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Design of a Permanent Magnet Stellarator[1] CAOXIANG ZHU, KENNETH HAMMOND, DAVID GATES, Princeton Plasma Physics Laboratory, SAS TEAM — Non-planar coils are the most complicated and expensive part of a stellarator. Permanent magnets provide a novel method to produce optimized stellarator configurations using very simple coils. The new concept for generating 3D fields using permanent magnets has led to the worlds first permanent magnet stellarator, which has been funded by ARPA-E and FES and will be located at PPPL. The project will design and construct a half-period of the magnet structure for a possible stellarator concept that would use components from NCSX, including the toroidal field coils and vacuum vessel, together with an array of neodymium magnets. The magnets are designed by the state-of-the-art code FAMUS employing topology optimization techniques. Conceptual designs of the magnet including the physics properties of the planned equilibrium and support structures for permanent magnets will be presented. Numerical calculations show that permanent magnets can produce plasma shapes not readily accessible with physical coils, including configurations with improved thermal and fast-ion confinement. The methods used during and the results from the design effort will be described in detail and the status of the construction activity will be summarized.

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