Kinetic theory of weakly excited and weakly ionized low-temperature gas in the presence of an electromagnetic field

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A microscopic approach to the consistent construction of the kinetic theory of low-temperature rarefied gases of hydrogen-like atoms in an external electromagnetic field is proposed. The approach is based on the formulation of the method of secondary quantization in the presence of bound states of particles. It is assumed that a bound state (for example, a hydrogen-like alkali metal atom in the ground or excited state) is formed by two charged fermions of various kinds, the valence electron and the core. The basis for the derivation of kinetic equations is the Bogolyubov-Peletminskii reduced description method of relaxation processes. In the framework of the developed approach, a system of kinetic equations is obtained for the Wigner distribution functions of free fermions of both sorts and their bound states, taking into account the effect on the system of external and self-consistent fields. The features of the effect of the electromagnetic field on the generally neutral excited atoms are analyzed. The possibility is discussed that the considered system in an external stochastic electromagnetic field can serve as a model of a physical medium with active fluctuations.