

PLENOPTIC EYEPIECE. TRANSFORM ANY MICROSCOPE INTO A 3D MICROSCOPE

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Lightfield, also known as plenoptic, cameras are commercialized since a decade ago and now many companies are beginning to present also lightfield displays. Both devices are based on integral-photography concept [1]: by inserting a lens array in front of the camera sensor, it is possible to register an integral image that contains both the spatial and the angular information of the rays proceeding from the 3D object. Later, by displaying the integral image on a pixelated monitor and placing a lens array in front of it the 3D scene is recovered.

The same concept can be applied to optical microscopy. The first approach was made by Levoy's group who suggested to place a microlens array at the image plane of the microscope and displace the CCD so that a collection of microimages are recorded [2]. Although highly inspiring, this lightfield architecture has some drawbacks, such as a very poor and inhomogeneous lateral resolution, or a low density of depth rendered planes.

Aiming to overcome these drawbacks, a new architecture for lightfield microscopy was proposed. Named as Fourier lightfield, this scheme is based in collecting the spatio-angular field at the Fourier plane of the microscope [3]. This new paradigm has been promptly adopted by other researchers [4-6].

Based on Fourier lightfield concept, a new start-up was launched, DoitPlenoptic S.L. [7]. At the moment its work is focused on the development and commercialization of its first product; the plenoptic eyepiece, a portable, plug-and-play device that, after inserted at the ocular port, converts any conventional optical microscope into a lightfield microscope, with the best performance in terms of resolution and depth of field. The plenoptic eyepiece can take profit from all the facilities instaled in the microscope, like illumination rings or filters, objective revolver, or even scanning platforms. The images captured with the plenoptic eyepiece are processed through the dedicated software to provide the user with full 3D information of the sample.

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