

# From the arrow of time in Badiali's quantum approach to the dynamic meaning of Riemann's hypothesis

Riot P., Le Méhauté A.

Kazan Federal University, 420008, Kremlevskaya 18, Kazan, Russia

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## Abstract

The novelty of the Jean Pierre Badiali last scientific works stems to a quantum approach based on both (i) a return to the notion of trajectories (Feynman paths) and (ii) an irreversibility of the quantum transitions. These iconoclastic choices find again the Hilbertian and the von Neumann algebraic point of view by dealing statistics over loops. This approach confers an external thermodynamic origin to the notion of a quantum unit of time (Rovelli Connes' thermal time). This notion, basis for quantization, appears herein as a mere criterion of parting between the quantum regime and the thermodynamic regime. The purpose of this note is to unfold the content of the last five years of scientific exchanges aiming to link in a coherent scheme the Jean Pierre's choices and works, and the works of the authors of this note based on hyperbolic geodesics and the associated role of Riemann zeta functions. While these options do not unveil any contradictions, nevertheless they give birth to an intrinsic arrow of time different from the thermal time. The question of the physical meaning of Riemann hypothesis as the basis of quantum mechanics, which was at the heart of our last exchanges, is the backbone of this note.

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## Keywords

Arrow of time, Fractional differential equation, Path integrals, Zeta functions

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