Due to its subwavelength field confinement and low propagation loss, designer surface plasmon holds considerable promise in microwave- to infrared- frequencies device applications. Here, we propose and experimentally demonstrate various novel wave manipulations of designer surface plasmon in microwave frequency range. First, we propose a surface-wave band-gap crystal implemented on a single metal surface which exhibits a complete band gap for surface waves. Surface waves can be tightly guided along the line defect and near-perfect transmission around multiple sharp corners can be achieved over a broad frequency band. Second, we realize the forward/backward switching of plasmonic waves propagation using sign-reversal coupling. By directly measuring the tight-binding Bloch waves on a periodic array of coupled designer surface plasmon resonators in the microwave regime, we demonstrate multi-band forward/backward switching of plasmonic wave propagation. Finally, a mechanically flexible photonic topological insulator that supports robust topological photonic states on a curved surface is experimentally demonstrated. Spatial topologies achieved by folding the flexible photonic topological insulator serve as a new freedom to manipulate the propagation of topological photonic states. This work bridges the gap between the emerging field of topological photonics and the technologically promising field of flexible photonics.

**Date:** 30 October 2017  
**Time:** 10.00 AM  
**Venue:** Conference Room, SPMS Level 2  
**Supervisor:** Assoc Prof Zhang Baile