

Apparatus And Method For Multiple-Pulse Impulsive Stimulated Raman Spectroscopy

Tech ID: 27207 / UC Case 2010-116-0

SUMMARY

UCLA researchers in the Department of Electrical Engineering have developed an apparatus and method for multiple-pulse impulsive stimulated Raman spectroscopy for molecule structure-level characterization.

BACKGROUND

Vibrational spectrum derived from a biological sample acquired in a non-pharmaceutical and low-invasive manner is used in biological diagnosis, such as discrimination between healthy tissue and cancerous tissue. Comparing with vibrational spectrum obtained in the fingerprint region, terahertz vibrational spectrum is expected to provide information specific to a molecular structure and structural change in function expression under physiological conditions. However, no existing terahertz detection method can deliver this potential due to superimposition of different molecular modes, mode denseness and damping.

INNOVATION

UCLA researchers proposed a new system design based on impulsive stimulated Raman scattering (ISRS) spectroscopy using near infrared light. By controlling the repetition rate of the optical pulse train and the excitation phase of the stimulated Raman scattering, this system is capable of extracting from a Raman spectrum both the vibrational frequency information and vibrational phase relaxation time information of the molecules in a biological sample. From these two types of information, the band information reflecting the structure of the molecule can be obtained although the Raman spectrum is structureless.

APPLICATIONS

- ▶ Non-pharmaceutical and low-invasive biological imaging and diagnosis
- ▶ Discrimination between healthy tissue and cancerous tissue
- ▶ Studies on physical properties of solid and liquid molecules

ADVANTAGES

- ▶ Capable of detecting information specific to a molecular structure and structural change in function expression under physiological conditions
- ▶ Limited near infrared light absorption by water and biological macromolecules
- ▶ Limited influence from influence of background light

STATE OF DEVELOPMENT

The UCLA researchers have proposed a spectroscopic measurement apparatus including pump optical pulse train generation, means to irradiate a single location in an object, probe light to gather vibrational coherence information, and spectrum acquisition means. In addition, other features have been proposed including memorizing Raman spectra and vibrational information from different molecules in an object, chemometric analysis of the obtained Raman spectra, spectrum comparison to desired target molecules, as well as fine frequency selection by setting the repetition rate of the pump optical pulse train.

PATENT STATUS

| Country | Type | Number | Dated | Case |
|---------|---------------|---------|------------|----------|
| Japan | Issued Patent | 5643329 | 11/07/2014 | 2010-116 |

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OTHER INFORMATION

KEYWORDS

Terahertz, Raman spectroscopy, molecule, light-molecule interaction, impulsive stimulated Raman scattering, impulsive stimulated Raman spectroscopy, ISRS, diagnosis, vibrational spectrum, near infrared light

CATEGORIZED AS

- ▶ **Optics and Photonics**
 - ▶ All Optics and Photonics
- ▶ **Imaging**
 - ▶ Medical
 - ▶ Molecular
- ▶ **Medical**
 - ▶ Diagnostics
 - ▶ Imaging

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