INTERNATIONAL SOLVAY INSTITUTES BRUSSELS

Solvay Colloquium

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There is plenty of room at the bottom... but even more in a fractal

Feynman's original idea of using one quantum system that can be controlled and manipulated at will to simulate the behavior of another more complex one has flourished during the last decades in the field of cold atoms. More recently, this concept started to be developed in nanophotonics and in condensed matter. In this talk, I will discuss a few recent experiments, in which 2D electron lattices were engineered on the nanoscale. The first is the Lieb lattice [1], and the second is a Sierpinski gasket [2], which has dimension D = 1.58. The realization of fractal lattices opens up the path to electronics in fractional dimensions. Finally, I will show how to control the electronic orbital degree of freedom [3] and how to realize topological states of matter using the same procedure. In all cases, we observe an excellent agreement between the theoretical predictions and the experimental results. This technique is proving itself to be a very versatile framework for the engineering and control of electronic systems.

[1] M.R. Slot, T.S. Gardenier, P.H. Jacobse, G.C.P. van Miert, S.N. Kempkes, S.J.M. Zevenhuizen, C. Morais Smith, D. Vanmaekelbergh, and I. Swart, "Experimental realisation and characterisation of an electronic Lieb lattice", Nature Physics 13, 672 (2017).
[2] S.N. Kempkes, M.R. Slot, S.E. Freeney, S.J.M. Zevenhuizen, D. Vanmaekelbergh, I. Swart, and C. Morais Smith, "Design and characterization of electronic fractals", arXiv:1803.04698, in print Nature Physics (2019).
[3] M. R. Slot et al., "p-band engineering in artificial electronic lattices", in print Phys. Rev. X (2019).

Tuesday 29 January 2019 at 4.00 P.M.

COFFEE AND TEA WILL BE SERVED AT 3.45 P.M. IN FRONT OF THE SOLVAY ROOM

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