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Hydrogen radiation emission as a synthetic diagnostic for magnetic fusion divertor plasmas

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In magnetic fusion, managing the power exhaust is one of the major issues that the community has to address and a promising scenario has already been identified and is even foreseen for future large-scale devices like ITER and DEMO. This scenario relies on the cooling of the divertor region by creating a dense and cold region, which is highly radiative, leading eventually to what is known as a detachment regime. This issue is one of the major topics of The European programs such as EUROfusion MST1 [1] and JET1 [2]. The work presented here is aimed to support these programs and is aimed to help the building of new synthetic diagnostics based on the radiation emitted by hydrogen/deuterium neutrals in detached divertor plasmas. A synthetic spectrum is calculated from plasma simulation results and should account for any spatial inhomogeneity along a given line of sight in addition to other considerations connected to the measurement chain and broadening mechanisms. Synthetic spectra, which represent complete spectra of the Balmer series, are calculated using spatial distribution of the plasma parameters (densities and temperatures) provided by numerical simulations tools such as the transport code Soledge2D-EIRENE [3]. Broadening of the high-n lines of the Balmer series as well as the discrete-to-continuum transition will be discussed for conditions relevant to detachment conditions, i.e., plasmas in a recombining regime [4].

References

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