Neutral flows in the divertors of ASDEX Upgrade and Wendelstein 7-X

D. Gradic, V. Perseo, F. Reimold, R. König, F. Effenberg\textsuperscript{a}, M. Krychowiak, A. Burckhart\textsuperscript{b}, R. Dux\textsuperscript{b}, the W7X Team\textsuperscript{c}, the ASDEX Upgrade Team\textsuperscript{b,**} and the EUROfusion MST1-Team\textsuperscript{b,***}

\textit{Max-Planck-Institute for Plasma Physics, Wendelsteinstr. 1, D-17489 Greifswald, Germany}
\textsuperscript{a} \textit{Princeton Plasma Physics Laboratory, Princeton University, New Jersey 08543, USA}
\textsuperscript{b} \textit{Max-Planck-Institute for Plasma Physics, Boltzmannstr. 2, D-85748 Garching, Germany}

E-mail address of the first author: dgradic@ipp.mpg.de

Neutral hydrogen/deuterium flows were measured for the first time with the Doppler Coherence Imaging Spectroscopy (CIS) diagnostic in the divertors of the medium-sized tokamak ASDEX Upgrade (AUG) and the stellarator Wendelstein 7-X (W7X). In both devices, directed neutral flows towards the target are observed from Balmer alpha and beta line emission. The flow pattern of the neutrals is similar to CIS-measured impurity ion flows \cite{1,2}, however smaller in magnitude. Accompanying ultra-high wavelength resolution spectra as well as CIS contrast measurements indicate that the detected neutrals are thermalized with the plasma background, suggesting that a significant fraction of the neutrals either entered the divertor area as ions (by e.g. having recently undergone charge exchange) or there is a considerable amount of friction with the background plasma. The behavior of neutrals is influenced by a complex interplay of several effects such as particle recycling, charge exchange/friction with background plasma or recombination. However, the relevance and the interplay of those effects is not well understood. Comparison with SOLPS and EMC3-Eirene simulations will be used to investigate this in detail and to better understand the fundamental flow behavior of the neutrals in both divertors.

\cite{1} V. Perseo, et al., Nucl. Fusion 59 (2019) 124003

* See author list of T. Klinger et al 2019 Nucl. Fusion 59 112004
** See author list of H. Meyer et al 2019 Nucl. Fusion 59 112014
*** See author list of B. Labit et al 2019 Nucl. Fusion 59 086020