

# **Metalens Design and Simulation with RSoft and CODE V**

## **0. Abstract**

An effective simulation approach for metalens design is demonstrated by combining multiple simulation algorithms. Finite-Difference Time-Domain (FDTD) or Rigorous Coupled Wave Analysis (RCWA) is used to calculate the phase delay of various individual nano-cells, and then efficient beam propagation methods are used to trace the beam through the metalens or its equivalent phase mask.

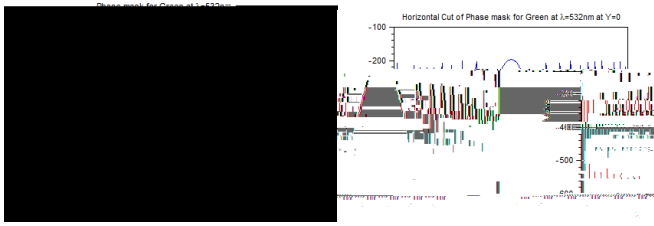


Figure 3: Phase mask of the metalens

### 2.3. Validation of BPM algorithm on a small structure

BPM is an efficient method to simulate forward propagation without accounting for backward reflections. We first validate BPM against the bidirectional FDTD algorithm on a small metalens  $20\mu\text{m}$  in diameter and  $\text{NA}=0.25$ . The theoretical focal length is  $F=17.3\mu\text{m}$ . Shown in Figure 4 on the left is the BPM simulation result with  $F=16.96\mu\text{m}$ , and on the right is the FDTD result with  $F=17.14\mu\text{m}$ . This comparison shows that BPM agrees very well with FDTD for this application.

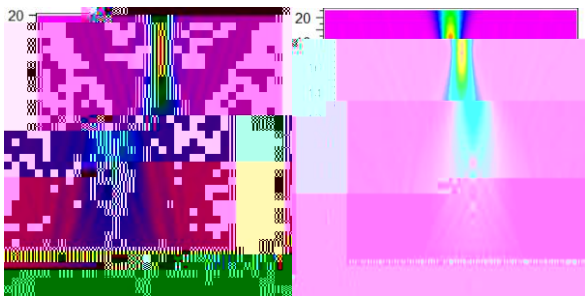


Figure 4: BPM result (left) and FDTD result (right)

For comparison the memory requirements for BPM were 0.19G and FDTD was 55G, and the respective simulation times

