Abstract:
Commercial infrared APDs are currently based on InGaAs absorption region and InP multiplication region. They are widely used for high speed optical networks, for LIDAR and photon counting applications. It is well known that current InP APDs have reached their performance limits, in terms of gain-bandwidth product (GBP) of less than 200 GHz, high excess noise associated with the multiplication process and strong temperature dependence of breakdown voltage. In this talk, I will present research at Sheffield to develop APDs with negligible excess noise, very high gain at low applied bias and extremely high GBP. I will first present our effort to transform InAs, a material that was generally thought of as leaky diode, to APDs with high gain, low noise (excess noise factor below 2) and high GBP of 580 GHz. These were achieved by designing the InAs APDs such that only electrons will initiate impact ionization events. In parallel to InAs, I will also present some recent progress made using very thin layer AlGaAsSb, a highly promising material for direct replacement of InP to achieve significantly lower noise and higher GBP. The avalanche gain has much weaker dependence on temperature, the excess noise factor is comparable to Si APDs and much higher GBP than InP can be achieved.

Biography:
Prof. C. H. Tan obtained his BEng and PhD in Electronic Engineering at the Department of Electronic and Electrical Engineering, The University of Sheffield (TUOS) in 1998 and 2002, respectively. He was a Research Associate in 2001-03, appointed as a Lecturer in 2003 and has been a Professor in Optoelectronic Sensors since Jan 2014. He is currently the Director of Research & Innovations and leads the Advanced Detector Centre in the Department of Electronics and Electrical Engineering at TUOS. His research interests includes design, modeling, fabricating and characterization of optical sensors ranging from X-ray and UV detectors, avalanche and single photon photodiodes, to infrared photodetectors. He has led various research projects from the UK Ministry of Defense, Engineering, and Physical Science Research Council and EU. Some of the technologies he developed have been transferred to industry via several knowledge transfer projects, as well as an industrial sabbatical at LAND Ametek. He has published more than over 79 journal papers and has delivered several invited talks in international conferences. He has carried out editorial roles for Optics Express, IET Optoelectronics and MRS Advances.

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