Abstract Submitted
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The conceptual design of a robust, compact, modular tokamak reactor based on high-field superconductors[1] D.G. WHYTE, P. BONOLI, H. BARNARD, C. HAAKONSEN, Z. HARTWIG, C. KASTEN, T. PALMER, C. SUNG, D. SUTHERLAND, L. BROMBERG, F. MANGIAROTTI, J. GOH, B. SORBOM, J. SIERCHIO, J. BALL, M. GREENWALD, G. OLYNYK, J. MINERVINI, MIT PSFC — Two of the greatest challenges to tokamak reactors are 1) large single-unit cost of each reactor's construction and 2) their susceptibility to disruptions from operation at or above operational limits. We present an attractive tokamak reactor design that substantially lessens these issues by exploiting recent advancements in superconductor (SC) tapes allowing peak field on SC coil > 20 Tesla. A R$\sim$3.3 m, B$\sim$9.2 T, $\sim$ 500 MW fusion power tokamak provides high fusion gain while avoiding all disruptive operating boundaries (no-wall beta, kink, and density limits). Robust steady-state core scenarios are obtained by exploiting the synergy of high field, compact size and ideal efficiency current drive using high-field side launch of Lower Hybrid waves. The design features a completely modular replacement of internal solid components enabled by the demountability of the coils/tapes and the use of an immersion liquid blanket. This modularity opens up the possibility of using the device as a nuclear component test facility.

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