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Aula Magna del Dipartimento
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A dipolar quantum gas with supersolid properties

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Abstract: The possibility that a quantum crystal might show a superfluid behavior was addressed theoretically 50 years ago by Andreev and Lifshitz [1]. Such “supersolid” has been searched experimentally in solid helium, so far without success [2]. Recently, ultracold quantum gases have attracted much interest, due to the possibility of engineering types of interactions that might lead to supersolid regimes.
In this talk, I will show how a Bose-Einstein condensate of strongly magnetic atoms develops, under specific conditions, a strong periodic density modulation due to the interplay of attractive and repulsive atom-atom interactions. Despite the modulated density, the condensate keeps its phase coherence, so it has the requisites for a supersolid [3]. This observation opens an exciting new direction to study the properties of the supersolid phase of matter.

[1] A. F. Andreev and I. M. Lifshitz, Sov. Phys. JETP 29, 1107 (1969).
[2] S. Balibar, Nature, 464, 176 (2010).
[3] L. Tanzi et al., Phys. Rev. Lett. 122, 130405 (2019).