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Validation of theoretical upper bounds on local gyrokinetic instabilities

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Turbulence-driven transport is still one of the main obstacles to overcome in order to obtain feasible thermonuclear reactors. For this reason, the microinstabilities that are found to drive turbulence have been extensively studied in the last decades, both analytically and numerically. In such studies, assumptions about plasma parameters and magnetic geometry are generally made, making difficult the discovery of any properties that might hold more generally.
Recently, it was shown by Helander and Plunk [1,2] that it is possible to obtain universal upper bounds on the growth rates of all local gyrokinetic instabilities via thermodynamic considerations. These bounds are valid for all possible microinstabilities that can be found both in tokamaks and stellarators. Some examples are ion- and electron-temperature-gradient-driven modes, trapped-electron modes, kinetic ballooning modes and microtearing modes. Moreover, these bounds are independent of the magnetic field configuration and some plasma parameters, such as the number of particle species, beta and collisions.
The validation of the upper bound for a hydrogen plasma with adiabatic electrons has already proved successful [3]. In particular, a comparison with results from linear, flux-tube gyrokinetic simulations has been carried out considering different magnetic field geometries, including various stellarator and tokamak configurations. The simulations have been performed with the gyrokinetic code stella [4]. The validation also included a comparison with analytical results. Here we extend the validation to the more general case in which electrons are treated kinetically [5].
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References:
[1] P. Helander, and G. G. Plunk, Physical Review Letters 127, 155001 (2021)
[2] P. Helander, and G. G. Plunk, Journal of Plasma Physics 88, 905880207 (2022)
[3] L. Podavini, et al., "Validation of theoretical upper bounds on local gyrokinetic instabilities", SmuK DPG Conference (Dresden, Germany), P 91 (P 11.43) (2023)
[4] M. Barnes et al., Journal of Computational Physics 391, 365 (2019)
[5] G. G. Plunk and P. Helander, Journal of Plasma Physics 88, 905880313 (2022)

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