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Ongoing design of Doppler Reflectometry for use on the Helically Symmetric eXperiment

Monday 13 May 2024 16:00 (30 minutes)

Reflectometry is one of the workhorse diagnostics at the Helically Symmetric Experiment (HSX) to study turbulence-induced density fluctuations in the frequency range from 10 −100 kHz. To further optimize the system for turbulence and flow studies, it is planned to upgrade the HSX reflectometer system into a Doppler Reflectometer. With the new setup, the diagnostic will be capable of providing perpendicular (to the magnetic field) flow measurements and perpendicular turbulent k-spectrum measurements. The perpendicular flows in HSX are in the range of 5 km/s, as measured previously by Charge Exchange Recombination Spectroscopy (CHERS). The expected observable perpendicular wavenumber range of 0.5 to 4.5 cm^{-1} is compared to TRAVIS [1] simulations. Design elements for a motor-controlled rotatable mirror apparatus are shown alongside ray-tracing results. A discussion of the design considerations for a magnetic field strength of 1.25 T (in addition to 1 T standard operation) is presented including an adapted frequency source in the Ka band (28-40 GHz). Once installed, the new system will be used to identify turbulence induced density fluctuations and flows, which can be further used to study radial electric field, and will provide insight into the physics of turbulent transport in HSX.

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