

High Power Helicon Antenna Design for DIII-D

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A new current drive system is being designed and fabricated for the DIII-D tokamak to drive current in high beta discharges, using electromagnetic helicon waves. The high power helicon antenna (HPHA) is expected to couple 1 MW of power into the DIII-D plasmas at a frequency of 476 MHz without degrading the plasma characteristics or introducing metal impurities. This high power traveling wave antenna array is expected to have higher efficiency in driving current than other typical tokamak systems. The HPHA is a 30 CuCrZr module array mounted on a series of back plates. The modules inductively couple and resonate with the adjacent module. The two end modules are connected to a dual inner conductor strip-line transmitting RF power to and from four, 15 cm dia. vacuum coaxial feed-throughs located at the two DIII-D upper vessel ports. The modules, pitched 15° to follow the magnetic field lines of the tokamak, are bolted to 6 water cooled back-plates which are mounted on pedestals welded to the vessel wall. A description of the design and analyses of the HPHA and the RF strip-line feeds with anticipated overall antenna performance is presented.

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