Terahertz Endoscopy Through Laser-Driven Terahretz Sources And Detectors

Tech ID: 29256 / UC Case 2015-815-0

SUMMARY

UCLA researchers in the Department of Electrical Engineering have developed a miniaturized terahertz imaging system that can be integrated to the tip of commercially available endoscopes, with significantly larger detectable depths and faster image acquisition rates.

BACKGROUND

Terahertz imaging has found applications in medical diagnostics due to low interference, non-ionizing radiation, and high sensitivity and specificity to variations in tissue hydration levels. However, currently available terahertz imaging systems are limited by large size which hinders their application in medical imaging, limited penetration depth into the biological tissue (0.1mm), long acquisition time, and limited image resolution.

INNOVATION

UCLA researchers proposed a miniaturized terahertz imaging system that can be integrated to the tip of commercially available endoscopes, with significantly larger detectable depths and faster image acquisition rates. The proposed technology uses a two-dimensional array of plasmonic photoconductive terahertz sources and detectors and an image-processing algorithm to generate diagnostically useful clinical data based on both the terahertz and optical imaging data.

APPLICATIONS

- Potential applications of the proposed technology include diagnosis of:
- Cancerous tumors
- Inflammation and bleeding in the respiratory and gastrointestinal tract

ADVANTAGES

- Increased signal-to-noise ratio over conventional terahertz imaging system by several orders of magnitude
- Increased detection resolution and detectable depths in the biological tissue
- Reduced lateral scan time
- Compatible with conventional endoscopes

STATE OF DEVELOPMENT

The UCLA researchers have developed and characterized plasmonic photoconductive terahertz sources and detectors. Currently, efforts are being made to integrate the terahertz imaging systems into conventional endoscopes and test them in *ex-vivo* biological tissues and organs. The proposed terahertz imaging system is expected to offer: 3 mm detectable depth into biological tissues, ~30 μm depth resolution, sub-millimeter lateral resolution, and ~1 ms scan time for each 3 x 3 pixel set.

PATENT STATUS

Country	Type	Number	Dated	Case
Japan	Issued Patent	6860210	03/30/2021	2015-815
United States Of America	Issued Patent	10,863,895	12/15/2020	2015-815
Germany	Issued Patent	3302224	10/14/2020	2015-815
France	Issued Patent	3302224	10/14/2020	2015-815
United Kingdom	Issued Patent	3302224	10/14/2020	2015-815

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INVENTORS

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OTHER INFORMATION

KEYWORDS

Terahertz, endoscope, plasmonic photoconductive source/detector, image-processing, two-dimensional array

CATEGORIZED AS

- **Optics and Photonics**
  - All Optics and Photonics
- **Biotechnology**
  - Health
- **Imaging**
  - Medical
- **Medical**
  - Imaging

RELATED CASES

2015-815-0

RELATED MATERIALS

- N. T. Yardimci, M. Jarrahi. High power telecommunication-compatible photoconductive terahertz emitters based on plasmonic nano-antenna arrays. Applied Physics Letters. 2016.

ADDITIONAL TECHNOLOGIES BY THESE INVENTORS

- Infrared Detectors And Heat Recycling Cells Based On Metallo-Graphene Nanocomposites
- Low-Duty-Cycle Continuous-Wave Photoconductive Terahertz Imaging and Spectroscopy Systems
- Scanning Terahertz Nanoscopy Probe

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