Abstract Submitted
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On the interpretation of particle tagging data[1] FRED SKIFF, University of Iowa — We develop a formalism for the interpretation of optical tagging data obtained from laser-induced fluorescence (LIF) experiments. There are three basic components to the calculation. The first is the modification, due to optical pumping, of the state-density velocity distribution function. The central part is the calculation of the two-point conditional probability function for ion orbits in the (phase-space) vicinity of a central guide orbit that contributes to the signal. The final part is the calculation of the modified LIF signal of the search laser due to the test-particle distribution function. As a special case we consider the model of a steady, uniform plasma in a straight magnetic field under the assumption of a constant (Lenard-Bernstein) velocity-space diffusion coefficient. In this case there is no need of the guide-orbit expansion in order to evaluate 12 of the thirteen integrals involved analytically. These twelve integrals cover the instrumental selection of initial and final phase-space coordinates of the test-particles. The remaining integral over time must be performed numerically and can be used to evaluate the test-particle transfer function in either the time or frequency domains (the latter being appropriate for experiments involving "chopped" lasers). The effect of finite quantum state lifetime (due, for example, to collisional quenching in the case of metastable states) is included.

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