NANO COLLOQUIA 2023 - S3 SEMINAR

Engineering emergent topological phases in van der Waals heterostructures

Thursday May 4, 2023 – 15:00
ON-SITE - S3 Seminar Room, Third Floor, Physics Building
ONLINE - https://tinyurl.com/MarcoGibertini

Speaker
Marco Gibertini- Università di Modena e Reggio Emilia e CNR Nano S3

Abstract
Despite the huge expansion in the family of 2D materials, quantum spin Hall and Chern insulators have remained rare and elusive, with most monolayers displaying topologically trivial properties. Still, combining such trivial 2D materials into van der Waals heterostructures offers combinatorially vast opportunities to realize emergent topological order. Here, not only we disclose different strategies to engineer topological heterostructures out of trivial insulating layers, but we also show how the emergent topological phase can be controlled by external means. On one side we report on the possibility to switch the Chern number of a heterostructure by varying the magnetization orientation through an external magnetic field. On the other hand, we propose to achieve a non-volatile electric-field control of a quantum spin Hall phase by combining a ferroelectric monolayer with a trivial 2D insulator. All theoretical scenarios are validated through accurate first-principles simulations and by screening 2D databases for realistic materials platforms.

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