

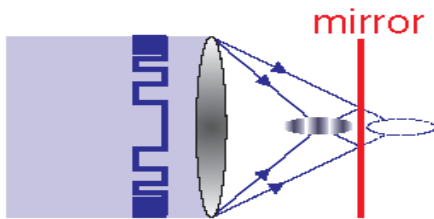
ISOTROPIC SINGLE-OBJECTIVE MICROSCOPY: EXPERIMENT AND APPLICATION

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Improving the spatial resolution in optical microscopes is a challenging task for many applications. In fluorescence confocal microscopy, the resolution is given by a length Detection Efficiency Function (DEF) which looks like a rice grain. 4Pi type C microscope has shown to be a powerful solution for considerably reducing the axial dimension of the DEF [1] and even its lateral dimension [2]. This results are obtained by superposing two coherent illumination beams and by adding coherently the two fluorescence wave-fronts emitted on the both sides of the luminescent sample. This set-up is very interesting but is somehow difficult to be used by non-specialized users since its alignment is not simple. Isotropic single objective (ISO) microscopy [3] is a solution based on the same principle with comparable results. The main advantage of this technique is that ISO works only with one objective which allows an implementation on all confocal systems.

The principles of ISO focusing is a mix of wave front shaping and interferometry [3-4]. The principle is based on the electromagnetism time-reversal cavity theory. The theory states that by sending in time reversed order (or with phase conjugation) the field radiated by a point source in an arbitrary environment, one forms an optimal light spot at the source location.



Principle of ISO microscopy [3]

That means if the incident wave front is shaped so that its reflection on a mirror, placed after the focus point, is phase conjugated then one would have a superposition of the focused spot (virtual source) and the optimum light spot formed by the reflection waves. The interference between these two spots allows an increasing of the axial resolution by a factor of six. We will present all advantages and our last experimental and theoretical results during the conference.

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