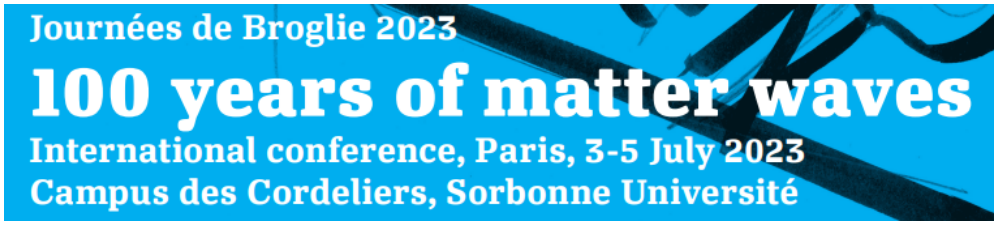

Fluctuat nec Mergitur – atom waves tunneling, spinning, colliding, and resonating in structures made of light

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Abstract

I will present the latest work from our ultracold Rubidium laboratory, in which starting from a Bose-Einstein condensate we use atomic lensing effects (“delta-kick cooling”) to prepare an atom cloud with a temperature on the order of 1 nK, corresponding to a coherence length over 5 microns. This enabled us to study tunneling of the atoms through a one-micron-thick barrier created by a focused laser beam, and carry out the first conclusive measurement of the time transmitted atoms spend in the classically forbidden region. More recently, we observed surprising spin-waves in the reflected cloud, which we now understand as an indistinguishability-driven interaction term between incident and reflected atoms. I will describe future plans for these tunneling studies, along with ongoing work to compensate aberrations in our “atom lenses” and to build Fabry-Perot cavities for atoms. I will also show some pictures of atomic interference we observed on the way to testing a prediction of quantum-enhanced sensitivity to magnetic field gradients.