

Apparatus And Method For Optically Amplified Multi-Dimensional Spectrally Encoded Imaging

Tech ID: 27206 / UC Case 2009-275-0

SUMMARY

Scientists at UCLA have developed an advanced optical imaging technique that uses spectral brushes to capture image data across an entire sample area at once, a technique that enables faster imaging and higher sensitivity over current methods.

BACKGROUND

Conventional detection techniques for imaging are slow and incapable of capturing dynamic processes that occur on the time scale of nanoseconds. CCD and CMOS sensor arrays in cameras have typical frame rates of 100 Hz – 10 kHz, so even at the fastest operating shutter speeds (~100 ns) the download time can still take several milliseconds, which bottlenecks the overall image collection procedure. Faster frame rates can be achieved, but require costly and bulky cooling systems or high intensity illumination setups that can damage biological samples.

INNOVATION

Researchers at UCLA have developed an apparatus and method for high speed, real-time, two- and three-dimensional imaging that can overcome the fundamental trade-off between sensitivity and speed. Their process is called femtosecond real-time serial imaging (FARSI) and it employs a two-dimensional spectral pattern as a probe beam with optical amplification on the backend. The image is ultimately obtained through spectrum decoding of the back-reflected light from the sample. This technique is already described in [Nature](#) as being the “world’s fastest camera.”

APPLICATIONS

- ▶ High speed microscopy
- ▶ Industrial inspection and monitoring
- ▶ Endoscopy, for industrial and medical use

ADVANTAGES

- ▶ Faster shutter speed
- ▶ Higher frame rate
- ▶ Higher sensitivity
- ▶ No mechanical scanning

STATE OF DEVELOPMENT

As a proof of concept, continuous real-time imaging at a frame speed of 163 nanoseconds (a frame rate of 6.1 MHz) and a shutter speed of 440 picoseconds is demonstrated in the [Nature](#) article.

RELATED MATERIALS

- ▶ K. Goda, K. K. Tsia, and B. Jalali. “Serial time-encoded amplified imaging for real-time observation of fast dynamic phenomena.” [Nature](#) 458, 1145-1149 (30 April 2009).

PATENT STATUS

Country	Type	Number	Dated	Case
United States Of America	Issued Patent	9,835,840	12/05/2017	2009-275

CONTACT

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INVENTORS

- ▶ Jalali, Bahram

OTHER INFORMATION

KEYWORDS

imaging, optics, process/procedure, microscopy, ultra-fast real-time optical imaging

CATEGORIZED AS

- ▶ **Optics and Photonics**
 - ▶ All Optics and Photonics
- ▶ **Imaging**
 - ▶ 3D/Immersive
 - ▶ Medical
 - ▶ Other

RELATED CASES

2009-275-0, 2009-280-0

ADDITIONAL TECHNOLOGIES BY THESE INVENTORS

- ▶ [Phase Transform For Object And Shape Detection In Digital Images](#)
- ▶ [Apparatus And Method For Multiple-Pulse Impulsive Stimulated Raman Spectroscopy](#)
- ▶ [Ultrafast Differential Interference Contrast Microscopy](#)
- ▶ [Global Training Of Neural Networks For Phenomic Classification](#)
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