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From Continuity to Complementarity: Tracing the Conceptual Foundations of Bohr's Quantum Framework

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Niels Bohr's concept of Complementarity consists of a profound rethinking of scientific objectivity. It stands as a fundamental and revolutionary contribution to modern physics that, however, remains regrettably underappreciated even a century after its first presentation. This neglect is mainly due to a persistent misunderstanding of both the concept itself and the intellectual path that led Bohr to formulate it.
This presentation offers a historical analysis based on archival material from the Niels Bohr Archive. It traces the genesis and development of Complementarity, demonstrating how Bohr constructed the only coherent conceptual framework for atomic physics of the time, underlining the central role of continuity in our classical understanding of nature.

Bohr's main point is that the assumption of continuity is what allows us to attribute meaningful properties to a physical system even when it does not directly interact with an observer. Continuity provides the foundation upon which the notion of an object can be built, one that is independent of our observations and possesses knowable properties. Central to Bohr's understanding of quantum phenomena is the recognition that the assumption of continuity is denied by the theory. The consequences of this constitute Complementarity.

If this element of Bohr's thinking remains underappreciated, contemporary approaches to quantum foundations risk being impoverished and current debates stalled. I will argue that in the era of the second quantum revolution, Complementarity —far from being a mere legacy of the past—can and should serve as the conceptual foundation for the very notion of information.

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