



ICFO COLLOQUIUM LETICIA TARRUELL 'Making Quantum Liquids from Quantum Gases'

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March 21, 2018

Wednesday, March 21, 2018, 15:00. ICFO Auditorium

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Ultracold Quantum Gases Experimental group at ICFO. Leticia Tarruell got her PhD from the Ecole Normale Supérieure in Paris in 2008 under the supervision of Christophe Salomon, on the study of strongly interacting superfluid Fermi gases. As a postdoc in the group of Tilman Esslinger at the ETH Zurich she studied fermionic atoms in optical lattices as model systems for graphene and quantum magnetism. After a CNRS position at Institut d'Optique in Bordeaux, she joined ICFO in 2013. The Ultracold Quantum Gases experimental group that she leads explores quantum many-body physics with mixtures of ultracold quantum gases. Self-bound states appear in contexts as diverse as solitary waves in channels, optical solitons in non-linear media and liquid droplets. Their binding results from a balance between attractive forces, which tend to make the system collapse, and repulsive ones, which stabilize

it to a finite size. In this talk, I will present our recent experiments on dilute quantum liquid droplets: macroscopic clusters of ultra-cold atoms that are eight orders of magnitude more dilute than liquid Helium, but have similar liquid-like properties. We have observed for the first time these droplets in a mixture of Bose-Einstein condensates with effective attractive interactions, and mapped out the associated liquid-to-gas transition [C. R. Cabrera et al., *Science* 359, 301 (2018)]. In a second series of experiments, we have placed such droplets in an optical waveguide and explored their connection to more conventional bright solitons [P. Cheiney et al., *Phys. Rev. Lett.* in press]. Interestingly, the existence of dilute quantum droplets is a direct result of quantum fluctuations. Thus, their properties constitute a sensitive test of quantum many-body theories.

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