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Predictive Modeling of Axisymmetric Disruption Halo Currents,[1] D.A. HUMPHREYS, A.G. KELLMAN, T.E. EVANS, M.J. SCHAFFER, General Atomics — Disruptive events which result in significant plasma-wall contact followed by plasma termination are to a large extent unavoidable and unpredictable in tokamaks at present. Such events produce the maximum stresses experienced by first wall and invessel components as a result of toroidal currents induced in conductors and poloidal currents flowing from the scrapeoff layer (SOL) "halo" region through the first wall. An assessment of these forces and thus an understanding of disruption halo current evolution is therefore essential to the design of new devices. We propose an analytic, closed-form model for the evolution and maximum amplitude of the axisymmetric component of disruption halo currents which can be used for estimating these forces in next-generation devices. The model provides explicit scaling of the maximum halo current amplitude with parameters describing halo region geometry and resistivity, conductor geometry, and characteristics of the plasma inside the last closed flux surface during disruption evolution. The halo current is driven by plasma current decay and reduction in the toroidal flux enclosed by the halo region as the plasma shrinks against the limiter. Model predictions are found to agree well with halo current measurements from disruptions in DIII–D using measured plasma temperatures and inferred halo geometry.

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