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Assessment of Divertor Heat Load with and without External Magnetic Perturbation

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Studies of the steady state scrape-off layer heat transport with and without external magnetic perturbation in ASDEX Upgrade L-Mode are shown.
It is found that the heat transport perpendicular to the magnetic field is within the uncertainty unaffected by external magnetic perturbation.
The observed heat flux pattern is explained by heat flux calculations using the vacuum field of the external magnetic perturbation.
It is seen that the intensity of the lobes to generate a toroidally non-uniform power deposition pattern is largely reduced with increasing divertor broadening S.

For type-I ELMs a multi machine scaling using data from three devices based on the pedestal pressure prior to the ELM crash is presented.
The presented multi machine scaling for the ELM induced thermal load onto the target includes data from JET, ASDEX Upgrade and MAST with unmitigated and mitigated ELMs.
The mitigation techniques used are external magnetic perturbation (MP) and kicks which is a fast vertical movement of the plasma column.
The leading quantity detected in the scaling is the pedestal pressure prior to the ELM crash.

An approach to scale the thermal load of ELMs without the need to scale the ELM wetted area is presented.
An approximately linear dependence of the peak ELM energy density with the pedestal top electron pressure and minor radius and a square root dependence on the relative ELM loss energy, is found in JET operating with CFC and ILW, ASDEX Upgrade operating with carbon and tungsten plasma facing components and MAST.

Results from ELM mitigation experiments using magnetic perturbation in JET, ASDEX Upgrade and MAST and aiming to induce higher ELM frequencies as well as experiments using kicks in JET are in agreement with the scaling.
Here it is observed that the reduced thermal load due to ELMs is correlated to the loss of pedestal pressure.
These new findings will be discussed for the operation of ITER and the access to ELM divertor heat load mitigation.

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Germany

Primary author: Dr SIEGLIN, Bernhard (Max-Planck-Institut for Plasma Physics)

Co-authors: Dr HERRMANN, Albrecht (Max-Planck_Institut für Plasmaphysik, Garching, Germany); Dr SCARABOSIO, Andrea (Max-Planck Institut für Plasmaphysik); Dr KIRK, Andrew (Culham Centre for Fusion En-

ergy); Dr THORNTON, Andrew (CCFE); Mr FAITSCH, Michael (Max-Planck Institut für Plasmaphysik); Dr EICH, Thomas (Max-Planck-Institute for Plasma Physics); Dr SUTTROP, Wolfgang (Max-Planck-Institut für Plasmaphysik)

Presenter: Dr SIEGLIN, Bernhard (Max-Planck-Institut for Plasma Physics)

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