

## MULTISPECTRL LASER SCANNING OPHTHALMOSCOPY

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**KEY WORDS:** Laser scanning ophthalmoscope, adaptive optics, acousto-optic modulator, off-axis aberration, supercontinuum.

Confocal laser scanning ophthalmoscopy is a retinal imaging technique similar to the setup of a laser scanning microscope, except that the eye serves as the objective lens. Retina is the only part of the central nerves system that can be imaged non-invasively in the living organism, so high-resolution functional imaging of retina will enhance our understanding of the cellular interaction and signal transduction in neural circuits. Although spectral imaging is crucial for identification of local chemical composition for functional imaging [1,2], previous laser scanning ophthalmoscopy demonstrations were limited to only several wavelengths due to the limitation of optics. Moreover, the intrinsic optical aberration of cornea and lens hinders proper focusing of external light onto the retina, increasing the difficulty for high-resolution ophthalmoscopy.

Recently, we have demonstrated a mirror-based broadband laser scanning system with diffraction-limited performance [3]. The applicable wavelength of the system spans from ultraviolet to terahertz regime, providing an invaluable flexibility for microscopic and ophthalmoscopic applications. We have also built up our own supercontinuum source, providing not only spectral range spanning across the whole visible range, but also highly coherent light for high-resolution application. The resolution is further enhanced by incorporating adaptive optics techniques, which has been proven to compensate the intrinsic aberration of the cornea/lens and provide sub-cellular resolution. Combined with an acousto-optic tunable filter, fast scanning across the whole visible range can be realized. Thus, high-speed, high resolution multispectral imaging of retina is achieved. Such multispectral ophthalmoscopy provides a potential extension to medical diagnostic applications, such as early detection of age-related macular degeneration. Since retina is also the only place in the body where a microscopic inspection of the health of the vascular system can be undertaken without an invasive procedure, this technique may be useful for early diagnosis of cancer or strokes by examination of chemicals in blood vessels.

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