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Dimensionless Size Scaling of Intrinsic Rotation

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A dimensionless empirical scaling for intrinsic toroidal rotation is given; MA˜βNρ, *where MA is the toroidal velocity divided by the Alfvén velocity, βN the usual normalized β value, and ρ* is the ion gyroradius divided by the minor radius. This scaling is in agreement with experimental data from DIII-D, and also incorporates some published data from C-Mod and JET. The velocity used in this scaling is in an outer location in minor radius, outside of the interior core and inside of the large gradient edge region in H-mode conditions, although the scaling result is not very sensitive to the chosen location in H-mode. This scaling establishes the basic magnitude of the intrinsic toroidal rotation and we discuss its relation to the rich variety of rotation profiles that can be realized for intrinsic conditions, that is, minimal injected torque. This scaling has some similarities to existing dimensioned scalings, both the Rice scaling [J.E. Rice et al, Phys. Plasmas 7, 1825 (2000)] and the scaling of Parra et al [F.I. Parra et al, Phys. Rev. Lett. 108, 095001 (2012)].

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