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Upgrade of the Helically Symmetric Experiment ALEXANDER THORNTON, DAVID ANDERSON, BENEDIKT GEIGER, KONSTANTIN LIKIN, AARON BADER, SANTHOSH KUMAR, JOSEPH TALMADGE, University of Wisconsin - Madison, HSX TEAM — The helically symmetric experiment (HSX) is an optimized stellarator using quasi-helical symmetry (QHS) of the magnetic fields to confine its plasmas. It has been in operation since 2001 and has successfully demonstrated minimized neoclassical transport and relevant turbulence physics. HSX performance is limited by the frequency of its electron cyclotron heating (ECH) source, which does not allow plasma densities higher than 1x10^{19} m^{-3}. In order to triple this limit, HSX is upgrading its facilities to operate with a gyrotron recently acquired from the Max Planck Institute for Plasma Physics in Germany. The new 70GHz, 500kW ECH system will use the X2 mode at 1.25 Tesla, requiring a 25% higher magnetic field. With higher temperatures in a denser plasma, neutral densities will be reduced, which will reduce the neutral damping of flow in the symmetry direction. 1D modelling results of the expected performance predict increased coupling between electrons and ions and reduced charge-exchange losses. Along with new wall conditioning techniques and strike line protection, this might provide ion temperatures as high as 300eV such that low collisionality ion confinement can be studied for the first time in a quasi-symmetric stellarator.

Alexander Thornton
University of Wisconsin - Madison

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