FOURIER TRANSFORM-BASED CONFOCAL MICROSCOPY USING IMAGE-ENCODED OPTICAL-FREQUENCY-COMB

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In this study, we proposed novel confocal microscopy using optical-frequency-comb (OFC) for highly resolved-three-dimensional amplitude and phase imaging. The proposed method is shown in Fig. 1.

This approach encoded the confocal microscopic image of a sample on OFC spectrum by using a two-dimensional disperser. The image-encoded OFC is decoded with dual-comb spectroscopy. Dual-comb spectroscopy is a promising technique for ultra-precise, accurate, and broadband spectroscopy. Dual-comb spectroscopy employs two OFC lasers having slightly different repetition rates, allowing the acquisition of a complete interferogram with an ultra-wide time span without mechanical scanning for deducing the highly resolved optical spectrum. Furthermore, dual-comb spectroscopy is based on Fourier transform spectroscopy, which provides amplitude and phase spectra by directly decoding from the interferograms of two OFC lasers. Therefore, the proposed imaging method enables confocal imaging under laser-scan-less condition. Furthermore, since the phase spectrum can be simultaneously acquired with the amplitude spectrum by dual-comb spectroscopy, inside of confocal volume can be optically sliced by use of the space-encoded phase spectrum.

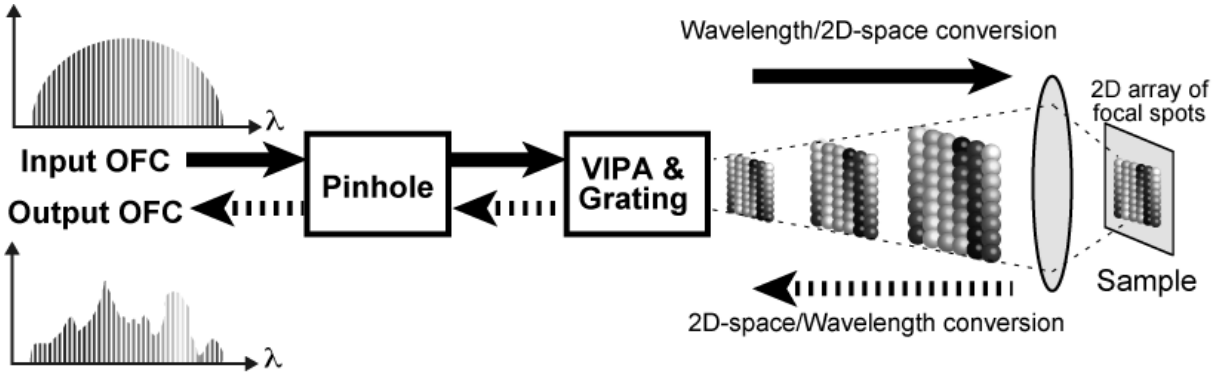

Fig. 1 Concept of Fourier transoform-based confocal microscopy using image-encoded optical-frequency-comb