

Title Metaphotonics for Next-Generation Optical Devices — From Plasmonics and Metamaterials to Strong Light–Matter Interactions —

Speaker **Professor Koichi Okamoto**

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Abstract

Metaphotonics is an emerging concept that extends nanophotonics by placing metamaterials at its core, aiming to design optical functionality through engineered subwavelength structures and their collective electromagnetic responses. This approach emphasizes systematic control of light–matter interactions beyond individual nanostructures.

In this seminar, I will present our recent studies on metaphotonic optical devices based on plasmonics and metamaterials. Plasmonic nanostructures supporting localized surface plasmon resonances enable strong electromagnetic field confinement, allowing control of spontaneous emission rates and wavelength-selective optical responses. By combining metallic nanostructures with dielectric spacer layers, we have demonstrated flexible resonance tuning over a wide spectral range, from the deep ultraviolet to the infrared.

Random plasmonic metamaterials, including nano-hemisphere-on-mirror (NHoM) structures, provide scalable platforms for full-color tuning and have been applied to emission enhancement, optical sensing, and imaging. Time-resolved optical measurements further reveal accelerated emission dynamics extending beyond the immediate near-field region, indicating plasmon-mediated radiative coupling and collective emission behavior.

Through these examples, this talk highlights metaphotonics as a unifying framework for plasmonics and metamaterials and discusses its relevance to next-generation optical devices through strong light–matter interactions.

About the Speaker

Prof. Okamoto received his Ph.D. degree in Chemistry from Kyoto University, Kyoto, Japan, in 1998. From 1998 to 2000, he was a researcher at the Venture Business Laboratory of Kyoto University, followed by a period as a Research Fellow of the Japan Society for the Promotion of Science (JSPS) from 2000 to 2002. He then worked as a Postdoctoral Scholar in Electrical Engineering at the California Institute of Technology from 2001 to 2005, and subsequently as a Senior Research Fellow in Physics at the same institution from 2005 to 2007. From 2007 to 2011, he served as a Research Associate Professor in Electronic Science and Engineering at Kyoto University. From 2011 to 2018, he was an Associate Professor at the Institute for Materials Chemistry and Engineering, Kyushu University. Since 2018, he has been a Professor in the Department of Physics and Electronics at Osaka Prefecture University, which was renamed Osaka Metropolitan University in April 2022 following a university integration. His current research interests focus on nanophotonics, plasmonics, and metamaterial-based optical devices, with an emphasis on controlling light–matter interactions for advanced photonic applications.

Registration https://zoom.us/webinar/register/WN_zyJ_UXpmRFKousodk3hP7Q

Host Prof. Yukina Takahashi

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