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量子科学研究センターよりご案内します。
この度、英国 Queen's University Belfast の Mike Hardy 博士が本学を訪問され、下記の要領で量子科学研究センターセミナーを開催いたします。
研究室の研究員、学生の皆様もお誘いあわせのうえ、奮ってご参加ください。

講演情報（Seminar Info）
日時(Date)：7 月 15 日(火) 14:40 - / July 15th 14:40 -
場所(Place)：東 6 号館 803 室 / Room 803, East 6 Building
主催：量子科学研究センター / Hosted by the Institute for Advanced Science http://www.ias.uec.ac.jp/

Title:
A Nano Factory: From 3D Prints to Sensing Chips

Speaker:
Dr. Mike Hardy （Queen's University Belfast, UK）

Abstract:
Rapid prototyping of nanoscale sensing devices is of paramount importance to many emerging application-spaces which require portable analysis, in the field, factory, or away from the clinic. However, full-chain for chip manufacture – schemes comprising nano- and microscale lithography, chip dicing, robotics for accurate picking-and-placing, device packaging, as well as the sensor test measurements – are often confined to industry settings rather than research environments thus hampering the ability to quickly iterate novel designs.
Within our newly established Smart Nano NI laboratory in Queen's Physics Department, we have established processes towards the fabrication, manipulation and testing of nanostructured sensing chips for surface enhanced Raman spectroscopy (SERS) sensing – chips that use the Raman effect, a highly selective analytical spectroscopy commonly described as a 'molecular fingerprint' that can be enhanced to single-molecule level by large electric fields generated by collective electron oscillations near certain metals.
In the current study we demonstrate the reduction of chip areas to 2mm×2mm via dicing saw, and their accurate placement and packaging via precise robotics and 3D printed parts. Further, quality control through machine vision and AI techniques has been investigated where small inter-chip imperfections may be identified [1]. Final chip designs demonstrated a confinement of applied solution (micropipette) of a target molecule for optimum pre-concentration, and thus analytical sensitivity, especially important where solution-substrate interaction is hydrophilic [1]. Signal enhancement of up to $10^{\wedge 6}\times$ and uniformity (relative standard deviation) of 10% have been recorded. The study thus paves the way for the rapid development of highly sensitive and reproducible sensors, of relevance to a broad range of application areas

where portable detection is required [2,3].

[1] Hardy M, Chu HOM, Pauly S, Bowman RM et al. White Light Transmission Spectroscopy for Rapid Quality Control Imperfection Identification in Nanoimprinted Surface-Enhanced Raman Spectroscopy Substrates. ACS Meas. Sci. Au 2025, 5, 2, 250–263
[2] Hardy M & Chu HOM. Laser wavelength selection in Raman spectroscopy. Analyst 2025, 150, 1986-2008
[3] Hardy M & Goldberg Oppenheimer P. 'When is a Hotspot a Good Nanospot' Nanoscale 2024, 16, 3293-3323

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