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P5.1061 Edge radial profile measurement of magnetic fluctuations using 3D pick up coils and a differential coil on W7-X

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Measurement of the edge radial profile of magnetic fluctuation is a basic and crucial method to investigate the edge turbulence and transport. A set of pick up coils, located in the combined probe head and mounted on the multi-purpose manipulator, has been used to measure the magnetic fluctuation in the scrape-off layer (SOL) during the experimental campaign OP1.2 of Wendelstein 7-X (W7-X). The 3D coil measured the evolving toroidal, radial and poloidal magnetic fluctuations at various radial positions near the SOL. Two branches of magnetic fluctuations which peak at 10 kHz and 60 kHz were observed in standard divertor configuration (EJM+252). Those peaked magnetic fluctuations became stronger and had boarder spectrums when the probe approached the last closed flux surface. Meanwhile, a broadband fluctuation appeared with frequencies up to around 250 kHz, sharing some similarities to the measurement of the Langmuir probe near the SOL region. To measure fluctuations more locally, a differential coil that obtains higher sensitivity to the position of fluctuation source was equipped beside the 3D coil. Those 10 kHz and 60 kHz modes observed from 3D coil measurements are weak on the differential coil measurement. Instead, a 40 kHz fluctuation appeared and showed no correlations with the same frequency fluctuations on the 3D coil. It indicates that this 40 kHz mode is not strong but far closer to the plasma periphery. A rough estimation to the fluctuation source position was made via the power density evolution at corresponding frequencies under a current sheet and differential coil model. In addition, some distinct behaviors on the magnetic fluctuation spectrum have been observed on both the 3D coil and differential coil under different configurations, suggesting a magnetic topology dependence of the magnetic fluctuations.

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