Many properties of materials are determined by electronic excitations. However, in a piece of matter an electron is never excited alone, since the Coulomb interaction between electrons is strong and long-ranged. In general an excitation involves the entire system, including classical electrostatic and purely quantum mechanical contributions. How can theory understand, and how can calculations predict, the wealth of unexpected phenomena that may take place?

In this talk we will see how first principles calculations contribute to our understanding, focusing on the main theoretical ideas, their conceptual and technical limitations, recent progress, and comparison with experiment.