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## Double Helix Point Spread Function, A fluorescence microscopy technique

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A fluorescence microscopy is an essential tool in the life sciences. In particular, it can be used for tracking a single molecule in a living cell or organic substance such as a polymer. Single molecule trajectory analysis allows an efficient method to explore intermolecular dynamics. Introduction of a technique named double helix point spread function enables accurate localization and orientation determination of a single fluorescent molecule in three dimensions [1]. It consists of changing the phase of the electric field of the emitter in order to make the intensity pattern sensitive to position and orientation [2]. The method uses optical Fourier processing through a 4f imaging system and a modelled phase loaded onto a spatial light modulator placed on the Fourier plane of the 4f imaging pathway [3]. The intensity pattern is changed from the conventional point spread function to a double helix point spread function. In this work, we introduce the phase mask in order to get a double helix point spread function then show results for its usefulness in fluorescence microscopy.

### References

- [1] Pavani SR, Thompson MA, Biteen JS, Lord SJ, Liu N, Twieg RJ, Piestun R, Moerner WE. Three-dimensional, single-molecule fluorescence imaging beyond the diffraction limit by using a double-helix point spread function. *Proceedings of the National Academy of Sciences*. 2009 Mar 3;106(9):2995-9.
- [2] Roeder C, Jesacher A, Bernet S, Ritsch-Marte M. Axial super-localisation using rotating point spread functions shaped by polarisation-dependent phase modulation. *Optics express*. 2014 Feb 24;22(4):4029-37.
- [3] Backer AS, Moerner WE. Extending single-molecule microscopy using optical Fourier processing. *The Journal of Physical Chemistry B*. 2014 May 12;118(28):8313-29.

**Apply to be considered for a student & award (Yes / No)?**

Yes

**Level for award (Hons, MSc, PhD, N/A)?**

MSc

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**Would you like to submit a short paper for the Conference Proceedings (Yes / No)?**

No

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