Dark-field digital holographic microscopy by using vortex beam illumination

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Abstract: We propose a dark-field digital holographic microscopy (DHM) by using vortex beam illumination. In this paper, the annular illumination of vortex beam and the dark-field DHM imaging system are theoretically analyzed, and the quasi-nondiffracting property of the vortex beam is discussed. A corresponding DHM imaging system is established. The polystyrene spheres each with a size of 690 nm are utilized as objects in the experiment. By comparing the results of reconstructed images under bright-field illumination with those under dark-field illumination DHM, it is proved that the resolution of dark-field DHM under speckle-field illumination is improved and the contrast of its reconstructed image is enhanced accordingly.
Dark-field microscopy (also called dark-ground microscopy) describes microscopy methods, in both light and electron microscopy, which exclude the unscattered beam from the image. As a result, the field around the specimen (i.e., where there is no specimen to scatter the beam) is generally dark. In optical microscopy, dark-field describes an illumination technique used to enhance the contrast in unstained samples. It works by illuminating the sample with light that will not be collected by the objective. Aulacodiscus kittoni with COL (left) and with DF illumination (right). Gregor T. Overney, Sunnyvale, California, USA.

Introduction. I was using a PixeLink PL-A662 FireWire digital camera. This device offers great flexibility to control the imaging process and connects directly to a C-mount adapter connected to a trinocular viewing body. With Köhler illumination, the field diaphragm is focused into the specimen plane by the condenser. (We also say that the field diaphragm is located in a conjugated image plane.) When using a low-cost Abbe condenser, color fringes will form around the image of the field diaphragm. By closing the field diaphragm more than necessary, we sometimes color the imaged specimens in DF with beautiful colors.