Scaling in time dependent current density functional theory

Maxime Dion and Kieron Burke

Department of Chemistry and Chemical biology, Rutgers University
Piscataway, NJ

Using the current instead of the density as the variational parameter in time dependent current density functional theory (TDCDFT) is advantageous: mainly, it allows for the exchange-correlation kernel to be approximated locally. We show that scaling the electron-electron interaction strength can be transformed to a much simpler homogeneous spatial scaling of the current for the relevant functionals in TDCDFT. The obtained scaling relations can be used to assess approximate functionals. The scaling relation for the exchange-correlation kernel can be used in conjuction with the adiabatic connection formula to compute ground-state properties. The resulting functional is quite different from usual approximate functionals: for example, it gives the correct form for van der Waals energies.