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A new method for line-shape modeling of hydrogen-like and Rydberg transitions in plasma

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Calculations of line shapes of hydrogen and hydrogen-like transitions (including Rydberg ones) are important for many topics of plasma physics and astrophysics. However, the Stark effect of the radiative transitions originating from high-n levels is rather complex, making the detailed calculations of their spectral structure very cumbersome. Surprisingly, the complex structure of such transitions can be approximated, under certain assumptions, with a quasi-contiguous (QC) rectangular shape. This formed the basis of an analytical method for the calculation of line broadening [1], resulting in a simple expression for the full width at half-maximum of the Stark line broadening in plasma. Although the method is especially suitable for transitions with $\Delta n \gg 1$, it describes rather well even first members of the spectroscopic series with Δn as low as 2. Recently, the QC method was extended [2] to analytical calculations of line *shapes* (not mere line *widths*) in plasmas. To this end, we employed a formulation [3] of the frequency fluctuation model. Accurate computer simulations [4] as well as comparison with experimental data, where available, were used to verify the validity of the method. Applications of the method to a range of physical problems are shown.

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