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**Advanced Tokamak Research at the DIII–D National Fusion Facility**[1] T.C. SIMONEN, J.C. DEBOO, R.D. STAMBAUGH, T.S. TAYLOR, General Atomics, T.A. CASPER, B.W. RICE, Lawrence Livermore National Laboratory, M. MURAKAMI, Oak Ridge National Laboratory, AND THE DIII–D NATIONAL TEAM — The tokamak magnetic fusion concept has an enormous range of freedom to optimize its properties and potential as a fusion power system. Early tokamaks formed plasmas whose properties were largely derived from inductive pulse formation, with centrally peaked current profiles and low self-driven current fractions. In contrast, the AT concept utilizes: (1) non-monotomic current profiles, (2) electric and magnetic field shear to reduce plasma turbulence and subsequently energy transport; (3) plasma pressure and current profile control to optimize plasma pressure for high reactivity; (4) self-driven bootstrap currents to enable efficient steady-state operation; and (5) divertor design to provide power dispersal and particle control to sustain plasma purity with intense power and particle exhaust. This paper reports DIII–D experimental progress in these individual research areas as well as their optimized integration and theoretical modeling toward demonstrating the advanced tokamak concept.

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T.C. Simonen
simonen@gav.gat.com
General Atomics

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