國立清華大學第 24 屆新進人員研究獎得獎人簡介

劉昌樺老師於 2014 年 1 月在美國密西根大學電機工程學系取得博士學位，之後分別在美國西北大學材料工程學系和華盛頓大學物理系從事共三年半的博士後研究，並於 2017 年 8 月加入清華大學電機系暨光電所擔任助理教授。劉老師過去的研究方向專注於探索奈米材料的新穎物理特性和奈米元件開發，在該領域中發表多篇論文於國際頂尖級期刊中，而近年來劉老師在清華大學所成立的研究團隊更專攻於利用二維奈米材料來發展紅外線波段的感測、發光元件和成像系統，並得到多項突破性研究成果，舉例來說其團隊在 2018 年開發出目前世界上最薄的平面介電質超穎透鏡，並成功展示此超薄透鏡可應用在光學成像上和兼具可多次撕貼的新穎特點，此項研究受到清華大學首頁和國內外多家媒體所報導。此外，劉老師的團隊在過去兩年間還首度以新穎二維奈米材料來取代傳統 III-V 族和 II-VI 族半導體，發展出優異的紅外線發光和感測元件，這些元件不但具有高調變速度、高量子效率、可在室溫下穩定運作的特性外，還可與目前成熟的矽光子積體電路整合，實現光電生醫感測晶片。由於這些研究成果發表，劉老師獲邀參與多個國際大型研討會(例如:*SPIE Photonics West, SPIE Optics + Photonics, CLEO-PR*)給予邀請演講，以及在近期獲得科技部奈米科技創新應用計畫的支持，將其實驗室所開發出的技術商品化。

Bio:

Prof. Liu is leading a research group at National Tsing Hua University, Institutes of Photonics Technology. Prior to joining NTHU, Prof. Liu received his Ph.D. from the Department of Electrical Engineering at University of Michigan, Ann Arbor in January 2014. After graduation, he worked at Northwestern University, Materials Science & Engineering for 1.5 years and focused on developing atomically-thin optomechanics. From 2015 to 2017, he worked in the Physics Department at University of Washington as a postdoctoral research fellow, exploring the applications of 2D materials integrated with nanophotonics.

His research group at NTHU has been focused on exploiting the emerging layered van der Waals (vdW) materials for novel infrared photodetections, light emissions and imaging applications. Over the past few years, multiple research breakthroughs have been made. For example, his group demonstrated ultrathin dielectric metalenses made of vdW materials in 2018 (Nano Letters 18, 6961 - 6966 (2018)). By utilizing their high refractive indices and the incomplete phase design approach, the thickness of vdW metalenses can be reduced to ~λ/10, operating at infrared and visible wavelengths. Furthermore, by exploiting the nature of vdW interactions, the developed metalenses can be readily peeled off and then transferred onto the flexible polydimethylsiloxane substrate to show strain-induced tunable focusing. In 2019, his group further demonstrated a novel photodetector based on black phosphorus (BP)-based van der Waals heterostructures. The present device could exhibit broadband photoresponses (visible to mid-infrared) with fast operation speed and high quantum efficiency at room temperature condition (ACS Applied Materials & Interfaces 12, 1201-1209 (2020)). In 2020, his group reported the mid-infrared light emitting diode (LED) based on the BP-based vdW heterostructures for the first time. The demonstrated LED could exhibit high modulation speed as well as exceptional operation stability, and the peak extrinsic quantum efficiency is comparable to the conventional III–V/II–VI mid-IR LEDs. Via integrating the BP LED with a silicon waveguide, he further demonstrated that the emission of BP LED can evanescently couple and propagate through the waveguide, showing its potential applications in on-chip mid-IR light source (Nano Letters 20, 6824-6830 (2020)). Due to these publications, he was invited to give talks at international conferences, such as *SPIE Photonics West, SPIE Optics + Photonics and CLEO-PR.*