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STOCHASTIC PROCESSES APPLIED TO LINE SHAPE CALCULATIONS

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Accurate line shapes are required for the diagnostic of various laboratory and astrophysical plasmas. For example, the determination of the stellar parameters is often based on hydrogen line profiles, lines which are also commonly used for the density diagnostic of laboratory plasmas. Detailed line shapes are also needed for an accurate calculation of the plasma opacity, a radiative property essential for the modeling of plasmas. Stark broadening calculations are performed with different approaches, based on the particle or the microfield point of view. A particle point of view is adopted in the impact theory (Griem, 1964) and unified theory (Smith et al. 1969; Voslamber 1969) often used for a description of electron broadening. A standard approach of Stark broadening takes a microfield point of view for the ionic perturbers. Neglecting the motion of the ions then requires the knowledge of the one and only probability density function (PDF) of the static microfield P(E). For many couples of plasma conditions and line transition, ion dynamics has to be retained, motivating the development of different methods: kinetic theory (Dufty 1969), Monte carlo type simulations (Stamm et al. 1984), and stochastic processes (Brissaud and Frisch 1971, Seidel 1977, Stehle 1994). We will discuss these approaches in conditions of low density plasmas for which the ion perturbers can never be treated with a static approximation. Stochastic processes then make use of other statistical properties of the microfield like the PDF of the time intervals for a microfield change. We will take a look at the accuracy vs. efficiency trade-offs of the algorithms using the microfield point of view, discuss the relevance of the improvement of stochastic processes, and of their possible application to neutral broadening.