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On the universality of power laws for tokamak plasma predictions JERONIMO GARCIA, DAVID CAMBON, CEA — Significant deviations from well-established power laws for the thermal energy confinement time, obtained from extensive databases analysis, have been recently reported in dedicated power scans. The validity and universality of power laws as tools for predicting plasma performance is analyzed in the framework of a simplified modeling for the heat transport which is however able to account for the interplay between turbulence and collinear effects with the input power which are known to reduce turbulence, such as fast ion pressure gradients or electromagnetic effects. Whereas at low power usual scaling laws are recovered with little influence of other plasma parameters, at high power it is shown how the exponents obtained are extremely sensitive to the heating deposition, the q profile or even the number and sampling of the points considered. In particular circumstances, even a minimum of the thermal energy confinement time with the input power can be obtained, which means that the approach of the energy confinement time as a power law is intrinsically invalid. Therefore, predictions of future plasmas performance using such approach, mainly at high β, can lead to significant deviations from reality and provide misleading results.

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