

Development of 3- Dimensional Fingerprinting Technology using Raman's Effect

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Abstract:- In fingerprint scanning technology, two dimensional images are used to create multiple images of small areas of finger. The images are overlapped hence a complete image is formed. It is done by Discrete Wavelet Transform (DWT). We can form spectral lines of same wavelength for same topographical depth using Raman's effect. Basically it would be an array of three different information which can provide three dimensional structure of the finger through overlapping.

I. INTRODUCTION

It is based upon the scattering principles, as given by Raman's scattering of inelastic collision and Rayleigh's scattering of elastic collision.

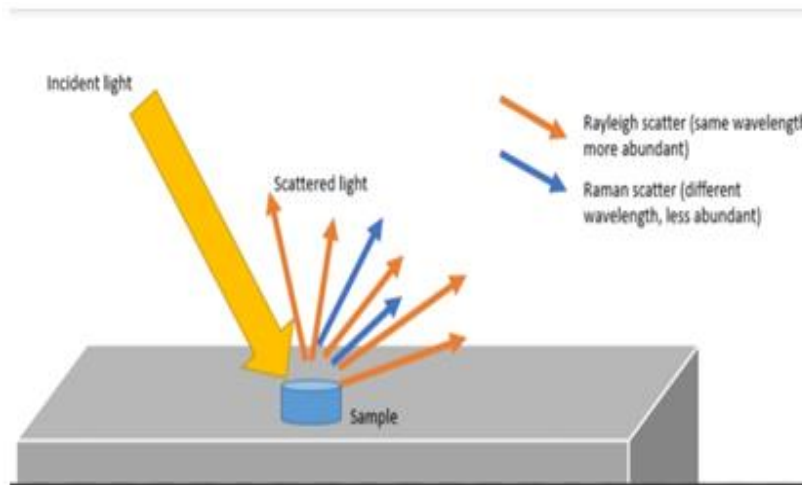


Fig 1:- (Scattering of light)

In this the same light is being used which when strikes a given object and scatters.

Raman's scattering principle is the in elastic scattering of the photon particles that was found by C.V.Raman in 1928. He received Noble prize for his work in 1930 for 'combinatory scattering'.^[6] It was done on liquids.^[1] Later it was experimented on crystals and then theoretically predicted.^{[2][3]} Photon particles not only gets scattered elastically as Rayleigh scattering but also a fraction of these particles scatter inelastically. These photons are called Raman scattered photons.^[4] These are 1 out of 10 million. These scattered rays generally have lower energy than the other photons. This was predicted by Adolf Smekal. In German it is referred as Smekal-Raman-Effect.^[5] The experiment was conducted with mercury lamp and photographic plates.^[7] (Raman Scattering, https://en.wikipedia.org/wiki/Raman_scattering).

II. USES

1. Raman spectroscopy is important for substance analysis using the Raman effect algorithm. It is a vibrational spectroscopic technique used to provide information about the crystal structures.
2. The spectrum of the Raman-scattered light from a substance depends on their molecular composition and state. Therefore such spectrum could be useful for material identification and analysis. Raman spectroscopy is used to analyze a wide range of materials, including gases, liquids, and solids.^[8] Highly complex materials such as biological organisms and human tissue can also be analyzed by Raman spectroscopy.^[10]
3. The Raman effect is infinitesimally small so it can be detected by CCD cameras.

III. ADVANTAGES

1. Non- contact analysis.
2. High spatial resolution.
3. In depth analysis can be done.
4. Samples analysis can be through transparent medium.
5. Typically only 10 millisecond to 1 second exposure needed to get Raman spectrum.
6. It can be done by scanning the laser beams.

IV. MATERIALS

A CCD camera for detection of both Raman scattering and Rayleigh scattering and optical Imaging sensor.(CCD Cameras, https://en.wikipedia.org/wiki/Charge-coupled_device).

V. METHOD

The spatial arrangement of the fingerprint with different shades representing different depths and different wavelengths for different excitation of electrons can be obtained through Raman scattering algorithm. The Rayleigh scattering will help in finding out the curvature of our finger through elastic scattering mechanism. The Optical Imaging sensor will take an optical image of the fingerprint in two dimensional array. It can determine the skin of the person and obtain a spectral image of each type of skin pattern. Hence it would be more secure. The arrangement of the points in the space would allow us to project the optical image on to it making three dimensional patterns of grooves.

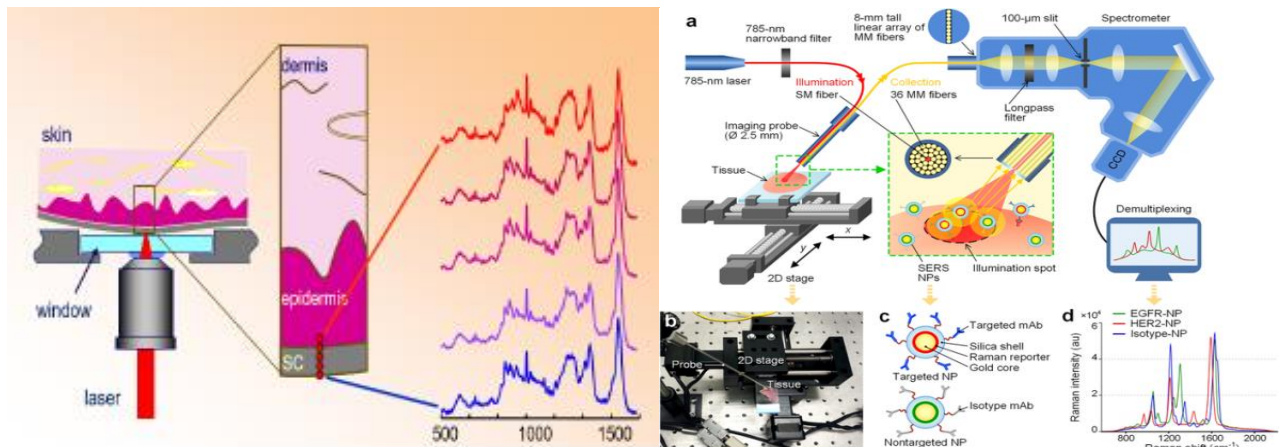


Fig 2:- (wavelengths of the skin formed by the method and the device measuring the wavelength of the tissue sample)

VI. ABOUT THIS TECHNOLOGY

In this, we would be keeping an array of data together. Not only the optical image but also the shape, size, curvature and arrangement of the fingerprints differ. From Rayleigh

scattering we get curvature. From Raman scattering we will get the spatial arrangement. This data will be stored as an array in which it will contain the two dimensional optical image, curvature of the finger and the spatial arrangement will be stored.

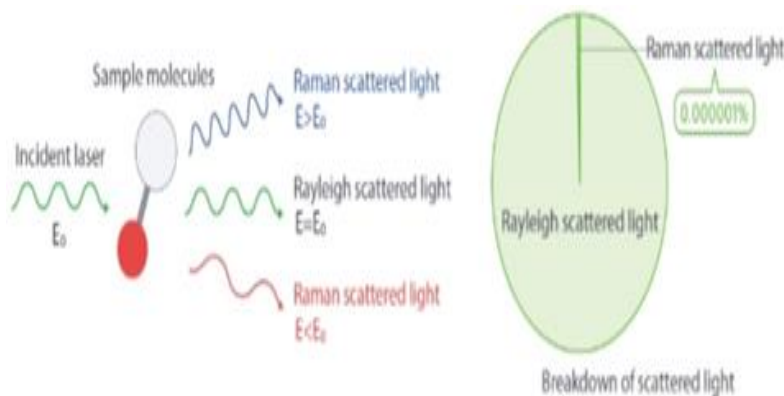


Fig 3:- Scattering of Light by Molecules (Percentage of Raman's and Rayleigh's scattering)

VII. OUTCOMES

1. It can be used for making high end security devices.
2. It can be used to get spatial images of different things.
3. It has a diverse use in the living organism imaging.
4. It can be used for both living and non living things to detect anything if modified because of the difference of wavelength.

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