Tunable Optical Metasurfaces with Amplitude and Phase Reconfigurability

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Optical metasurfaces are driving the future of smart and miniaturised optical technologies. Several exciting applications have been demonstrated over the past few years, including high efficiency metalenses and holograms. However, all examples to date use static metasurfaces that cannot be dynamically reconfigured to perform multiple optical functions. The need for meta-devices with reconfigurable and programable functionalities has driven a quest for the development of metasurfaces with strong tunability. In this talk, I will present some of our recent advances in reconfiguring optical metasurfaces enabled by tuning their surrounding environment or constituent elements. In particular, I will discuss the development of liquid crystal-tunable metasurfaces for full-range optical phase modulation of 2π. I will also discuss the development of electrically programmable thermo-optical metasurfaces to perform fast transmission modulation of over 70%. Finally, I will discuss some of fundamental considerations needed to maximise the change of the light transmitted through optical metasurfaces with lossy materials, including free-form optimisation of optical transmission through phase-changed metasurfaces. The presented developments aim to advance the field of tunable optical metasurface for real-world applications of active meta-optics.

Biography: Dragomir Neshev is a Professor in Physics at the Australian National University (ANU) and the Director of the Australian Research Council Centre of Excellence for Transformative Meta-Optical Systems (TMOS). He received a PhD degree from Sofia University, Bulgaria in 1999. Since then, he has worked in the field of optics at several research centres around the world and joined ANU in 2002. He is the recipient of several awards and honours, including a Highly Cited Researcher (Web of Science, 2021), a Queen Elizabeth II Fellowship (ARC, 2010), and a Marie-Curie Individual Fellowship (European Commission, 2001). His activities span over several branches of optics, including periodic photonic structures, singular optics, plasmonics, and optical metasurfaces.

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