Comparison of the β Dependence of Confinement and Heat Transport in ASDEX Upgrade and DIII-D Experiments*

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The β dependence of heat transport has been a subject of controversy for a while. For H-mode plasmas with type-I ELMs, the widely used empirical multi-machine scaling law IPB98(y,2) predicts a degradation of the global confinement increasing β as $B\tau_{th} \propto \beta^{-0.9}$ [1]. However, dedicated experiments in DIII-D [2] and JET [3] which varied β while keeping the other dimensionless parameters (ρ*, ν*, *q*, …) and the plasma shape constant yielded no β dependence of confinement and heat transport. In contrast, similar β scaling experiments carried out recently in JT-60U [4] and ASDEX Upgrade [5] exhibited a clear β degradation in agreement with the scaling law prediction. The comparison of the experimental conditions in both DIII-D and AUG scans suggested a possible effect of the plasma shape on the resulting β scaling of transport. To investigate this possibility, new β scaling experiments have been performed in the DIII-D tokamak in the hybrid scenario. A first scan used the standard DIII-D plasma shape with β_N = (2.0-2.7) while a second scan used a lower triangularity "AUG-like" shape with β_N = (1.5-2.5). In both conditions, a degradation of the confinement is observed with increasing β. The present paper will present transport analysis of both β scans and a comparison between experiments performed in DIII-D and AUG tokamaks. The results of this experiment may allow us to understand why different experiments have reported different β scalings of confinement. In particular, the plasma rotation seems to be a key parameter in this kind of experiment.

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