DIAGNOSTIC REQUIREMENTS FOR DIVERTOR PHYSICS*

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Most current divertor physics research can be grouped into three overall topics; radial transport in the Scrape-Off-Layer (SOL) and divertor, neutral and impurity source profiles, and plasma flows arising from drifts and particle sources and sinks. Progress in these areas will lead to better predictive capability using existing sophisticated modeling codes. The radial transport of energy and particles is an underlying property of the SOL that affects most parameters important for divertor design, including heat flux at the divertor target, fueling of the core plasma and impurity generation. Presently SOL radial transport is not well understood, or even sufficiently characterized, and may vary poloidally as well as toroidally. Recent advances in SOL transport measurements include improved Langmuir probe techniques as well as use of core plasma turbulence diagnostics, such as BES and reflectometry. Plasma flux to the divertor and main chamber walls due to transport is responsible for the source of neutral particles and impurity flux into the plasma. Characterization of these sources is an inherently 2D, and in many cases a 3D, problem requiring diagnostic innovation. A common theme for divertor research is the need for 2D profiles that imaging can produce. Improvements in imaging techniques and analysis is likely to significantly advance divertor research. Plasma flows that arise from particle and fluid drifts, as well as particle sources, can, in principle, be calculated using sophisticated 2D fluid codes. However, the complexity of including all the plasma flow sources remains a challenge and experimental measurements of the flow field are necessary to benchmark the computational results. Profiles of the main ion temperature in the divertor is an important parameter in the study of all the topics described above. However, measurement of this basic parameter is difficult because it can be very different from the impurity ions that are more easily measured. CER spectroscopy utilizing a divertor diagnostic neutral beam is one technique that may be able to address this need.

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