

Optical properties of metallic nanoparticle assemblies.

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Abstract:

Nanostructures, including low-dimensional systems and nanometer-size clusters, exhibit unexpected properties that differ from the bulk material. Among such systems, superlattices of ordered metal nanoparticles represent an exciting new class of materials. Arrays of nanoparticles provide the possibility of probing individual and collective properties ¹⁻³, resulting from the relative positioning of the nanoparticles on the substrate. Tailoring the collective properties of such ordered nanostructures is a future direction in materials science.

This presentation will discuss the optical properties of self-assembled silver nanocrystals in a two-dimensional (2D) hexagonal structure. We aim to examine the effect of substrate dielectric properties on the observed optical properties. The experimental results show additional resonances under s-polarization when the nanocrystals are organized on a gold metallic substrate, which are attributed to the excitations of multipolar plasmon modes of self-assembled spherical silver nanocrystals. This conclusion is supported by numerical calculations performed for a similar system of metallic nanoparticles. Multipolar orders (L_{\max}) higher than quadrupolar ($L_{\max}=2$) reproduce additional resonances at higher energy under s-polarization.

References

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Biography:

Dr. Abdelhafed Taleb received his Ph.D. diploma in nanomaterials science from Pierre et Marie Curie University (currently named Sorbonne University) with high honors, in Paris in 1998. In 2000, he joined Sorbonne University, and since 2009, he has led the group, “Elaboration and Modelling of Nanostructured Films”, focusing on the design of inorganic-organic hybrid nanostructured films with novel architectures and their applications. His research aims to develop and study new innovative materials that could be incorporated into nanotechnological devices linked to the energy and environment fields. Through his 29 years of experience in nanomaterial applications and real-life problems, he has gained knowledge of the effectiveness and suitability of different methods. Dr. Abdelhafed TALEB co-organized several international conferences and is on several journals' Editorial Boards, including Sensors and Frontiers in Energy Research: Nano Energy Technologies and Materials. He is also an expert for various institutions such as the French Ministry of Higher Education, Research and Innovation (MESRI). He was awarded the Electrocorr Award in 2005 and nominated for the Eni Award in 2017. In 2019, he was awarded a Bonus for Sorbonne scientific excellence. He authored and co-authored more than 86 publications and patents on various topics, focusing on advanced materials and their applications (4837 citations, Google Scholar). He is also the author of more than 100 presentations at National and International conferences, including plenaries and keynotes.

