NOVEL MICROOPTICS-BASED SPINNING DISK CONCEPT

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1. OPTICAL DESIGN

Multifocal systems have become the gold-standard for fast, minimal damage confocal live cell observation. Simple Nipkow designs suffer from low excitation efficiency. This has been overcome by the Yokogawa CSU-design, which employs two synchronously spinning disks with a pinhole-pattern in one and a corresponding micro-lens pattern in the other disk. However, in this design the dichroic must be placed between the disk, into a non-infinite optics space, and this causes a number of severe problems regarding magnification, NA-matching to magnification and maximal field-size. We have overcome these by a novel design which uses a single disk only, comprising a pattern of concave micro-mirrors, a cornercube-based retroreflector-concept and a corresponding pattern of pinholes in the center of the mirrors, which are passed by the excitation light focused by the micro-mirrors. The quasi-hexagonal pattern of micro-optics and pinholes warrants equal intensity illumination for all areas of the illuminated field. The genuine infinite space in the optical beam-path facilitates:

- better matching to different magnifications (particularly to 60x water immersion objectives);
- using larger field-sizes;
- the integration of a dual emission module without additional optics, using a single camera.