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Tokamak Size Scaling

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The size scaling is recently developed by Costley, Hugill and Buxton (CHB) for seeking highest tokamak performance within physics limits at fixing the fraction of Greenwald density limit fGW, normalized plasma pressure βN, and fusion power Pf by scanning device-major-radius, R. The size-cancelling effects of the density limit are found in the fusion triple product of Lawson criterion, $nT\tau E$ and fusion power gain, Qf. In CHB scaling, cylindrical geometry plasma is assumed to be in the nearly-full-sized vacuum chamber of tokamaks, together with a minimum of 250 MWt fusion power output in a JET-sized machine [A.E. Costley 2016 Nucl. Fusion 56, 066003]. However the assumption meets the real low-power-gain case of JET experiments at less than 20 MW due to low burn rate of deuterium-tritium (DT) fusion. The compressed plasma is thus suggested for filling the power gaps of existing low-power-gain cases of tokamaks to high-power gain. Existing limitations of EAST tokamak are analyzed for accommodating and simulating the high-performance discharges, including the additional pulsed power suppliers and magnets. Possible operation scenarios of tokamaks are further analyzed for high-gain high-field (HGHF) fusion plasma suggested in [Li. G., Sci. Rep. 5, 15790 (2015)].

Eligible for student paper award?

No

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