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Short-time dynamics of correlated quantum Coulomb systems[1]

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Strong correlations in dense Coulomb systems are attracting increasing interest in many fields ranging from dense astrophysical plasmas, dusty plasmas and semiconductors to metal clusters and ultracold trapped ions [1]. Examples are bound states in dense plasmas (atoms, molecules, clusters) and semiconductors (excitons, trions, biexcitons) and many-particle correlations such as Coulomb and Yukawa liquids and crystals. Of particular current interest is the response of these systems to short excitations generated e.g. by femtosecond laser pulses and giving rise to ultrafast relaxation processes and build up of binary correlations. The proper theoretical tool are non-Markovian quantum kinetic equations [1,2] which can be derived from Nonequilibrium Green's Functions (NEGF) and are now successfully solved numerically for dense plasmas and semiconductors [3], correlated electrons [4] and other many-body systems with moderate correlations [5]. This method is well suited to compute the nonlinear response to strong fields selfconsistently including many-body effects [6]. Finally, we discuss recent extensions of the NEGF-computations to the dynamics of strongly correlated Coulomb systems, such as single atoms and molecules [7] and electron and exciton Wigner crystals in quantum dots [8,9].

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