The connection of electron cyclotron resonance heating (ECRH) and intense MHD activity with outward impurity convection in the plasma centre has been investigated in H-mode discharges at ASDEX Upgrade (AUG). Central impurity accumulation is routinely mitigated with central ECRH, observed to increase the impurity diffusivity and suppress the convective pinch, in some cases leading even to the rise of an outward (positive) impurity convection [1, 2, 3, 4]. Theoretical interpretation of this positive convection has mainly concentrated on the role of turbulence: in case of low $q$, low shear and high electron temperature gradient, an outward impurity convection could be driven by density fluctuations caused by parallel compression [5]. Such theoretical calculations assume a geometry of nested flux surfaces. They can therefore be applied only to plasma regions with no (or very low) MHD activity, but cannot be applied to explain the strong outward impurity convection observed inside $r_{q=1}$ in-between sawtooth crashes in the presence of strong $(m,n) = (1,1)$ mode activity and central ECRH at AUG [4, 6].

This contribution aims to analyse how intense MHD activity and central ECRH concur in generating outward impurity convection thus creating centrally hollow impurity density profiles. Impurity transport coefficients have been evaluated experimentally with the use of the Soft X-Ray diagnostic and the aid of other X-ray spectrometers. Neoclassical calculations and turbulence stability analysis have been performed for radii larger than $r_{q=1}$ while inside the $q = 1$ surface an analysis of the possible resonance mechanisms between the MHD modes and the thermal impurity ions, which could lead to their expulsion outside $r_{q=1}$, has been investigated with the use of the HAGIS code. Mode stability analysis has also been performed.

References