



Steering Light with Sound

--from 3 nanometers to 300 meters

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Abstract:

Lightning is seen much earlier than the thunder is heard, because light travels nearly one million times faster than sound in air. In solid-state materials, however, the speed of sound increases while the speed of light slows down. Moreover, the acoustic wave traveling in the medium generates a periodic modulation of the medium's optical properties, which can lead to strong interaction with the light wave also traveling in the medium. Engineering the light-sound interaction in photonic devices and quantum materials can lead to many novel phenomena and applications. In this talk, I will discuss two lines of recent works in which we exploit light-sound interaction with applications in classical and quantum regimes, respectively. We invented an integrated acousto-optic beam steering (AOBS) device in which gigahertz frequency acoustic wave is generated to steer and scan laser light from a chip. The device is used for scanning light detection and ranging (LiDAR) for imaging over a distance of 100 meters and potentially reaches 300 meters for future commercial applications. In another extreme, we use the same type of acoustic wave to transport light-emitting particles—excitons, in 2D semiconductors over a distance far beyond the diffusion limit, potentially enabling exciton circuits. Interesting, when localized to nanometer scale single photon emitters, excitons also emit phonons—the quanta of acoustic wave. Therefore, the 2D semiconductor excitonic system is a fertile ground for exciton-photon-phonon engineering.

Biography:

Mo Li is a Professor in the Department of ECE and Department of Physics at the University of Washington, where he joined in 2018. Before UW, he was an Associate Professor of ECE at the University of Minnesota from 2015 and Assistant Professor from 2010. From 2007 to 2010, he was a postdoctoral associate in the Department of Electrical Engineering at Yale University. He received his Ph.D. degree in Applied Physics from Caltech in 2007, B.S. degree in Physics from the University of Science and Technology of China (USTC) in 2001. He is an OSA Fellow, a recipient of AFOSR YIP and NSF CAREER awards, and a McKnight Land-Grant Professor of the University of Minnesota.