CHAPTER OVERVIEW

6: Electromagnetism

This chapter discusses two major effects that arise when electric and magnetic fields are changing in time: the “electromagnetic induction” of an additional electric field by changing magnetic field, and the reciprocal effect of the “displacement currents”- actually, the induction of an additional magnetic field by changing electric field. These two phenomena, which make time-dependent electric and magnetic fields inseparable (hence the term “electromagnetism”[1]), are reflected in the full system of Maxwell equations, valid for an arbitrary electromagnetic process. On the way toward this system, I will make a pause for a brief review of the electrodynamics of superconductivity, which (besides its own significance), provides a perfect platform for a discussion of the general issue of gauge invariance.

Reference

[1] It was coined by H. Ørsted in 1820 in the context of his experiments – see the previous chapter.

Thumbnail: The magnetic field of a current-bearing coil, illustrating field lines. (CC BY 4.0; Y. Qing).