



**ΟΜΙΛΙΑ**  
**ΤΜΗΜΑ ΦΥΣΙΚΗΣ**

**Efthimios Kaxiras**

Department of Physics,  
Harvard University, Cambridge MA 02138

***«Twistronics: manipulating  
electronic behavior in two-  
dimensional twisted  
heterostructures»***

**Παρασκευή 29 Ιουνίου 2018, ώρα 12:00μ.μ.**  
**Αίθουσα Σεμιναρίων Τμήματος Φυσικής**  
**Βιβλιοθήκη - κτίριο Φ2 - 3<sup>ος</sup> Όροφος**

# Abstract

The stacking of individual layers of two-dimensional materials can be experimentally controlled with remarkable precision on the order of a tenth of a degree. The relative orientation of successive layers introduces variations in the electronic properties that can be controlled by the twist angle. We use simple theoretical models and accurate electronic structure calculations to predict that the electronic density in stacked 2D layers can vary in real space in a manner similar to the band-structure in momentum-space, creating moiré super-lattices. A direct consequence of the patterns is the localization of electronic states. We demonstrate this effect in graphene, a semi-metal, and MoSe<sub>2</sub>, a representative material of the transition metal dichalcogenide family of semiconductors.

We also connect these findings to the recent discovery of superconductivity in twisted bilayer graphene, and comment on the origin and nature of the localized states.

These effects are useful in the design of localized electronic modes with specific geometries for experimental or technological applications.