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A code for Simulating the Hydrogen Balmer-α Spectral Line Shape from Magnetic Fusion Devices

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In this paper, we present the development of a code for simulating the H_α emission spectrum at 656.28 nm emitting from magnetically confined fusion devices. The developed code generates the synthetic H_α emission spectra using magnetic field strength and the temperature and density of the hydrogen neutrals. The code includes all the broadening mechanisms such as Doppler, Zeeman, Stark or pressure broadening for simulating the H_α emission spectrum along with proper convolution of the instrumental width of the measuring system. Depending on the strength of the magnetic field, the code incorporates 7 Zeeman components in case of normal Zeeman splitting, whereas 48 (18 π and 30 σ) components are taken in to account in case of Paschan-Back Zeeman splitting. The simulated spectra are used to obtain true values of ion/neutral temperatures by iteratively fitting them to the measured spectrum from the edge region of Aditya tokamak [1]. Furthermore, the developed code has been used to isolate the cold, warm and hot (charge-exchange) components of the hydrogen atoms from the measured H_α emission spectra from the edge region of Aditya tokamak.

References

[1] S. Banerjee, J. Ghosh, R. Manchanda, et al., “Observations of Hα emission profiles in Aditya tokamak”, J. Plasma Fusion Res. Series 9, 29 (2010).