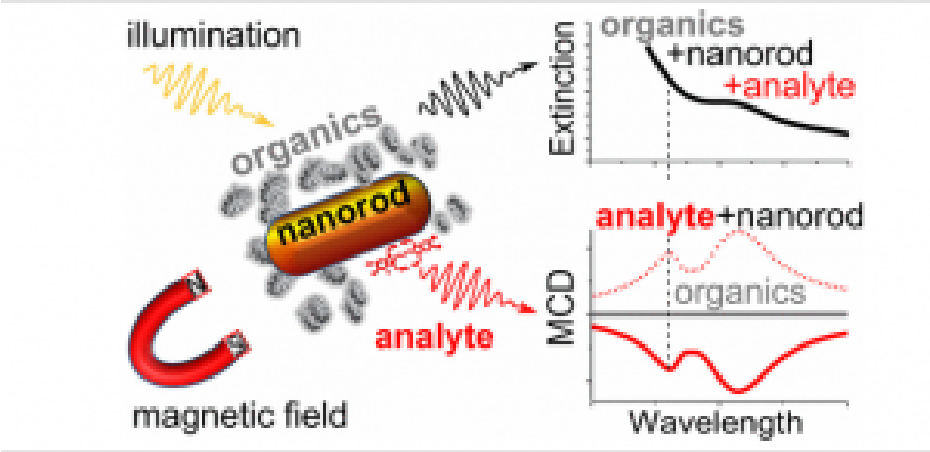
Strong magneto-optical response of non-magnetic organic materials coupled to plasmonic nanostructures



Plasmonic nanoparticles (PNPs) can significantly modify the optical properties of nearby organic molecules and thus present an attractive opportunity for sensing applications. However, the utilization of PNPs in conventional absorption, fluorescence, or Raman spectroscopy techniques is often ineffective due to strong absorption background and light scattering, particularly in the case of turbid solutions, cell suspensions, and biological tissues. Here they show that nonmagnetic organic molecules may exhibit magneto-optical response due to binding to a PNP. Specifically, they detect strong magnetic circular dichroism signal from supramolecular J-aggregates, a representative organic dye, upon binding to silver-coated gold nanorods. They explain this effect by strong coupling between the J-aggregate exciton and the nanoparticle plasmon, leading to the formation of a hybrid state in which the exciton effectively acquires magnetic properties from the plasmon. Their findings are fully corroborated by theoretical modeling and constitute a novel

magnetic method for chemo- and biosensing, which (upon adequate PNP functionalization) is intrinsically insensitive to the organic background and thus offers a significant advantage over conventional spectroscopy techniques.

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Related paper: Dzmitry Melnikau et al.,Strong Magneto-Optical Response of Nonmagnetic Organic Materials Coupled to Plasmonic Nanostructures,*Nano Lett.*, 17 (3), pp 1808–1813,(2017).