Titre: Photonic jet lens: near-field to far field coupling in the super-resolved microscopy

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Abstract:

The characterization of nanomaterial, biomaterial and life cells by electronic microscopy or AFM is complex and requires long acquisition times. New optical nanoscopy techniques in the far field allows label free imaging of nanostructures and even 3D measurements. Recently our team has developed such a high-resolved 3D microscopy technique with very high potentials. A classical interferometric microscope is coupled with a photonic jet lens. 3D full field reconstructions with nanometric resolution in the three directions (10x50x50 nm^3) have been obtained. Nevertheless, the physical mechanics explaining such a resolution, more than two times smaller than the diffraction limit, are not well understood. The PhD objective will be to explore them experimentally and theoretically. The role of evanescent waves in the interaction between micro-bead and the sample will be studied. Their high spatial frequencies seems to play a major role in the reached resolution. A key point is their coupling with propagative waves required to image in the far field. This will be considered using a rigorous electromagnetic method to simulate the interaction in the near field, coupled with far field imaging system modeling software. The hypothesis will be tested experimentally. The influence of several parameters having influence on the resolution will be explored: bead properties, material of the sample, illuminating source,
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