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Preface

ARIES-AT special issue

This special issue results from a 2-year study of an advanced tokamak, advanced technology power plant, ARIES-AT. The study was performed by the ARIES Team, which had previously conducted a number of studies of magnetic confinement concepts to assess their economics, safety and environmental potential as fusion power plants and to identify physics and technology areas with the highest leverage for fusion research. The Team utilizes detailed and integrated physics and engineering analyses (using the most current models available) to perform optimization and trade-off studies. Previous studies include: the ARIES-I through ARIES-IV, the ARIES-RS and the Pulsar tokamaks; the ARIES-ST spherical torus; the TITAN reversed-field pinch; and the SPPS stellarator.

The ARIES-AT study was initiated to assess the potential of high-performance tokamak plasmas together with advanced technology in a fusion power plant. Several avenues were pursued in order to arrive at plasmas with a higher β and better bootstrap alignment compared to ARIES-RS. Advanced technologies that were examined in detail include: (1) an innovative high-temperature blanket with SiC_f/SiC as structural material, providing the possibility of high power cycle efficiency; (2) use of high-temperature superconductors for possible improvements to the overall system. The ARIES-AT study shows that the combination of advanced tokamak modes and advanced technology can lead to an attractive fusion power plant with excellent safety and environmental characteristics and with a competitive cost of electricity.

The ARIES program is a national effort led by Prof. Farrokh Najmabadi of UCSD, and includes the participation of scientists from US national laboratories, universities and industry, as well as strong international collaboration. The papers presented in this special issue benefited from the contributions of all the scientists in the ARIES Team, who are acknowledged in the first article by Prof. Najmabadi.

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