

## **Matter-Radiation Interaction**

*Carlo Maria Bertoni*

Dipartimento di Fisica, Università di Modena e Reggio Emilia

Via Campi, 213/A - 41100 Modena (Italy)

The interaction between electromagnetic (e.m.) radiation and matter is described on the basis of quantum theory of matter and of the electromagnetic field. The quantum description of the free e.m. field is given in terms of the eigenstates of the single-mode occupation numbers (photons), while the matter is described in terms of quantum states of systems composed by electrons and nuclei (atoms, molecules, solids and surfaces). The interaction is treated in the non relativistic limit, using perturbation theory. The different terms of the perturbation expansion can be graphically represented by Feynman graphs. Each term corresponds to an elementary process of the interaction, that is at the basis of an experimental technique used in synchrotron radiation research.

Absorption, emission, scattering of photons, photoemission spectroscopy,... can be described in this way at any level of complexity. The link with the description offered by classical physics is pointed out step by step.