Dissipation in Quantum Time Dependent Mean Fields

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Mean field provides an essential starting point to understand the dynamics of numerous many-body systems ranging from nuclei to molecules, clusters and nano structures. The analysis of far-off equilibrium processes requires the account of correlations beyond mean field, especially incoherent ones. The topic has been widely explored in nuclear dynamics with major efforts devoted to the development of semi-classical approximations, leading to Boltzmann type kinetic equations [1, 2]. Recent developments in laser technology now allow to analyse in some detail the response of clusters and molecules in short intense laser fields which typically lead to dissipative effects, beyond mean field. There is thus a growing interest in the inclusion of dissipative features in current mean field theories in the case of electronic systems [3, 4].

We propose a quantum Relaxation Time Ansatz (RTA) providing an approximate quantum kinetic treatment [5, 6] and a stochastic extension of mean field, known as Stochastic TDHF [7]. The RTA allows to access realistic laser irradiation scenarios and study in particular the impact of dissipation on electron emission in moderate size clusters. The STDHF approach is much richer but still at a more schematic level. We have nevertheless explored it in simple molecular systems and been able to analyse its capabilities in detail [8, 9]. We have recently formulated an average version of the theory which will allow to consider realistic scenarios in the near future [10].

References

[1] G.F. Bertsch and S. Das Gupta, Phys. Rep. **160** (1988) 190

[2] Y. Abe, S. Ayik, P-G. Reinhard and E. Suraud, Phys. Rep. **275** (1996) 49

[3] P.G. Reinhard, E. Suraud, *Introduction to Cluster Dynamics*, Wiley, Berlin, 2003

[4] Th. Fennel et al., Rev. Mod. Phys. **82** (2010) 1793

[5] P-G. Reinhard, E. Suraud, Ann. Phys (NY) **354** (2015) 183

[6] M. Vincendon, E. Suraud, P.-G. Reinhard, Eur. J. Phys. D **71** (2017) 179

[7] P. G. Reinhard and E. Suraud, Ann. Phys. (NY) **216** (1992) 98

[8] E. Suraud, P-G. Reinhard, New. J. Physics **16** (2014) 063066

[9] N. Slama, P-G. Reinhard, E. Suraud, Ann. Phys (NY) **355** (2015) 182

[10] L. Lacombe, P.M. Dinh, P.-G. Reinhard, E. Suraud, J. Phys. B **49** (2016) 245101