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Plasmonic Circular Dichroism of Chiral Nanoparticle Assemblies
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Chiral metal nanoparticle (NP) assemblies exhibit plasmonic circular dichroism in the visible spectral region. It was found previously that CD signals can be induced by dipolar interactions between nanoparticles of a chiral NP assembly. In this study, we show that plasmonic CD signals can be enhanced by multipole effects in tightly packed nanoparticle assemblies. We have used discrete dipole approximation (DDA) in the simulation of CD signals of nanoparticle tetramers with different geometries, which include an equilateral tetrahedron, a helical structure and an asymmetric pyramid. Our results show that the strength of CD signals rapidly decreases with the interparticle distance as $1/R^{9.7}$ for the helices and as $1/R^{18}$ for the equilateral tetrahedral 4-NP complexes, where R is an interparticle distance. On the other hand, plasmonic CD response can also be enhanced through anisotropy. We will show that orientated NP assemblies generally exhibit stronger CD response than those in colloidal system. This study can be useful in the design of chiral nanoparticle structures for sensing and optical applications.

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