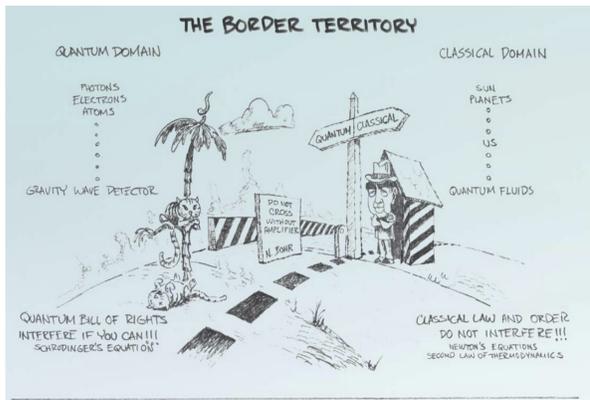


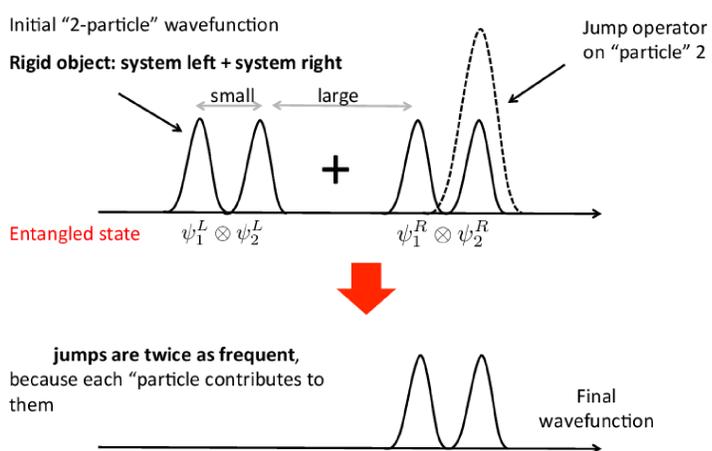
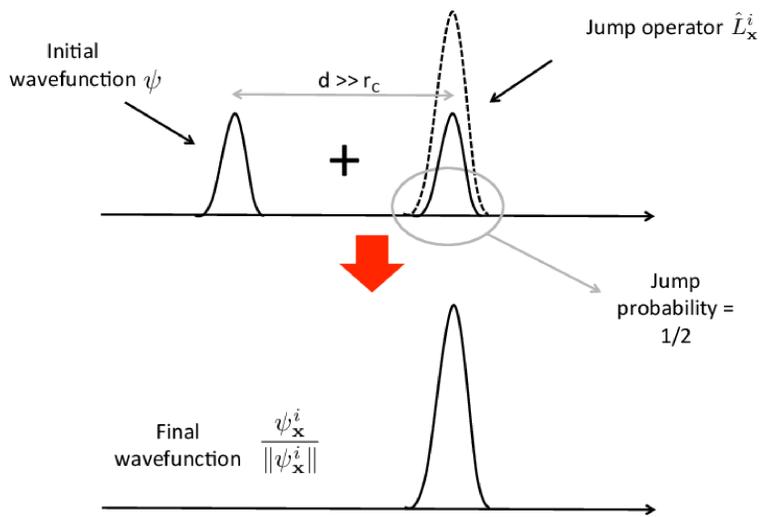
QUANTUM MECHANICS

Representatives: Prof. Bassi Angelo, Prof. Benatti Fabio.
Ph.D. students: Bacchi Stefano, Carlesso Matteo, Curcuraci Luca and Marcantoni Stefano.

Foundations of Quantum Mechanics Collapse Models

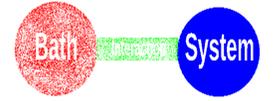
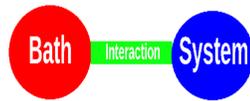


Quantum Decoherence - Volume 48 of the series Progress in Mathematical Physics pp 1-31 - Decoherence and the Transition from Quantum to Classical - Revisited - Wojciech Hubert Zurek



Prof. A. Bassi - Spontaneous wave function collapse models: an introduction (Munich 1st-4th November 2016)

Open Quantum Systems



$$H = H_b + H_{int} + H_s$$

$$\dot{\rho} = -\frac{i}{\hbar}[H, \rho]$$

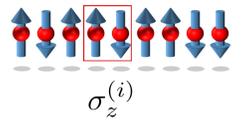
$$\rho_s = Tr_b(\rho)$$

$$\dot{\rho}_s = -\frac{i}{\hbar}[H_s, \rho_s] + L(\rho_s)$$

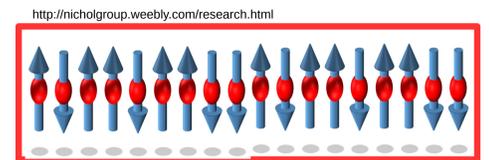
$$L(\rho_s) = \sum_{m,n=1}^{N^2-1} h_{mn} \left(L_n \rho_s L_m^\dagger - \frac{1}{2} (\rho_s L_m^\dagger L_n + L_m^\dagger L_n \rho_s) \right)$$

Quantum Fluctuations

Microscopic physics: quantum mechanics

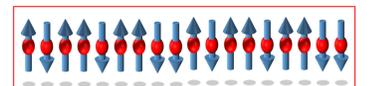


Mesoscopic physics:
bosonic fluctuations



$$\frac{1}{\sqrt{N}} \sum_{i=1}^N \left(\sigma_z^{(i)} - \langle \sigma_z^{(i)} \rangle \right)$$

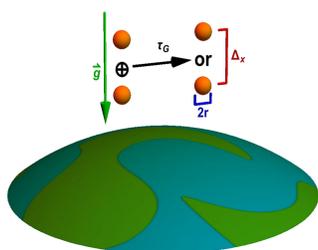
Macroscopic physics: classical mean-field averages (mean magnetization)



$$\frac{1}{N} \sum_{i=1}^N \sigma_z^{(i)}$$

Quantum Mechanics and Gravity

A composite particle in superposition will decohere owing to time dilation.



Matteo Carlesso, Angelo Bassi, Decoherence due to gravitational time dilation: Analysis of competing decoherence effects, Physics Letters A, Volume 380, Issues 31-32, 15 July 2016, Pages 2354-2358, ISSN 0375-9601, https://doi.org/10.1016/j.physleta.2016.05.034.

Quantum Thermodynamics

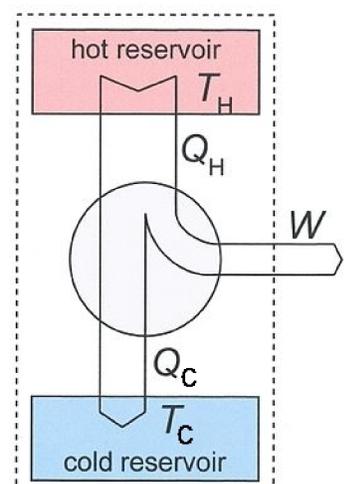
$$U(t) := Tr[\rho(t)H(t)]$$

$$\partial_t W(t) := Tr[\rho(t)\partial_t H(t)]$$

$$\partial_t Q(t) := Tr[(\partial_t \rho(t))H(t)]$$

$$S(t) := -Tr[\rho(t) \log \rho(t)]$$

$$\sigma(t) := \partial_t S(t) - \beta \partial_t Q(t)$$



Wikipedia.com