Moiré Photonics and Light Manipulation with Stacked Plasmonic Lattices

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Plasmonic nanoparticle lattices can support hybrid photon-plasmon excitations—surface lattice resonances—that exhibit both deep-subwavelength light confinement and strong far-field scattering. Single-layer nanoparticle lattices are a powerful platform that have facilitated nanoscale lasing, strong coupling dynamics, Bose-Einstein condensation, enhanced single-photon emission, reconfigurable lensing, photo-electrocatalysis, and thermal regulation of smart materials [1-9]. However, there has been limited work on stacked plasmonic materials. This talk will describe the preparation and properties of stacked bilayer and multilayer plasmonic lattices. We will discuss how these architectures can generate mixed color and white-light lasing emission [10] and how superimposing two or more of these periodic lattices can result in moiré superlattices mediated by ultra-long range coupling [11].

References

[1] Guan, J., Park, J.-E., Deng, S., Tan, M.J.H., Hu, J., Odom, T.W. 2022 *Chemical Reviews* 19, 15177-15203.
[2] Tan, M.J.H., Park, J.-E., Freie-Fernandez, F., Guan, J., Juarez, X.G., Odom, T.W. 2022 *Adv. Mater.* 2203999, 1-7.
[3] Park, J.-E., Lopez-Arteaga, R., Sample, A.D., Cherqui, C.R., Spanopoulos, I., Guan, J., Kanatzidis, M.G., Schatz, G.C., Weiss, E.A., Odom, T.W. 2022 *ACS Nano* 16, 3917-3925.
[4] Sample, A.D., Guan, J., Hu, J., Reese, T., Cherqui, C.R., Park, J.-E., Freie-Fernandez, F., Schaller, R.D., Schatz, G.C., Odom, T.W. 2021 *Nano Lett.* 28, 7775-7780.
[5] Vakevainen, A.I., Moilanen, A.J., Necada, M., Hakala, T.K., Daskalakis, K.S., Torma, P. 2020 *Nature Comm.* 11, 3139.
[6] Tran, T.T., Wang, D., Xu, Z.-Q., Yang, A., Toth, M., Odom, T.W., Aharnovoich, I. 2017 *Nano Lett.* 17, 2634-2639.
[7] Hu, J., Wang, D., Bhowmik, D., Liu, T., Deng, S., Knudson, M.P., Ao, X. Odom, T.W. 2019 *ACS Nano* 13, 4613-4620.
[8] Deng, S., Zhang, B., Choo, P, Smeets, P.J.M., Odom, T.W. 2021 *Nano Lett.* 21, 1523-1529.
[9] Lee, Y.-A.L., Mousavikhamene, Z., Amrithanath, A.K., Neidhart, S.M., Krishnaswamy, S., Schatz, G.C., Odom, T.W. 2021 *Small* 18, 2103865, 1-7.
[10] Guan, J., Li, R., Juarez, X.G. Sample, A.D., Wang, Y., Schatz, G.C., Odom, T.W. 2021 *Adv. Mater.* 2103262, 1-6.
[11] Guan, J., Hu, J., Wang, Y., Tan, M.J.H., Schatz, G.C., Odom, T.W. 2023 *Nature Nanotech.* DOI:10.1038/s41565-023-01320-7