UNIVERSITY of DAYTON

Thesis Defense
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10:00 am - CPC 568
All are invited

Numerical study on the characteristics of metal-insulator-metal diode integrated with spiral optical antenna

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Abstract

Metal-insulator-metal (MIM) diode structures attract increasing interests in many technical areas including the solar cell technologies because of their capabilities to directly convert optical energy into electric current. During the process of energy transfer, surface plasmon polaritons (SPPs) play an important role due to their intriguing properties such as high local field enhancement and short effective wavelength. As an important figure of merit, the field enhancement arising from the SPPs excitation is limited by the relatively large mode volume in the traditional MIM structure. A potential way to improve the field enhancement factor is to introduce an optical antenna in the design of MIM diode structure to efficiently couple the energy of free-space radiation into a confined region of subwavelength size with highly enhanced field.

In this thesis, I present the numerical studies on the characteristics of a novel device design that integrates MIM structure with a spiral slot optical antenna. As a spin sensitive structure, the response of the spiral slot antenna strongly depends on the spin state of the illumination. Three-dimensional finite element method model has been built to numerically simulate the performance of the proposed structure. Modeling results show that this hybrid structure has the ability to achieve both extremely high field enhancement and circular polarization extinction ratio simultaneously. A field enhancement of 150 and circular polarization extinction ratio of 200 can be obtained with this design. Such a device may find useful applications in polarimetric imaging and remote sensing.

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