VIDEO ARTICLE

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Hybrid Loss-compensated Plasmonic Device

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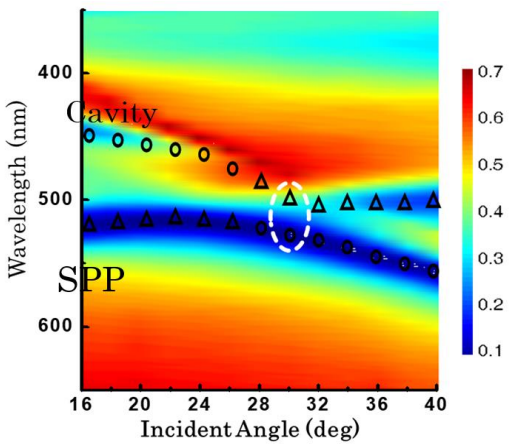
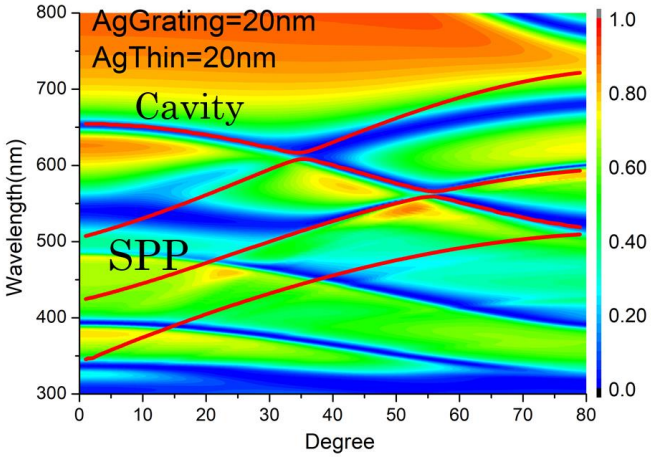
Graphical Abstract



Microcavity-SPP mode coupling with Rabi-like split. The microcavity has a passive dielectric.



Simulation results of the PTS device showing two possible Exceptional Points (EP) at @30^o and 54^o when both the Ag grating step is 20nm deep and Ag thin film is 20 nm thick.

Abstract

In this talk, I will present recent work on metamaterial, we have focused mainly on non-linear optics aspects and recently beginning to work on plasmonic devices with parity time symmetry (PTS) or PTS-like characteristics. We studied how active medium affects the Rabi-analogue splitting when an active plasmonic microcavity mode is coupled to a surface plasmon polariton mode. The incorporation of Rubrene-like molecules in the plasmonic microcavity resulted in stronger modal coupling. Anti-crossing was observed with a large Rabi-analogue splitting energy of 280 meV in the strong coupling regime. The active medium contributed to the split enhancement through channeling more energy towards the coupling. The variation of photoluminescence emission and exciton-cavity mode coupling from the hybrid plasmonic microcavity were also measured. This work shows that by introducing an active medium in the microcavity, mode coupling between microcavity and surface plasmon polariton (SPP) can be enhanced and the hybrid plasmonic device exhibits parity time symmetry characteristics. Work is still in progress to further elucidate the device physics.

Keywords: Plasmonics, parity time symmetry, rabi-analogue split.

Acknowledgements

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Biography of Presenting Author

Kok Wai Cheah is the Dr. Elizabeth K.S. Law Endowed Professor in Advanced Materials in Department of Physics, as well as Director and founder of Institute of Advanced Materials, Hong Kong Baptist University. He was the head of department from 2008 to 2014. He joined the Department of Physics, Hong Kong Baptist University in 1990. He is Fellow of Institute of Physics, UK. He also holds Visiting Professor position at Fudan University, Shanghai, China, Sun Yat-sen University and Jinan University, Guangzhou, China. He took his B.Sc. Hon degree in Physics, then M. Sc and DIC in Science of Materials, and Ph. D. in Electrical and Electronic Engineering all at Imperial College, London. After his Ph. D., Prof. Cheah spent 10 years in the UK industry, including 8 years in Astrium Space (then Marconi Space System), UK, working on various satellite projects including Meteosat and the Space Station. He is the principle founder of Cathay Photonics Limited (CPL), a spin-off company from Hong Kong Baptist University, and the company is licensed by the university to commercialise the ultra-hard anti-scratch sapphire thin film technology. Prof. Cheah is the chief inventor behind the invention of ultra-hard anti-scratch sapphire thin film technology, which won the grand prix of Geneva International Invention Exhibition in 2016. His research areas include linear and non-linear optical properties of organic complexes/devices and plasmonic nano-structures. He has presented/published more than 340 papers in journals and conferences, and holds more 25 US and other patents. His Google citation index is 12017; h-index is 52 @May 2020.

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