A structured illumination microscopy (SIM) is presented using an illumination with interference spots generated by a nano hole array. A sub-diffraction spatial resolution is achieved by a small interference spot size illumination and a scan. It can reach $\lambda/4$.

The optical microscope setup is completed by a common low resolution lens with a large field of view.

An experimental example is given. For illumination, a nano hole array with $80 \times 80$ holes, hole diameters of 530 nm and distances of 6 µm is used. The generated interference spot size is 280 nm ($\lambda = 532$ nm) and a $20 \times 20$ scan was performed with 300 nm steps. The used lens (10x / 0.2) has a spatial resolution of 1.6 µm (Koehler illumination) and a field of view diameter of 2.3 mm.

A reconstructed image (detail) is given below. The lateral resolution is about 600 nm. This is a factor about three below the diffraction limit of the lens.

The illumination by a nano hole array and the use of a common microscope lens without any immersion is especially useful for wide field microscopy with high resolution below the diffraction limit. The results are discussed and evaluated to other super-resolution techniques.

Figure: Details of an advanced microscopic image of 2 µm PMMA beads taken by an optical microscope with a common lens (10x / NA = 0.2). The same object is imaged twice by the same lens, common plane wave illumination (left) and illumination by a nano hole array and a scan (right). The resolution is more than three times better than the diffraction limit. The field of view is given by the 10x / 0.2 lens.