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Minicolloque PM3 :Toward flying Qbits

A mini-colloque on ultrafast quantum nanoelectronics.

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Probing directly the quantum dynamics of electronic states in the time domain requires low temperatures (in the tens of mK range) combined with very high frequencies (10GHz or higher) making this line of research very challenging. The first elements of this electronic analogue to quantum optics have been realized recently in various teams, with major contributions coming from France. This includes (coherent) single electron sources of various forms (produced with quantum dots, surface acoustic waves or Ohmic contacts), beam splitters (quantum point contacts) and ultrasensitive noise and correlations measurement setups. The field has now reached a level of maturity where all these individual elements can be brought together to perform exciting experiments of a new kind. Beyond the current paradigm of quantum information where only discrete degrees of freedom (e.g. Qbits or single bosonic modes) are studied, this emerging quantum toolbox will allows one to study the dynamics of continuum states, i.e. states which can *propagate,* sometime referred to as flying Qbits. Another interesting route is the coupling of these systems with actual (radio-frequency) quantum optics where the interplay between the bosonic and fermionic statistics leads to new phenomenon.

In this mini-colloque, we will invite the major players of the field to review the current state of the art, discuss the remaining bottlenecks (such as single electron detection) as well as the forthcoming physics that these technical developments will make possible. Some time will also be devoted to the theoretical concepts of the field, the existing ones as well as the new one needed to account for the peculiarity of fermionic statistics.

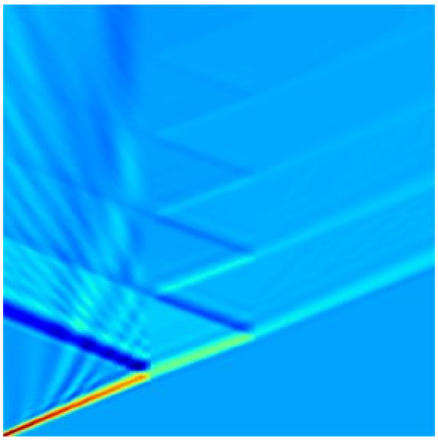

Fig. Simulation of the propagation of a voltage pulse through an electronic Fabry-Perot interferometer. X axis: space, Y-axis: time, the color indictate the intensity of the local current.