Statistical analysis of SOL fluctuations on COMPASS tokamak as measured by the Li-BES diagnostic

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In this paper the COMPASS Li-BES (Lithium Beam Emission Spectroscopy) system is introduced to demonstrate its capabilities in Scrape-off Layer (SOL) density fluctuation studies. The effect of atomic physics is examined by applying small perturbations (with different amplitudes and radial locations) to artificial density profiles. From these synthetic perturbed density profiles, using a collisional-radiative model, Li-light profiles are calculated. It has been shown that the beam attenuation has a significant effect on the observed perturbation amplitudes and localisation. Simple numerical simulations based on stochastic models of the SOL filaments (blobs) [1] have been performed and the effect of atomic physics on the statistical properties of the same filament events in the Li-light fluctuations such as amplitude distributions, waiting times, conditionally averaged waveforms have been studied. The results are compared to experimental data and theoretical expectations [2]. It is found that they are in good agreement with what is seen on other tokamaks and what the models suggest. Moreover the interesting problem of the so called 'hole' emergence has also been addressed in the context of atomic physics effects.

Analysing the statistics of the measured Li-BES signals, it has been shown that the PDFs are not in fact dominated by large an rare events but by the small and frequent. However the emerging statistics are qualitatively still in line with model predictions albeit with different model parameters. These results can also be recreated by numerical simulations using the modified parameter set.

References

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