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Benefits and drawbacks of low magnetic shears on the confinement in magnetic fusion toroidal devices[1] MARIE-CHRISTINE FIRPO, Laboratoire de Physique des Plasmas, CNRS-Ecole Polytechnique, Palaiseau, France, DANA CONSTANTINESCU, Association Euratom-MECI, University of Craiova, Romania — The issue of confinement in magnetic fusion devices is addressed within a purely magnetic approach. As it is well known, the magnetic field being divergence-free, the equations of its field lines can be cast in Hamiltonian form. Using then some Hamiltonian models for the magnetic field lines, the dual impact of low magnetic shear is demonstrated. Away from resonances, it induces a drastic enhancement of magnetic confinement that favors robust internal transport barriers (ITBs) and turbulence reduction. However, when low-shear occurs for values of the winding of the magnetic field lines close to low-order rationals, the amplitude thresholds of the resonant modes that break internal transport barriers by allowing a radial stochastic transport of the magnetic field lines may be much lower than the ones obtained for strong shear profiles. The approach can be applied to assess the robustness versus magnetic perturbations of general almost-integrable magnetic steady states, including non-axisymmetric ones such as the important single helicity steady states. This analysis puts a constraint on the tolerable mode amplitudes compatible with ITBs and may be proposed as a possible explanation of diverse experimental and numerical signatures of their collapses.

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