We report recent progress in the simulation of electronic systems by a novel many-body wavefunction approach based on quantum Monte Carlo and molecular dynamics methods. This allows us to perform simulations of several hundreds of electrons, with a very accurate description of the electronic correlation without relying on the density-functional theory paradigm.

We have recently applied our method to hydrogen at high pressure and liquid water at ambient conditions, by neglecting atomic quantum effects. In the first case we have obtained a new description of the liquid-liquid atomization-metallization transition at extremely high pressures, whereas in the second one we have obtained a rather good description of liquid water.

Finally we report also a recent development of our technique, allowing us to include atomic quantum effects, with a very efficient algorithm.