

課題番号 : F-16-HK-0048  
 利用形態 : 共同研究  
 利用課題名(日本語) :  
 Program Title (English) : The near field image of Archimedes spiral by using the photoemission electron microscopy.  
 利用者名(日本語) : 蔡瑋義, 蔡定平  
 Username (English) : Wei-Yi Tsai, Ding-Ping Tsai  
 所属名(日本語) : 台湾大学物理学系  
 Affiliation (English) : Department of physics, National Taiwan University.

## 1. 概要(Summary)

The Archimedes spiral provide an interacting platform between the orbital and spin angular momentum to generate the optical vortex and super focusing on the metal surface. The main effect involved in this process is surface plasmon polariton (SPP) which is launched from the nano slit and then propagating to the center of spiral. With the nonlinear photoemission process, photoemission electrons microscopy (PEEM) presents the potential that allow us to analyze the dynamic motion of SPP wave, obtain the near field image in shorter time as well as improve the resolution. Once we successfully obtain the near filed results of spiral, the further experiment for realizing the high-order spiral will be executed.

## 2. 実験(Experimental)

### 【利用した主な装置】

超高精度電子ビーム描画装置

### 【実験方法】

We fabricated the spiral samples and then bring to prof. Misawa's group to proceed the measurement. The sample was put into the main chamber of PEEM and applied external voltage to help the image. The SPP wave is excited under the pulse light source of PEEM. The nonlinear process, four photons to release one electron, help us to clearly image the near field distribution of fundamental and high-order spiral.

## 3. 結果と考察(Results and Discussion)

The preliminary result show that the time-average optical vortex and super focusing can

be realized. Also, the interference ring within the spiral structure can be clearly observed.

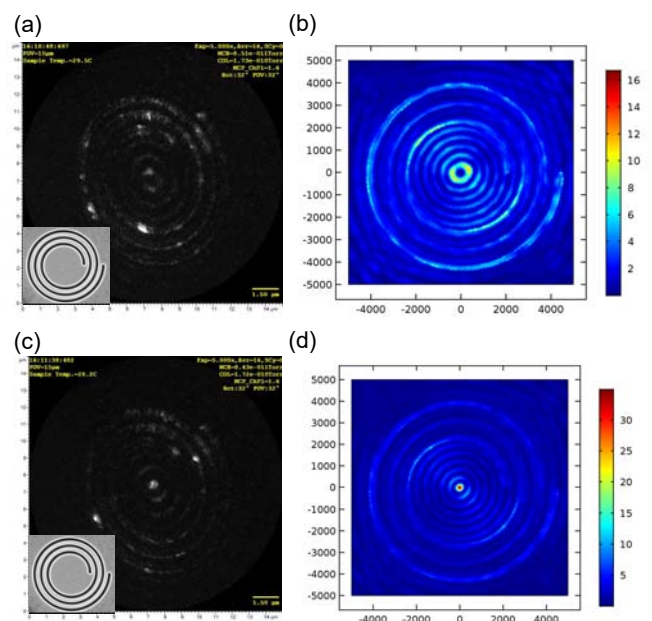


Figure 1 (a-b) show the measurement and corresponding simulation for optical vortex. (c-d) show the case of super focusing.

## 4. その他・特記事項(Others)

References:

- Q. Sun et al., ACS Nano, 10, 3, 3835-3842, 2016.
- Q. Sun et al., Light: Science & Applications, 2, e118, 2013.
- Hui-Hsin Hsiao et al., SPIE OPTICS + PHOTONICS, San Diego, USA, 2017.
- Yi Chieh Lai et al., SPP8, Taipei, Taiwan, 2017.
- 共同研究: 孫泉、上野貢生、三澤弘明(北大電子研)

## 5. 論文・学会発表(Publication/Presentation)

N/A

## 6. 関連特許(Patent)

N/A