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NANYANG TECHNOLOGICAL UNIVERSITY

URECA
*Undergraduate Research Experience on CAmpus*

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# PLASMONICS COUPLING IN A TWIN-CORE PHOTONIC CRYSTAL FIBER

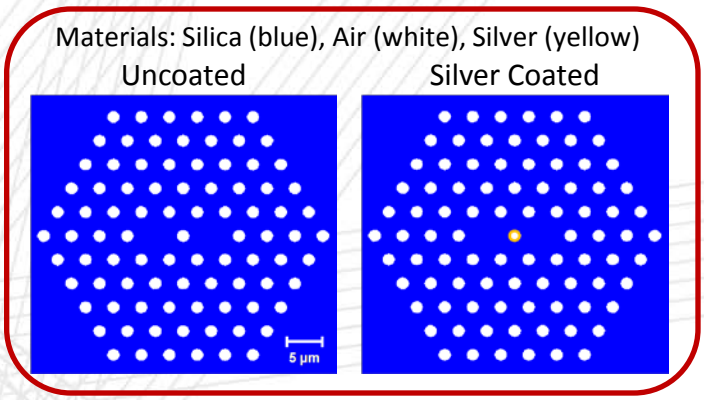
## Objective

To design an efficient fiber coupler with *short coupling length* & *low loss* based on plasmonics effect

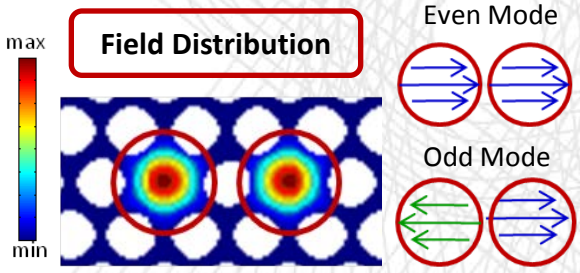
## Background

The plasmonics has twofold influence on the coupler performance. On one hand, absorption in the metal layer is the largest at resonance, which facilitates inter-core coupling and shortens the coupling length. On the other hand, the introduction of metal brings in insertion loss, which limits the energy propagation in the waveguide. However, this trade-off can be minimized via proper waveguide design.

## Structure

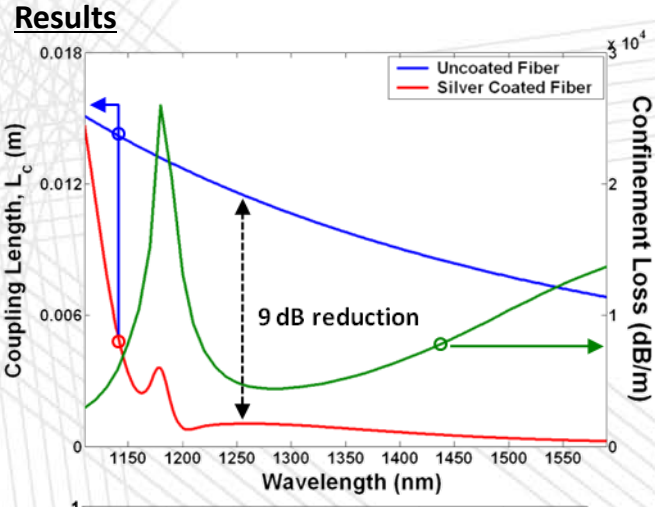


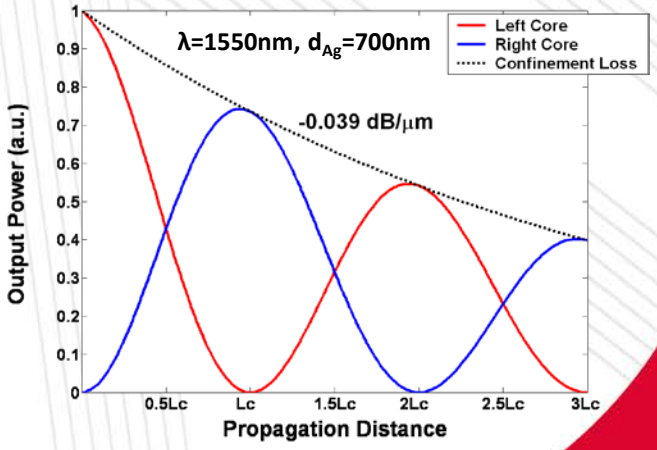

## Principles




- Coupling Length, $L_c = \pi/(\beta_{even} - \beta_{odd})$
  β: propagation constant
- Loss ($dB/m$) = $40\pi * Im(n_{eff})/[\lambda(m) * \ln(10)]$
  $Im(n_{eff})$: imaginary part of effective index
- Transmittance = $\sin^2[(\beta_{even} - \beta_{odd}) * L/2]$
  L: physical fiber length

## Results




## Conclusions

- Features:
  - ✓ Short coupling length & low loss
  - ✓ High coupling efficiency up to 73%
  - ✓ Easy fabrication techniques
- Applications:
  - ✓ High sensitivity measurement
  - ✓ Polarization splitters
  - ✓ Photonic integrated circuits

**Project Title: Design of Surface Plasmon Enhanced Photonic Crystal Fiber Devices**
**Supervisor: Prof Shum Ping** **Co-supervisor: Dr Yu Xia Mandy**