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# The Characterization of Energetic Particle Beams Using Stark Broadening Analysis of Hydrogen Lines in Tokamak Edge Plasmas

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Atomic processes and plasma surface interactions play a key role in the physics of the edge, divertor and X-point plasmas. Passive spectroscopy is one of the best methods helping to characterize tokamak edge plasmas [1]. We examine the possibility for a diagnostic of energetic particle beams based on passive spectroscopy, with a focus on the atomic lines observed in the edge region of tokamaks. Our investigation employs a quasilinear model for the collective electric field generated by the plasma-beam instability. If the beam is sufficiently energetic, the electric field can be comparable to the thermal Holtsmark microfield and the corresponding Stark effect on atomic energy levels can be observable on spectra. The spectra have been obtained by a computer simulation for calculating the dynamic ion field combined to a numerical integration of the Schrödinger for the emitter evolution operator [2, 3]. We investigate this issue and perform new hydrogen line shape calculations. An adjustment using a Stark line shape model provides the electron density within a good accuracy. The applicability of the model to the diagnostic of runaway electrons is discussed.

References

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