李偉立助研究員與李定國特聘研究員所領導的研究團隊首次於雙層石墨烯元件中驗證“場效熱電效應”。

本所李偉立助研究員與李定國特聘研究員所主導的雙柵極雙層石墨烯(dual-gated bilayer graphene)元件研究計畫中，首次實驗驗證“場效熱電效應”。當外加一垂直電場(D)於雙原子層石墨片時，並且在載子濃度約略相同的條件下，其熱電能(thermopower)仍最多可被放大四倍以上，已超越一些知名的低溫熱電材料。此現象的核心物理機制源於電場衍生之反對稱性破壞 (inversion symmetry breaking)造成了能隙(band gap)的產生，進而增加能帶曲率(band curvature)。此外，熱電能的極性(polarity)亦可簡單運用柵極電壓(gate voltage)來調控成為電子型或電洞型。此研究成果為熱電相關研究領域提供一個全新的思考方向，完整的結果資料已發表於物理評論通訊(Physical Review Letters **107,** 186602 (2011))。

A team led by Dr. Wei-Li Lee, and Dr. Ting-Kuo Lee has demonstrated for the first time the “field-effect thermoelectricity” in a bilayer graphene device.

In a research project on dual-gated bilayer graphene devices led by Dr. Wei-Li Lee and Dr. Ting-Kuo Lee, the “field-effect thermoelectricity” has been demonstrated for the first time. When applying a perpendicular electric field (D) on a bilayer graphene, the thermoelectric power (TEP) can be amplified more than 4 folds while the carrier density remains the same. The value of TEP is comparable to or exceeding several known low temperature thermoelectric materials. The physical mechanism is rooted in the band-gap opening due to the inversion symmetry breaking by D, which largely increases the band curvature near the band edges. On the other hand, its polarity can be readily tuned by the gate voltage to be either electron-type or hole-type. Our results open up a new possibility in thermoelectric application using graphene-based device. Complete data and analysis have been published in Physical Review Letters (PRL **107,** 186602 (2011)).