# Super-resolution technique for nanolithography

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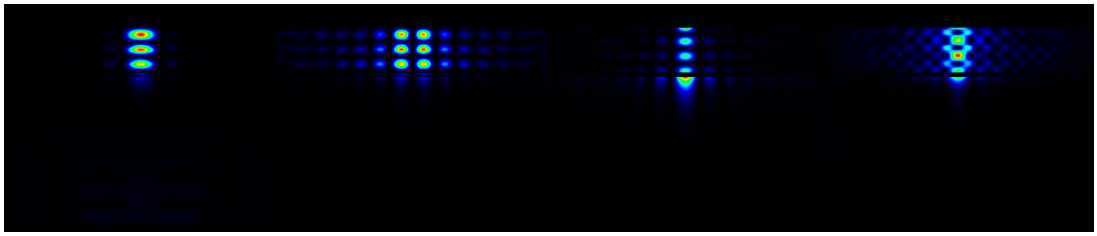
## ABSTRACT

Super-resolution in nanolithography is somehow different from super-resolution imaging, because a number of data processing techniques can be used in the later case, while for nano-lithography, a super-resolution focal spot is essential. Fig. 1 demonstrates an example of the combining far-field light modulation techniques and near-field plasmonic effect to create a focal spot only a quarter of wavelength in size. A radially polarized beam is produced by using spatial light modulator. After passing through a high numerical aperture objective lens, a strong longitudinal component $E_z$ which has a narrow focal spot is produced and further enhanced by the plasmonic effect of a metal thin film. As a result, the transverse polarized components $E_x$ and $E_y$ which represent strong side-lopes at the focus is efficiently suppressed. In this paper, a simulation model based on high angle diffraction theory and three-dimensional finite difference time domain (FDTD) method is developed to study light focusing through non-linear materials such as metal, non-linear dielectric media etc. The investigation aims to develop super-resolution techniques for nano-lithography.



$|E_x\_yz|^2$ $|E_y\_yz|^2$ $|E_z\_yz|^2$ $|E\_yz|^2$

Fig. 1 Focusing of a radially polarized beam by a high numerical aperture objective through a 50 nm silver thin film.