# Department of Biomedical Engineering
# The Chinese University of Hong Kong

## Graduate Seminar – PhD Oral Defence

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| ***Student*** | ***:*** | Mr. ZHAO Guangyuan |
| ***Supervisor*** | ***:*** | Prof. ZHOU Renjie |
| ***Date*** | ***:*** | 21 October 2026 (Wednesday) |
| ***Time*** | ***:*** | 9:30 am |
| ***Venue*** | ***:*** | Room 1122, William M W Mong Engineering Building, CUHK |

**Title: Mastering the Control of Light with Machine Intelligence**

Bridging advances in artificial intelligence with the physical world depends on informative interactions, in which light transport plays a crucial role in cameras, sensors, and augmented and virtual reality displays. High-fidelity modeling and precise control of light transport remain challenging because of the reality gap between physical systems and their simulations. Inspired by robot learning, my research prioritizes information acquisition and system modeling through real-world interactions. This seminar presents white-box, black-box, and gray-box approaches to computational imaging and optics. For white-box modeling, Gaussian Beamlet Splatting combines adaptive Gaussian beamlet densification with analytical complex-field propagation for efficient ray-wave simulation and inverse design. For black-box optimization, model-free optimization uses measured task feedback to train physical optical computing systems without differentiating a system simulator. For gray-box optimization, a Real2Sim2Real framework connects fabrication modeling with optical design. Real2Sim learns a differentiable photolithography model from paired layouts and measured print topographies. Sim2Real combines this model with analytical wave optics for design-fabrication co-optimization. These approaches improve the efficiency of complex-field light-transport modeling, enable closed-loop optimization of physical optical computing systems, and improve the post-fabrication performance of holographic and imaging devices. Together, these contributions advance our understanding of computational optical systems and their applications and help bridge AI with the physical world.

***** ALL ARE WELCOME *****

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