Contribution ID: **96** Type: **Poster**

Filament Transport in the SOL of ASDEX Upgrade

Tuesday 14 October 2014 08:30 (4 hours)

At the edge of fusion plasmas, intermittently expelled density filaments, so-called blobs [1], are propagating through the scrape-off layer (SOL) perpendicular to the magnetic field. Due to its higher density and temperature compared with the background SOL plasma, they can lead to a significant degradation of plasma facing components in the main chamber. Since this degradation is critical for the first wall in future fusion devices, an understanding of the generation and the propagation of blobs is needed. Therefore, the dynamics of blob filaments is investigated in the SOL of ASDEX Upgrade by means of Lithium beam emission spectroscopy (Li-BES) [2], Langmuir probes, and gas puff imaging. This way, the density, velocity, lifetime, frequency and size of the blobs perpendicular to the magnetic field are determined. A comparison of the measurements with a recently developed analytical blob model based on a drift-interchange-Alfvén fluid model [3] indicates an influence of a finite ion temperature on the blob dynamics which has typically been neglected in other blob models. The blob dynamics agree well with the sheath-connected regime at lower plasma densities, and inertial effects play only a minor role [4]. At higher densities, a transition into another regime with large blob amplitudes and increased transport is found [5]. This points to a prominent role of blob transport at higher Greenwald fractions and has implications for the gross erosion of wall material in reactor relevant operation scenarios with a detached divertor near the density limit.

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Paper Number

EX/P1-25

Country or International Organisation

Germany

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Session Classification: Poster 1