Magnetic Helicoidal Dichroism

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Abstract. The spin angular momentum (SAM) of a photon is associated in the wave picture to the circular polarization of the light beam. However it is less known that like any other particle a photon can carry also orbital angular momentum (OAM). This is associated to a modification of the wavefront, which becomes helicoidal instead of a plane wave. While generation, control and detection of the OAM of light is becoming more and more common in laser technology, the interaction of such twisted light beam with matter is still largely unexplored. One can imagine new forms of dichroism and new selection rules for the processes a material undergoes when it scatters or absorbs a photon with OAM, and the first predictions are indeed very interesting. In this presentation I will introduce the classical electromagnetic theory of reflection of light with OAM by a magnetic structure, an extension of magneto-optic Kerr effect, as well as its first experimental confirmation. A new kind of dichroism called magnetic helicoidal dichroism (MHD) is introduced. The extension of these studies to other aspects of light-matter interaction, like photoemission, are very promising.