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Terahertz spectral profiling and imaging for skin cancer detection

Terahertz scanning reflectometry enables investigating both the surface and the sub-surface of biological tissues in non-invasive fashion. T-ray is non-ionizing, thus, eliminates radiation damage of sensitive tissues while still probing disease conditions in the deeper layers leading to an effective early diagnostic tool. In this study, terahertz techniques have been developed that is comprised of terahertz scanning reflectometry, terahertz time-domain spectroscopy and terahertz 3D imaging for detection of Basal Cell Carcinoma (BCC) in comparison with the benign skin samples. Benign skin biopsy samples and the biopsy from cancerous area were investigated. Thickness profiling exhibits significant differences in profiles of the respective skin samples both in their layer structure and also in their total reflected intensities; thus indicating presence and lack of cellular order for the respective specimens. Terahertz spectra acquired in transmission, exhibits quantifiable differences for both groups. Additionally, 3D terahertz image of the benign skin shows regular cell patterns while the images of BCC sample exhibit irregular and agglomerated cell patterns. The lack of cellular order in the skin, thus, may be used as an indication of cancer forming process. This finding, therefore, may be used as an early diagnostic tool. It is notable that this is the first of such a concerted observation of benign versus BCC skin samples from three different experiments. The results are consistent from individual experiments and collectively provide an accurate means of early detection of BCC.

Biography

Anis Rahman is known for his work on dendrimer based photonics and terahertz technology. He coined the term "Silicon for Photonics" and his approach makes it possible to fabricate chip based components from dendrimer for sensing and terahertz generation. He proposed a new mechanism, dendrimer dipole excitation that generated continuous wave terahertz over a broad spectrum. Under his leadership, dendrimer technology received prestigious awards including the NASA Nanotech Brief's nano-50 award and CLEO/Laser Focus World's Innovation award (2011). He completed MS and PhD at Marquette University (Milwaukee, WI) and a Post-doctoral research position at Columbia University (NY).

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