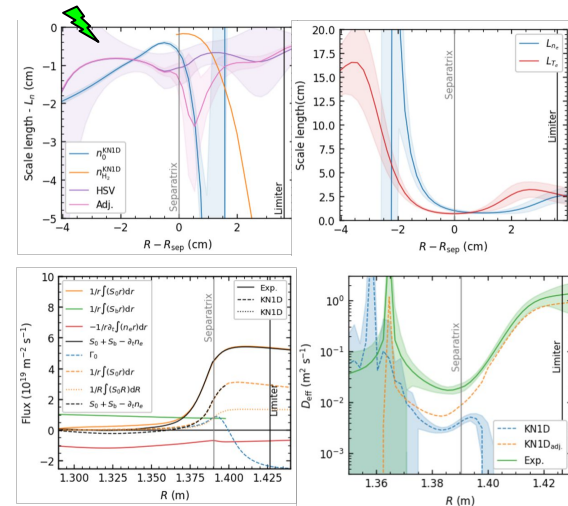
First comparisons with KN1D



- 1D in space (x), 2D in velocity (x, v) kinetic neutral transport code solves the Boltzmann equation for atomic and molecular Deuterium neutrals from the wall to the core in a fixed plasma background
 - Jamie Dunsmore - this afternoon
- ADAS and Yacora emission rates - different emission processes
 - Correction to isolate emission from excitation only



- Minimal effect on L_n
 - No obvious correlation with plasma scale lengths



- Differences between simulated and measured D_α attributed to reflections
- A chance for discussions