



permanent magnets is a completely new way to design stellarators,” said Tony Qian, a graduate student in the Princeton Program in Plasma Physics. “This technique allows us to test new plasma confinement ideas quickly and build new devices easily.” Qian is the lead author of papers published in the *Journal of Plasma Physics* and *Nuclear Fusion* on the theory and engineering of the device.

In 2014, Michael Zarnstorff, a senior research physicist at PPPL, had the idea that permanent magnets could be used to build a stellarator’s complex, twisted structure more cheaply. The PPPL team embedded purchased magnets in a 3D-printed shell around the device’s vacuum vessel.

According to PPPL, MUSE has greater quasisymmetry than any other stellarator has shown. In fact, it has quasiaxisymmetry—while the physical shape of the magnetic field inside the stellarator may not be symmetrical, a magnetic field has quasisymmetry, leading to good plasma confinement,

if its strength is uniform all the way around the device. “MUSE’s quasisymmetry optimization is at least 100 times better than any existing stellarator,” Zarnstorff said. The PPPL team plans to investigate MUSE’s quasisymmetry by mapping the magnetic fields more precisely and measuring how the spinning plasma slows down.

Thea Energy, formerly known as Princeton Stellarators Inc., was spun out from PPPL in 2022. The company’s stellarator concept does not use permanent magnets, but it does use an array of flat, planar magnet coils around the torus like those seen in MUSE, rather than the twisting, 3D coils used for other stellarators. Thea Energy was chosen by the DOE in May 2023 (when it was still known as Princeton Stellarators) as one of eight fusion developers in the Milestone-Based Fusion Development Program to receive funding to develop a fusion pilot plant design.

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