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Heisenberg's 1925 "Umdeutung" Paper: A Commented Translation from the Physicist's Perspective

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The year 2025 marks the centennial of Heisenberg's seminal paper that gave rise to quantum mechanics. Its impact remains as profound today as it was then: indeed, 2025 has been declared the International Year of Quantum Science and Technology, a testament to the ongoing influence of quantum theory on our understanding of the world. However, the emergence of quantum mechanics was neither sudden nor straightforward. The path to a coherent quantum framework was marked by conceptual struggles, bold hypotheses, and a growing awareness that physics needed to be fundamentally rethought. In our culturally informed approach to quantum mechanics, revisiting and understanding Heisenberg's 1925 article is not merely an homage to history, but an opportunity to rediscover the conceptual and epistemological foundations of the theory. From a pedagogical perspective, we believe that a proper understanding of the paper requires a well-documented and precise knowledge of its historical context. Yet, it is equally essential to move beyond that context and address the questions it raises through the lens of physical concepts. This is the aim of the present work, which offers a new English translation of Heisenberg's article, with special attention to the original terminology, accompanied by a commentary designed to clarify its meaning at a level accessible to university physics students. To our knowledge, despite the extensive literature on the subject—including numerous discussions and interpretations—no step-by-step fully annotated, pedagogical translation in English had yet been available to make the text as clear and transparent as possible.

Authors: GILIBERTI, Marco (Università degli studi di Milano); LOVISETTI, Luisa (Università degli Studi di Milano)

Presenter: GILIBERTI, Marco (Università degli studi di Milano)

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