

Physics and Mathematics Meeting at a Single Point: The Distributional Approach to Quantum Mechanics

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Abstract: Point interactions are singular interactions supported on a single point. Despite their apparent simplicity, they can describe a remarkable range of quantum phenomena: from modeling impurities in solids to reproducing the effects of sharply localized potentials. Their mathematical singularity, however, poses both technical challenges and subtle conceptual interpretative difficulties—after all, what does it mean for a particle to interact “at a point”? In this talk, we explore the distributional approach to point interactions in quantum mechanics, a framework that aims to treat these singular terms with mathematical precision while preserving their physical interpretability. We will outline the key ideas behind this approach, emphasizing how it allows one to relate the mathematical parameters of a point interaction to physical fields. Finally, we will discuss some of the limitations and open problems that remain.



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