

## Contexts, systems, modalities: A physically realist framework for quantum mechanics

I will present a possible way to make usual quantum mechanics fully compatible with physical realism, defined as the statement that the goal of physics is to study entities of the natural world, existing independently from any particular observer's perception, and obeying universal and intelligible rules. A new ontology for quantum mechanics is proposed, where physical properties are attributed jointly to the system, and to the context in which it is embedded. In combination with a quantization principle, this non-classical definition of physical reality sheds new light on counter-intuitive features of quantum mechanics such as the origin of probabilities, non-locality, and the quantum-classical boundary. Eventually, this quantum ontology translates into physically realist axioms, allowing to recover the quantum formalism and Born's rule: in this heuristic approach, quantization comes first, interferences second.

[1] A. Auffèves and P. Grangier, Contexts, systems and modalities : A new ontology for quantum mechanics, *Foundations of Physics*, 46(2), 121-137 (2015).

[2] A. Auffèves, Philippe Grangier, Recovering the quantum formalism from physically realist axioms , *Scientific Reports* 43365 (2017).

[3] A. Auffèves and P. Grangier, Donner du sens à la Mécanique Quantique, *Journal du CNRS* (March 2016)

[4] A. Auffèves, Libérons le chat de Schrödinger, *Pour la Science*, hors-série (October 2016-December 2016)

[5] A. Auffèves, N. Farouki and P. Grangier, Manifeste pour un nouveau réalisme quantique, *La Recherche* (February 2017)