Ultrafast Differential Interference Contrast Microscopy

Tech ID: 29925 / UC Case 2010-262-0

SUMMARY

UCLA researchers in the Department of Electrical Engineering have developed a novel instrument that can image unstained transparent objects with high speeds.

BACKGROUND

Finding rare diseased cells in a large population of healthy cells in a high-throughput manner is difficult but essential for early detection of diseases. Current limitations include screening biological cells that are transparent without the use of labels or dyes, which is time-consuming and often causes cell death, with high resolution. Traditional imaging technologies suffer from slow shutter speed, resulting in blurred images during high-speed screening. Recently, serial time-encoded amplified microscopy (STEAM) has overcome these limitations and provides ~1000 times higher frame rates and shutter speeds than conventional image sensors, but is inadequate for imaging transparent samples without the use of dyes.

INNOVATION

Professor Bahram Jalali and his research team have developed a novel 2D and 3D imaging technique, termed Nomarski STEAM (N-STEAM). This high-speed, high-contrast imaging modality enables image acquisition of transparent media without the use of staining. As a proof of concept, transparent test structures and white blood cells were imaged in flow at a shutter speed of 33 ps and a frame rate of 36.1 MHz using a single-pixel photo-detector. This instrument will be a valuable tool for high-throughput screening of unstained cells and will have a broad range of applications from semiconductor process monitoring to blood screening.

APPLICATIONS

- Biological cell imaging
- Cancer detection
- Blood screening
- Semiconductor process monitoring

ADVANTAGES

- Label free, transparent sample imaging
- High-speed and high-contrast
- Real time and high-throughput
- 2D and 3D imaging
- Combines differential interference contrast and STEAM imaging

STATE OF DEVELOPMENT

A prototype N-STEAM device has been developed and tested with transparent samples.

PATENT STATUS

Country	Type	Number	Dated	Case
United States Of America	Issued Patent	8,654,441	02/18/2014	2010-262

CONTACT

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INVENTORS

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OTHER INFORMATION

KEYWORDS

Nomarski serial time-encoded amplified microscope, N-STEAM, differential interference contrast, label free, high-throughput, transparent media, cell imaging, cancer detection, blood screening, semiconductor process monitoring

CATEGORIZED AS

- **Biotechnology**
  - Health
  - Other
- **Engineering**
  - Engineering
  - Other
- **Medical**
  - Screening
- **Sensors & Instrumentation**
  - Biosensors
  - Medical

RELATED CASES

2010-262-0

RELATED MATERIALS

- A. Fard, A. Mahjoubfar, K. Goda, D. R. Gossett, D. Di Carlo, and B. Jalali. Nomarski Serial Time-Encoded Amplified Microscopy for High-Speed Contrast-Enhanced Imaging of Transparent Media. Biomedical Optics Express. 2011.

ADDITIONAL TECHNOLOGIES BY THESE INVENTORS

- Phase Transform For Object And Shape Detection In Digital Images
- Apparatus And Method For Optically Amplified Multi-Dimensional Spectrally Encoded Imaging
- Apparatus And Method For Multiple-Pulse Impulsive Stimulated Raman Spectroscopy
- Global Training Of Neural Networks For Phenomic Classification
- A Single-Shot Network Analysis Method For The Characterization Of Opto-Electronic And Electrical Devices And Systems
- Apparatus and Signal Processing Technique for Real-Time Label-Free High-Throughput Cell Screening

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