Pedestal and core confinement of hybrid scenario in ASDEX Upgrade and DIII-D

C.F. Maggi[1], R.J. Groebner[2], C. Angioni[1], T. Hein[1], L.D. Horton[1], C. Konz[1], A.W. Leonard[2], C.C Petty[2], A.C.C. Sips[1], P.B. Snyder[2], J. Candy[2], R.E.Waltz[2], ASDEX Upgrade[1] and DIII-D[2] Teams

[1]*MPI für Plasmaphysik, EURATOM Association, D-85748 Garching, Germany*

[2]*General Atomics, San Diego, California 92186, USA*

e-mail: Costanza.Maggi@ipp.mpg.de

Abstract. Pedestal and core confinement of hybrid discharges in ASDEX Upgrade (AUG) and DIII-D are studied in dedicated power scan experiments. The *H98(y,2)* confinement factor increases with total β_N in both tokamaks and it is higher in DIII-D with higher δ plasma shape at a given β_N . The pedestal beta, β_N^{PED}, increases linearly with total thermal beta $\beta_{N,th}$ in AUG improved H-modes, while it is roughly constant with $\beta_{N,th}$ at fixed shape in the DIII-D power scans. The confinement enhancement with power observed with respect to the IPB98(y,2) scaling is due to an increase in pedestal confinement in AUG improved H-modes and to an increase in core confinement in the DIII-D hybrid power scans. The increase in pedestal pressure with power in AUG improved H-modes is primarily due to an increase in the width of the edge transport barrier at constant pressure gradient. In both machines the width Δ of the T_e pedestal is consistent with a $\Delta_{Te} \sim \beta_{pol,PED}^{1/2}$ scaling and Δ_{Ti} increases with β. Δ_{ne} shows no dependence on β in AUG and is consistent with $\beta_{pol,PED}^{1/2}$ scaling in the DIII-D power scans. The variation in β_{pol} in the DIII-D scans is mainly obtained through variation in plasma shape. The maximum pedestal pressure achieved in the experiment prior to the onset of type I ELMs is consistent with predictions from ideal MHD, however a physics model explaining the increase of the pedestal width with β is still missing. The increase of R/L_{Ti} with β in the core of DIII-D is consistent with predictions by linear gyrokinetic simulations. In the plasma core, *ExB* shearing rate stabilization of the ITG-modes is significant in both machines as beta is increased. Inclusion of electromagnetic effects in the gyrokinetic calculations provides additional stabilization at β_N values achieved in the experiment. In AUG, proximity to the kinetic ballooning threshold and/or a stronger reduction in normalized ion heat flux with increasing input power are possible explanations for the constancy of R/L_{Ti} at mid-radius as beta is increased.