

Symmetry and Quantum Phenomena: Does the Theory of Dynamic Symmetry Say Anything New?

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This article explores the concept of dynamic symmetry and its potential implications for quantum mechanics. It presents symmetry as a fluid, subjective concept rather than a rigid, objective property, aligning with the probabilistic nature of quantum phenomena. The theory challenges traditional views of symmetry and suggests a need to rethink our understanding in light of quantum mechanics.

The article discusses how this perspective could offer new insights into quantum processes such as superposition and wave function collapse, and potentially address long-standing paradoxes in quantum theory. It emphasises the interplay between order and disorder as a fundamental symmetry, and explores the role of observer dependence in quantum phenomena.

The theory's multiscale applicability is highlighted, suggesting its potential as a unifying principle across different domains of physics. The article also discusses how this dynamic view of symmetry could provide new ways to interpret seemingly paradoxical quantum behaviours and offer fresh perspectives on symmetry breaking in quantum systems.

While acknowledging the need for further research and theoretical development, the article concludes that this concept of dynamic symmetry presents a promising new approach to understanding quantum mechanics, with potential for significant advancements in quantum research and our understanding of the relationship between quantum and classical physics.

The concept of dynamic symmetry offers a revolutionary perspective that could fundamentally transform our understanding of quantum phenomena. This innovative idea challenges traditional notions of symmetry, presenting it as a fluid and subjective concept rather than a rigid, objective property. Such a dynamic view of symmetry aligns remarkably well with the probabilistic and non-deterministic nature of quantum mechanics, where particles can exist in superposition states and outcomes remain uncertain until observed.

By advocating for the abandonment of the "objective Newtonian mindset" *(see excerpt below), this theory resonates deeply with quantum mechanics' fundamental departure from classical physics. It suggests a need to radically rethink our understanding of symmetry in light of quantum phenomena, potentially offering new insights into some of the field's most perplexing aspects. This shift in perspective could be crucial in addressing long-standing paradoxes and interpretational issues in quantum theory.

Central to this theory is the emphasis on the interplay between order and disorder, which

Benedict Rattigan describes as "the most fundamental symmetry there is". This concept could provide fresh perspectives on quantum processes such as superposition and wave function collapse, where ordered states emerge from seemingly disordered quantum systems. It might offer new ways to conceptualise the transition between quantum and classical realms, addressing the long-standing question of why quantum effects aren't more apparent in everyday life.

The theory's focus on observer dependence is particularly intriguing in the context of quantum mechanics. In *The Language of Symmetry*, Rattigan questions what symmetry "is" without an observer to give it form, a notion that aligns closely with the observer-dependent nature of quantum phenomena. This could potentially offer new insights into the role of measurement and observation in quantum mechanics, one of the field's most hotly debated topics. By viewing symmetry as a "shape-shifter" that adapts to the observer's perspective, we might gain new understanding of the measurement problem and the nature of quantum reality.

Described as having "applications at every level of life", the theory suggests a multiscale applicability that could be particularly valuable in bridging quantum and macroscopic scales. This broad applicability, combined with its description as a potential Theory of Everything, hints at its potential as a unifying principle across different domains of physics, including quantum mechanics. The idea of symmetry as a shape-shifter could provide a conceptual framework for understanding how quantum principles manifest at different scales and in different contexts.

The concept of symmetry as a principle that "expresses itself in contradictory ways under different circumstances" is especially provocative when applied to quantum mechanics. It could provide new ways to interpret seemingly paradoxical quantum behaviours, offering a framework for understanding how symmetry principles apply across different domains of physics. This perspective might help reconcile apparent contradictions in quantum theory, such as wave-particle duality or the EPR paradox, by viewing them as different expressions of a more fundamental, shape-shifting symmetry.

By suggesting that symmetry is not just an expression of invariance or order, this theory might offer new perspectives on symmetry breaking and other dynamic aspects of quantum systems. This could lead to fresh insights into fundamental quantum processes and potentially inspire new experimental approaches. The idea of symmetry as a dynamic, adaptive principle rather than a static property could open up new avenues for exploring quantum phenomena and their interactions with the classical world.

Further research and rigorous theoretical development would be needed to fully assess the

implications of the theory for our understanding of quantum phenomena. But his concept of symmetry as a shape-shifter presents a tantalising new approach to understanding quantum mechanics. By challenging traditional notions of symmetry and aligning with some of the most perplexing aspects of quantum theory, it offers the potential for fresh insights and new directions in quantum research. As this theory continues to be explored and developed, it may well lead to significant advancements in our understanding of the quantum world and its relationship to classical physics. The true test of its value will come as researchers work to integrate these ideas into the existing framework of quantum mechanics and explore their predictive power and experimental implications.

* Excerpt from *The Language of Symmetry* (ed. Rattigan, Noble & Hatta): Benedict Rattigan's concluding observations:

'In their quest for the ordering principle, scientists and philosophers have been trying to identify a law that they assume must be fixed and objective, like Archimedes' principle or Newton's laws of motion. But quantum mechanics suggests that, at the deepest level, the universe is paradoxical and subjective. For example, we've learnt that light can present itself in contrasting ways. To some observers it takes the form of a particle, which is localised, whilst to others it appears as a wave, which is spread out. Yet whilst these two interpretations, particle and wave, appear to be contradictory, both are valid.

Symmetry, however, [finds expression] in a sequence of oppositional symmetries: sometimes it is orderly, and sometimes chaotic; often it is logical, whilst at other times it's contradictory; it is always ubiquitous, yet often quite difficult to see. It can express itself as harmony and opposition simultaneously, as with a set of weighing scales; or as transformations that leave an object unchanged. It is deeply symmetrical. Which of its complementary aspects are observed depends on the observer. Mesopotamian mythology describes it in terms of harmony, whereas the Ancient Egyptians saw it as a law of opposition and conflict. Both of these subjective interpretations of symmetry are valid, but they contradict each other. And it is here, with the crucial polarity of the observer and the observed, that quantum mechanics and relativity coincide with symmetry. In fact, I would suggest that without an observer to give it form, we might even wonder what symmetry, in itself, really 'is'.

From a philosopher's perspective, it seems clear that the time has come to discard the objective Newtonian mindset. Symmetry isn't just an expression of orderly transformation, it is far more complex than that. And that's why the ordering principle has so long eluded physicists — it has never occurred to anyone that it might be a shape-shifter, a law that expresses itself in contradictory ways under different circumstances.'