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Berry phase and pseudospin winding number in bilayer graphene[1] CHEOL-HWAN PARK, MIT and University of Oxford, NICOLA MARZARI, EPFL and University of Oxford — In 2006, two seminal studies on the novel quantum Hall effect of bilayer graphene [K. S. Novoselov et al., Nat. Phys. **2**, 177 (2006); E. McCann and V. I. Fal'ko, Phys. Rev. Lett. **96**, 086805 (2006)] appeared. Those papers claim that a non-trivial Berry phase of 2π in bilayer graphene is responsible for the novel quantum Hall effect described. Since then, it has become widely accepted by people working on the novel physics of graphene nanostructures that bilayer graphene has a non-trivial Berry phase of 2π (different from 0, as for conventional two-dimensional electron gas). In this talk, we show that (i) the relevant Berry phase for bilayer graphene is the same as that for a conventional two-dimensional electron gas and especially that (ii) what is actually obtained in the quantum Hall measurements is not the absolute value of the Berry phase of graphene multilayers but the pseudospin winding number. The results of our study ask for a re-interpretation of the numerous works related to the Berry phase in graphene multilayers.

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