Enhancement of nanoparticles' tracking using phase imaging microscopy

Minh-Chau Nguyen, Pierre Bon
Laboratoire Photonique Numérique et Nanosciences (LP2N), Institut d'Optique d'Aquitaine
Rue François Mitterrand, 33400 Talence, France
Email: pierre.bon@cnrs.fr

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In this paper, we demonstrate that quantitative phase and intensity imaging microscopy based on lateral shearing interferometry [1,2,3] (Figure 1a) allows to observe and track at high frame rate nanoparticles in solution down to diameter of 80 nm in solution. To do so, we desribe a novel approach for tracking the particle based on the Rytov approximation of electromagnetic field inferred from the complexe electromagnetic filed image (intensity image and phase image). Having access to the complex electromagnetic field allows indeed to perform numerical propagation of the particle's image into different planes. It enables to bring in-focus all the defocused particles independantly. Transforming the 3D problem into a 2D problem greatly facilitate the tracking algorithm of many particles simultaneously, while keeping the knwoledge about the 3rd dimension. Figure 1b shows several particles in brownian diffusion at different planes. The same particles are putted back in focus after the propagation in Figure 1c. We will discuss the applicability and limits of our method on various dielectric and metal nanoparticles.

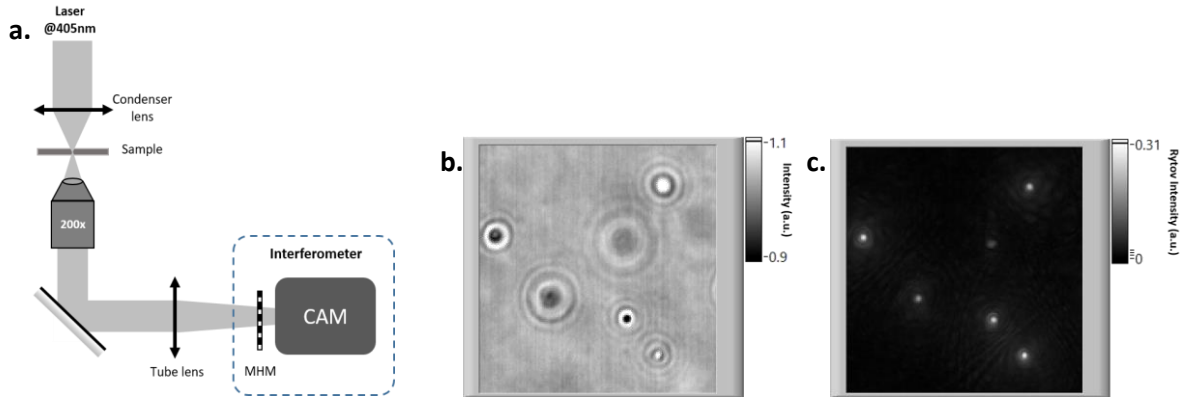

Figure 1: (a) Experimental setup of phase imaging microscopy using MHM. **(b,c)** Image of several particles in solution (200 nm of diameter) by their intensities (b) and by their Rytov approximation intensity after the numerical propagation (c).

References

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