# Turbulence in CIEMAT's new quasi-isodynamic configuration

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***Laboratorio Nacional de Fusión* (CIEMAT)**

***Thrust 4: Stellarators***

**Meeting on optimization of turbulent transport**

**October 7th, 2022**

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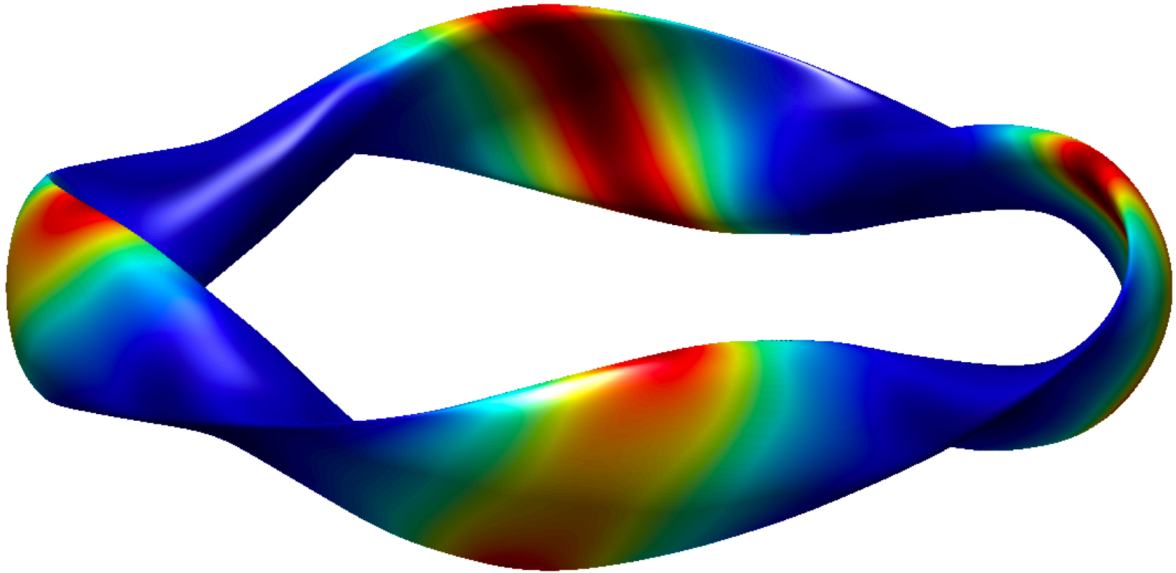

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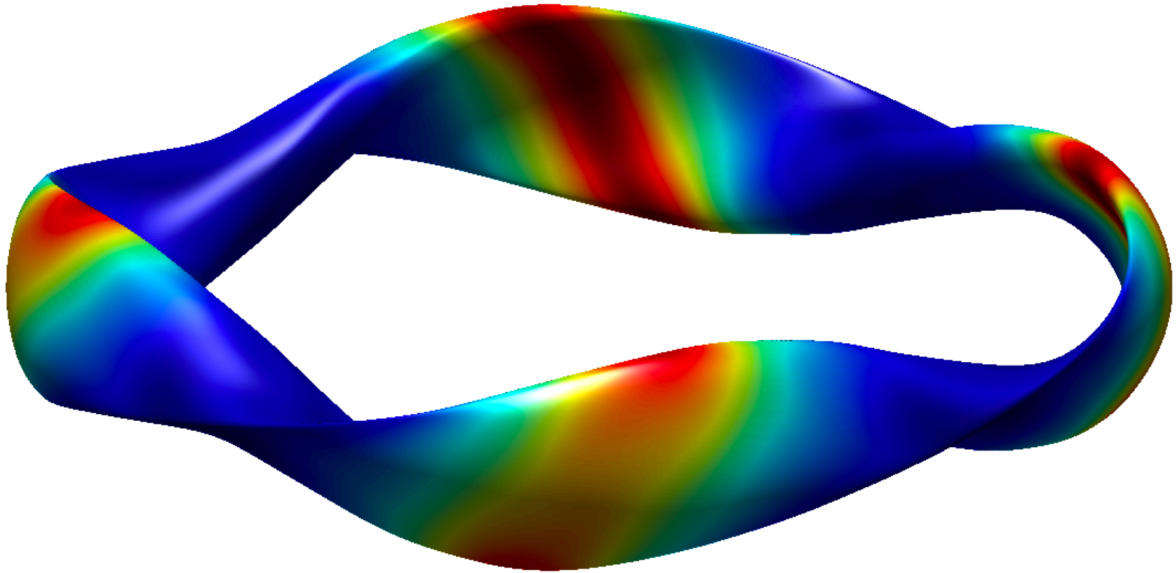

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**... and reduced turbulent transport (this talk)**

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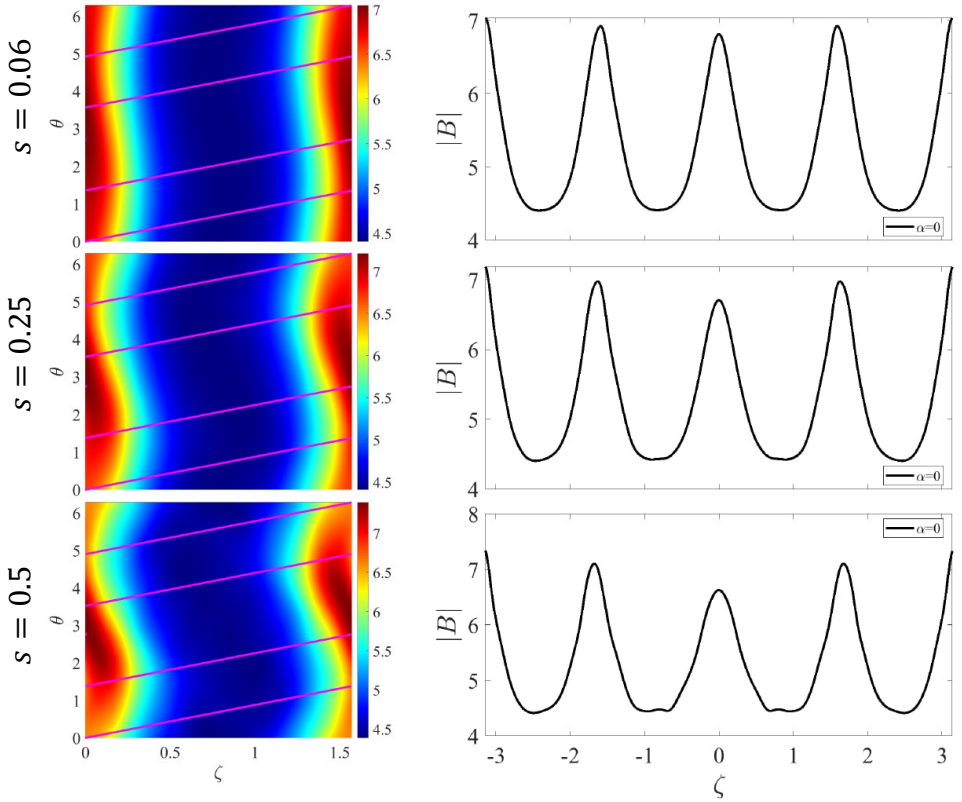

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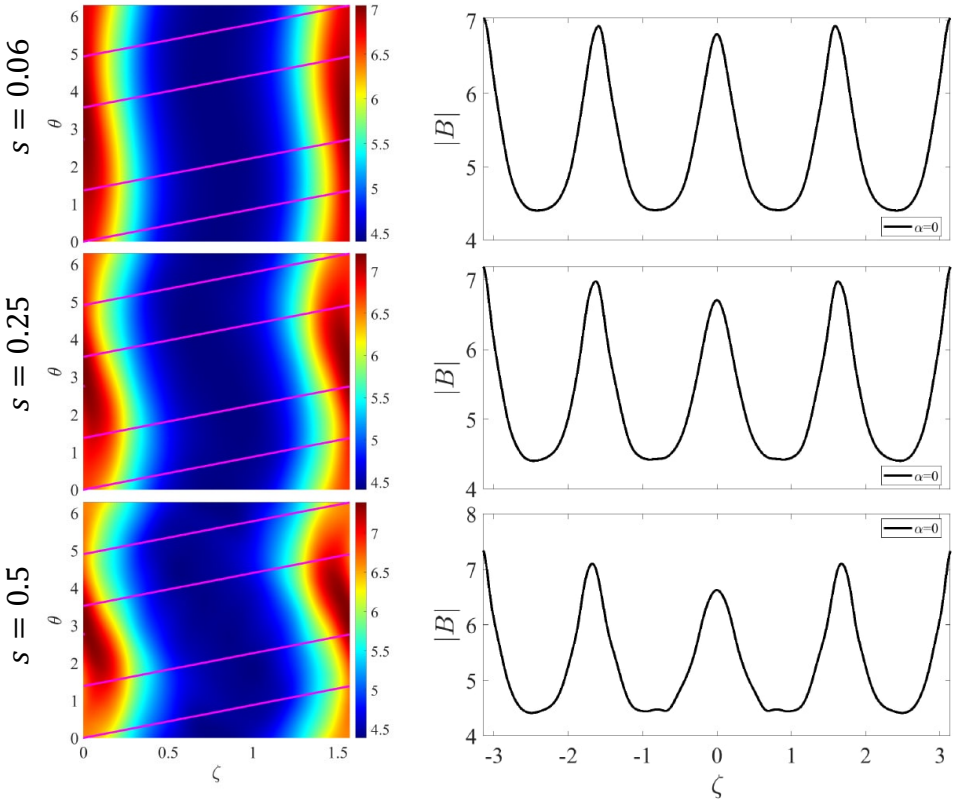

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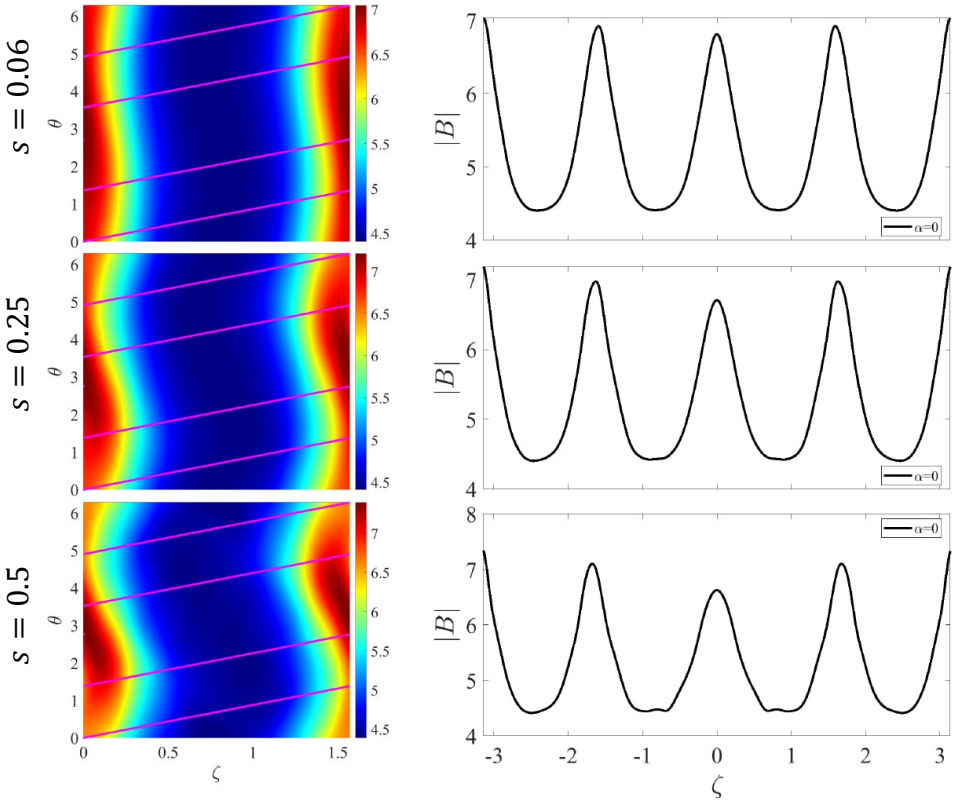

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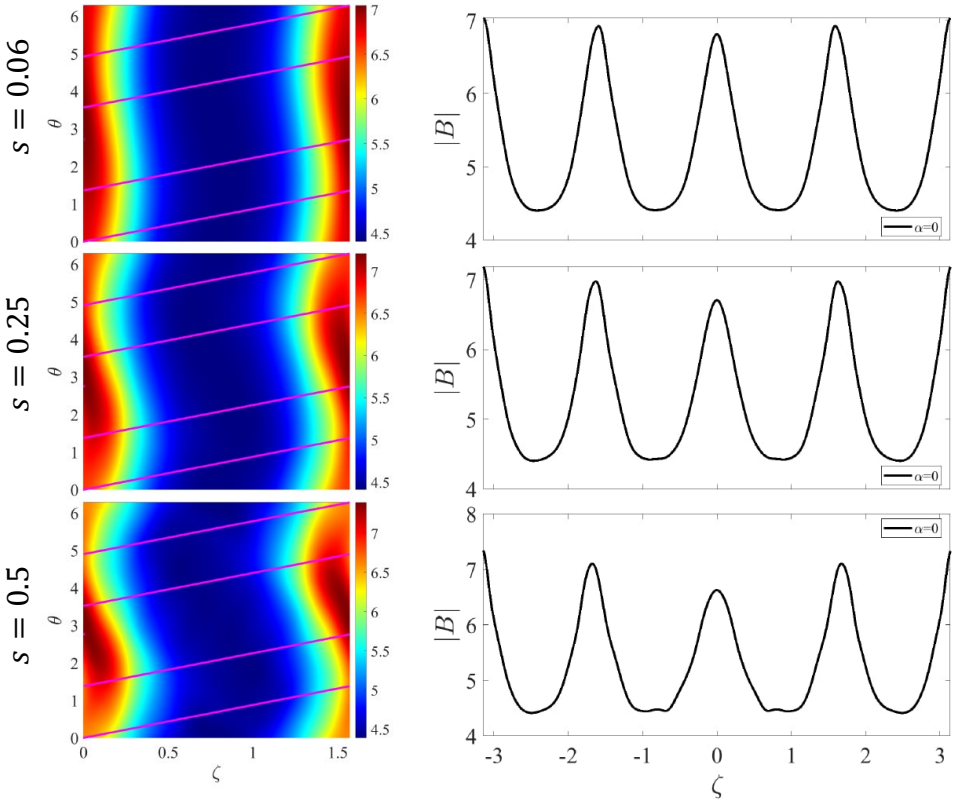

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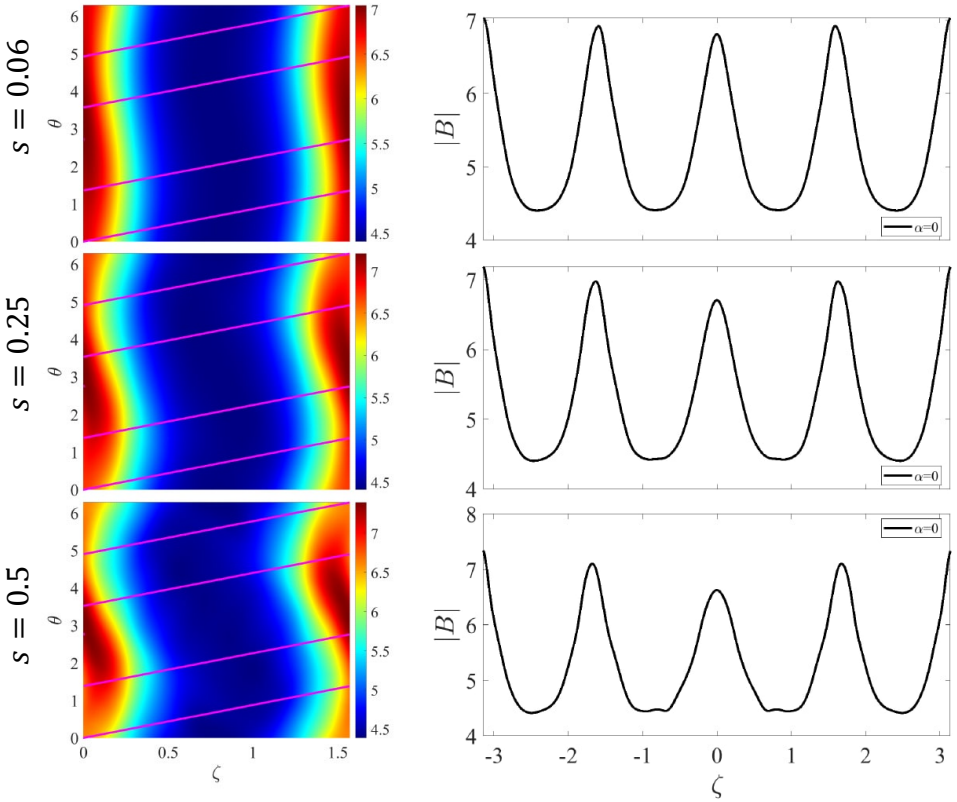

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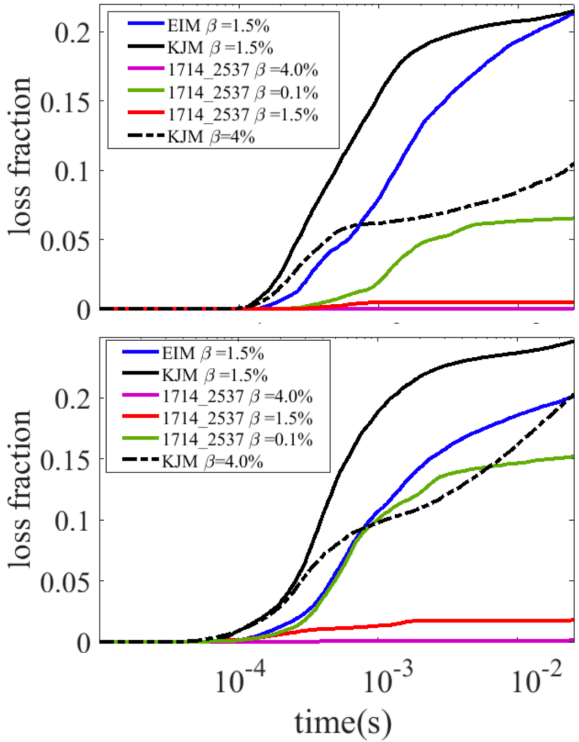
- Good fast-ion confinement at low $\beta$ and excellent fast-ion confinement at high $\beta$.



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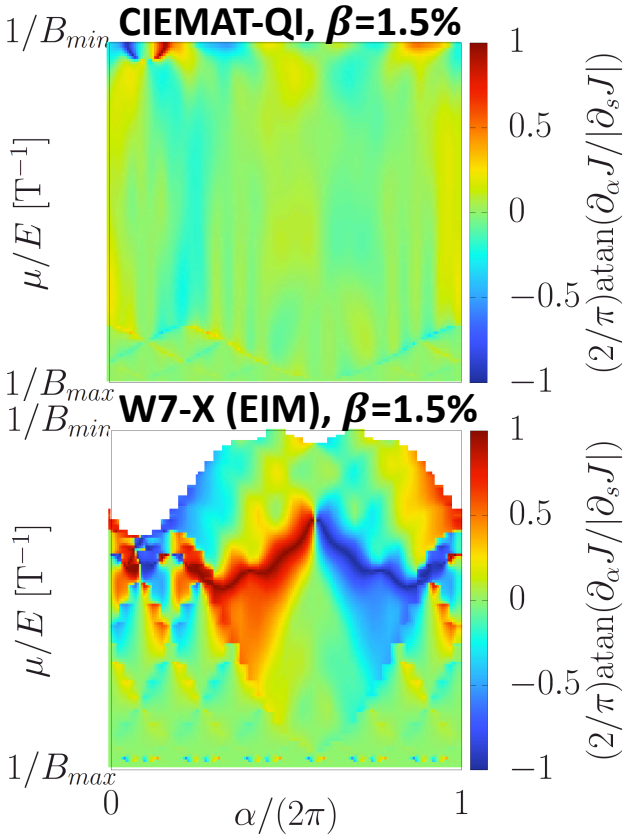


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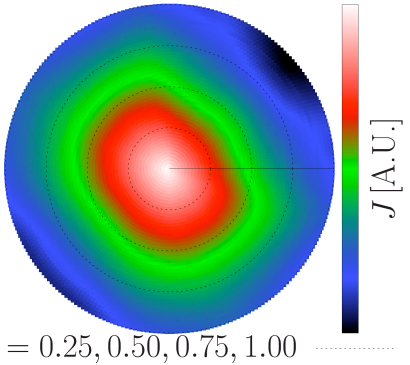
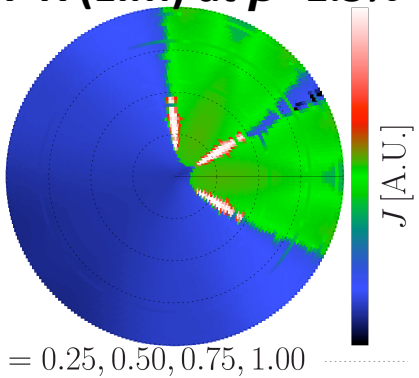



**W7-X (EIM) at $\beta$=1.5%**

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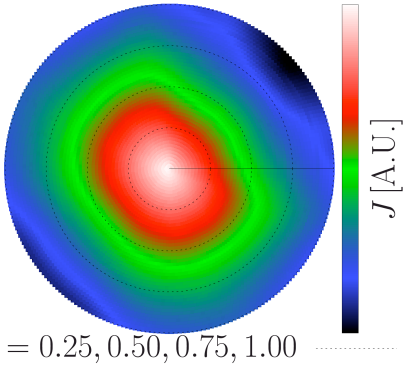


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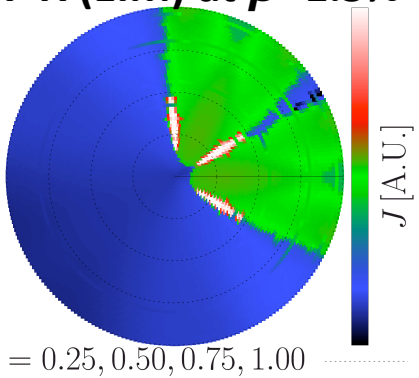


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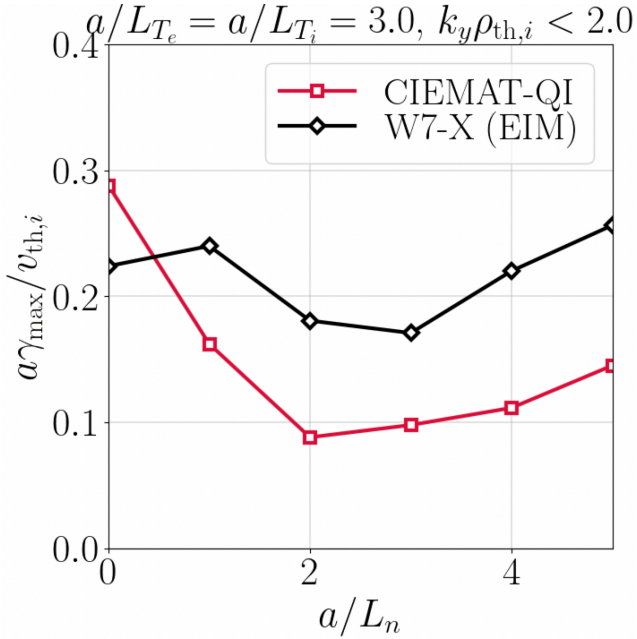
Linear **stella** simulations with **kinetic electrons at *s= 0.49***

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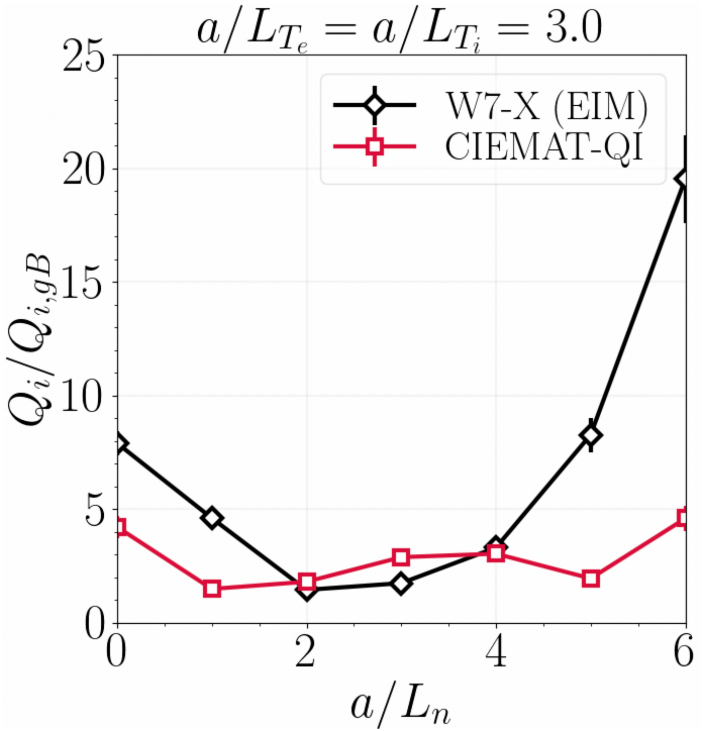

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- At low $a/L_n$, **lower ion heat flux ($Q_i$)** of **CIEMAT-QI** configuration ⇒ more accesible **peaked $T_i$ profiles** and **weak dependence on auxiliary particle sources** to reduce turbulence via $a/L_n$ increase.

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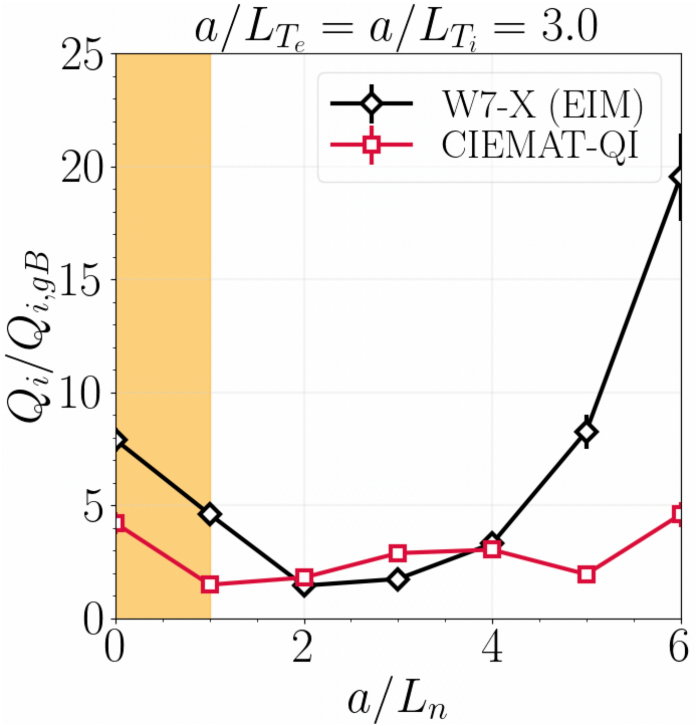

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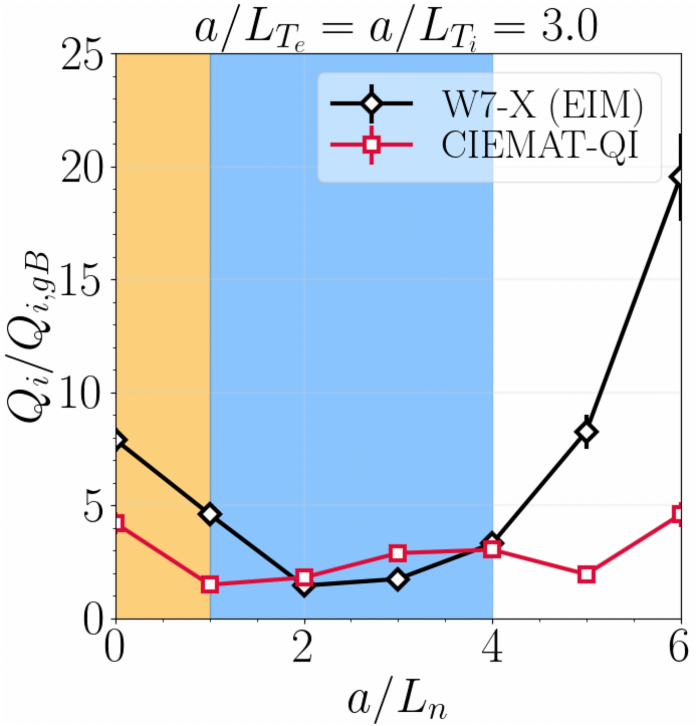

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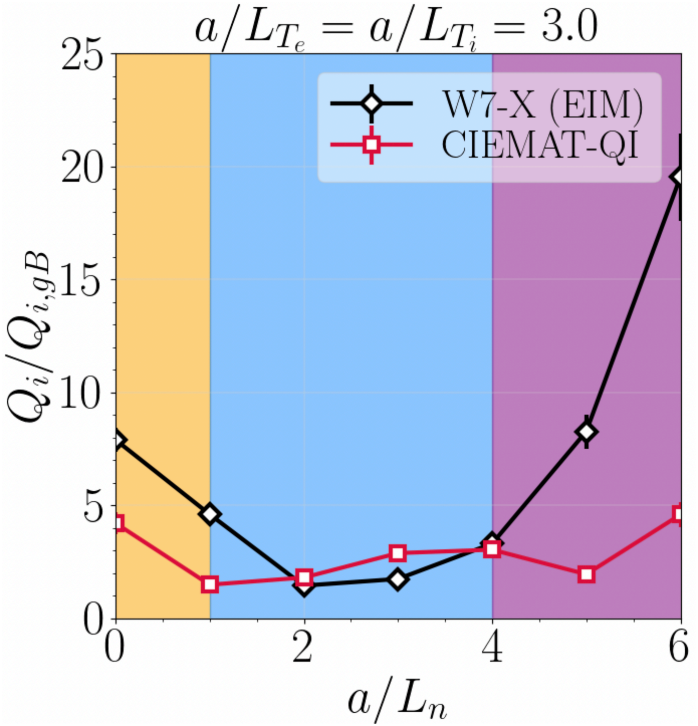

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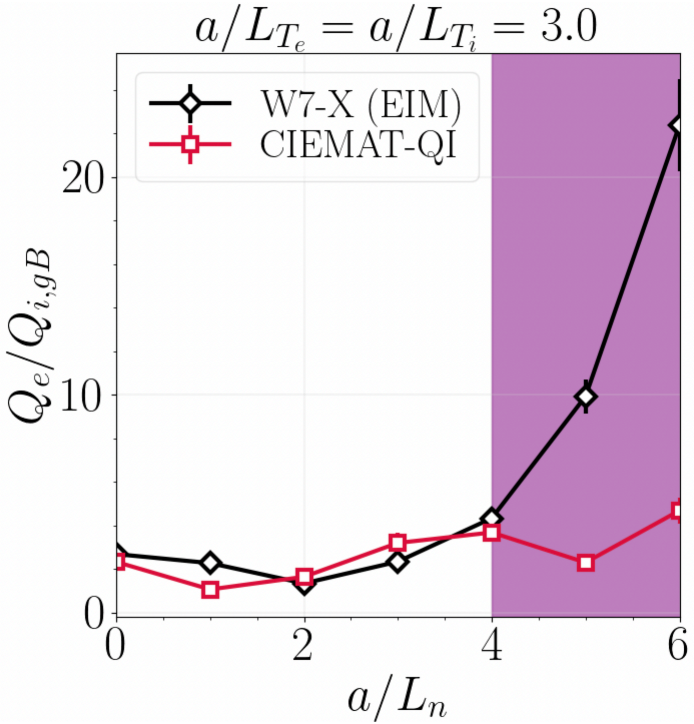

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  - ... and **lower $Q_e$** as well**,** which favours **peaked $T_e$** profiles.
  - Accessing **strong $a/L_n$** should be **more feasible** than in W7-X, as **<u>particle flux</u> barely increases with $a/L_n$.**

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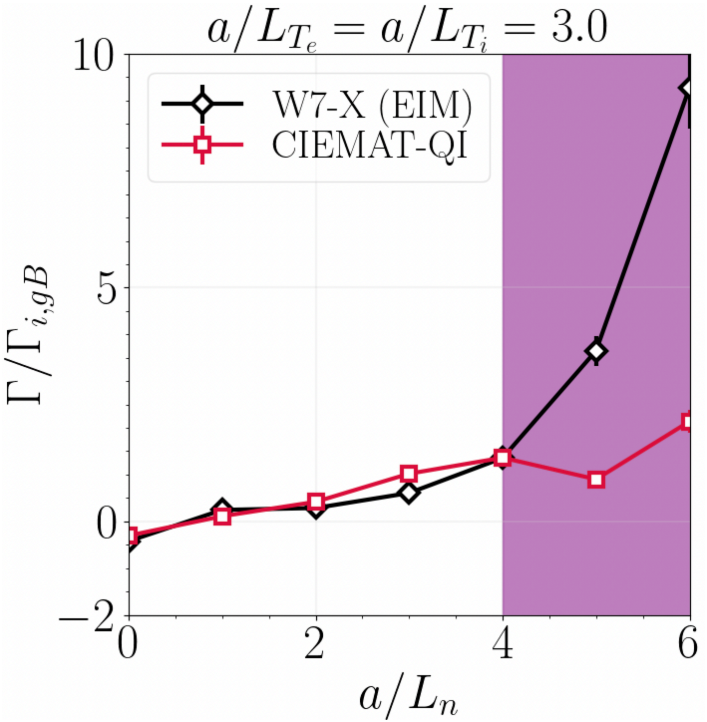

# Summary

- We have obtained a **new configuration at CIEMAT**, **remarkably close to exact quasi-isodynamicity <u>at low $\beta$ values</u>**, with **low $\varepsilon_{eff}$**, good ideal and ballooning **MHD stability up to $\beta \sim 5\%$** and **small bootstrap** current.
- It features **<u>good fast-ion confinement</u>** at **low $\beta$** and **<u>excellent fast-ion confinement</u>** at **high $\beta$**.
- **<u>With regard to turbulent transport</u>**, the new configuration:
  - has low heat flux levels, **weakly dependent on $a/L_n$**.
  - Turbulent heat and particle **fluxes resist to turbulence driven** by large **$a/L_n$**.
  - **Expected outcome**: **better control** of density and temperature profiles and **more efficient use** of particle and heating sources.