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Electronic delocalization in bilayer graphene induced by electric field

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Bilayer graphene is a zero-gap semiconductor, in which an energy gap can be opened by an external electric field perpendicular to the layer. We found that, in the smooth disorder with respect to the atomic scale, the gap opening leads to a phase transition at which the localization length diverges. We show that this is a topological effect due to the nontrivial Berry phase in the band structure. This can be interpreted as the quantum Hall transition even though the magnetic field is totally absent.