

Interpretations of Quantum Mechanics

With special focus on The Many Worlds Interpretation

David Stranahan

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From Newton to Schrödinger

- Isaac Newton – July 1687

$$\vec{F} = m\vec{a}$$

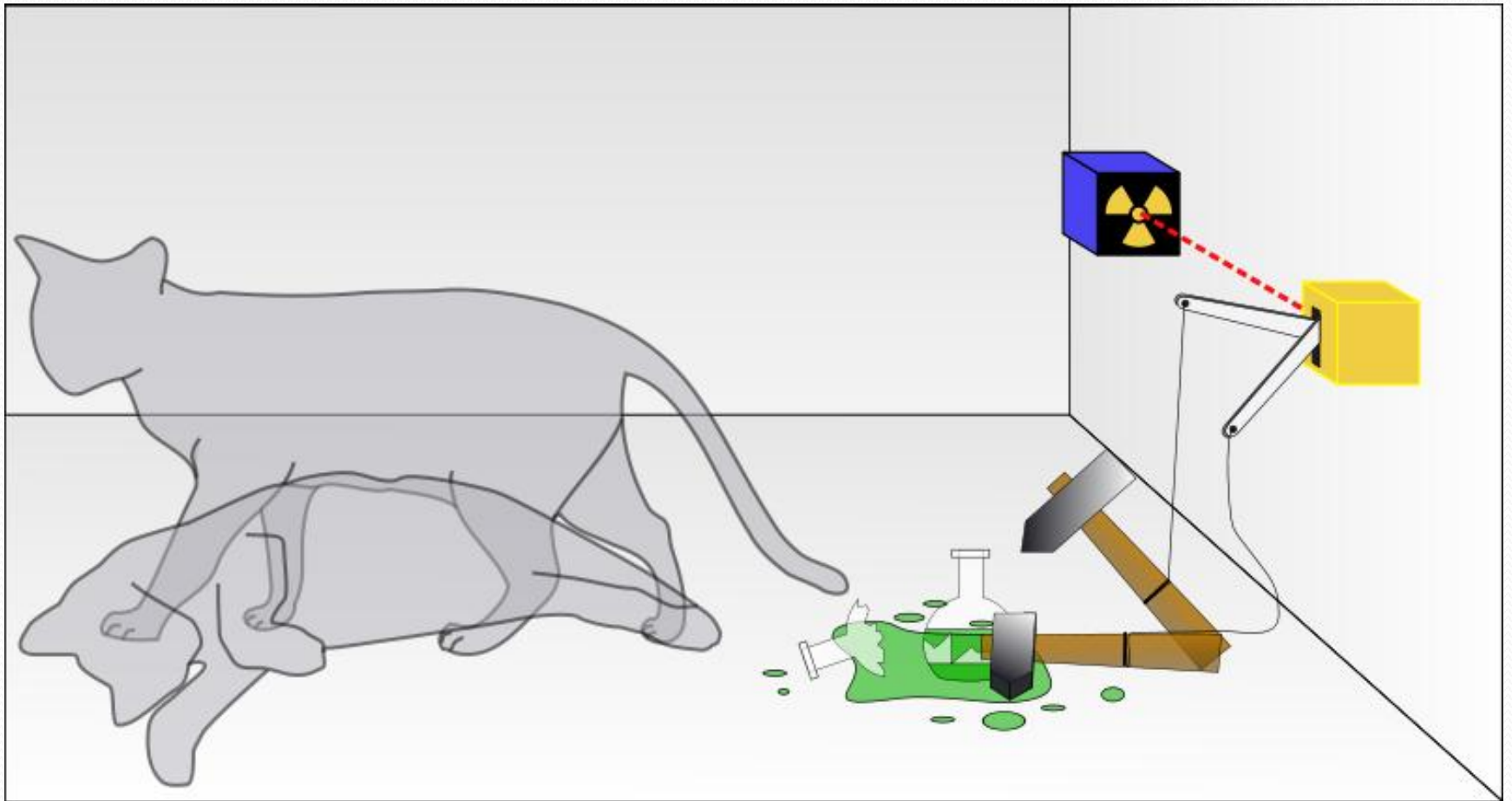
- Erwin Schrodinger – January 1926

$$-\frac{\hbar^2}{2m} \frac{\partial^2 \psi(x,t)}{\partial x^2} + U(x)\psi(x,t) = i\hbar \frac{\partial \psi(x,t)}{\partial t}$$

- Max Born – July 1926

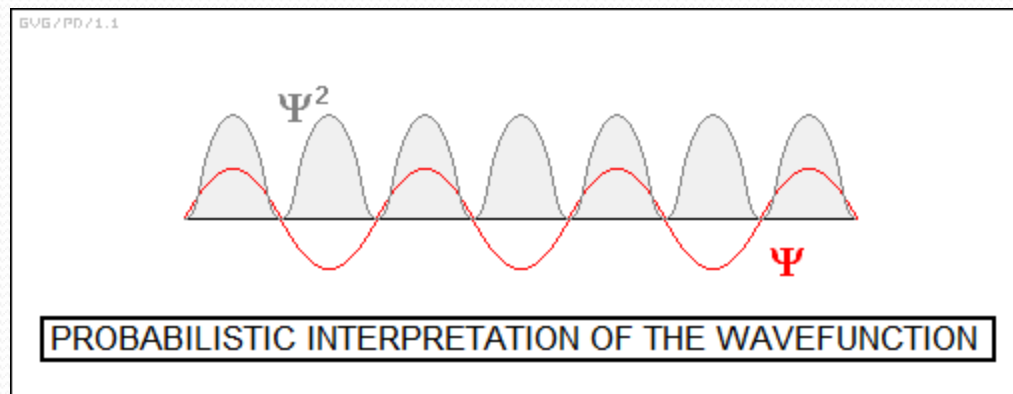
$$\Psi^*(x,t)\Psi(x,t)$$

Schrödinger's Cat



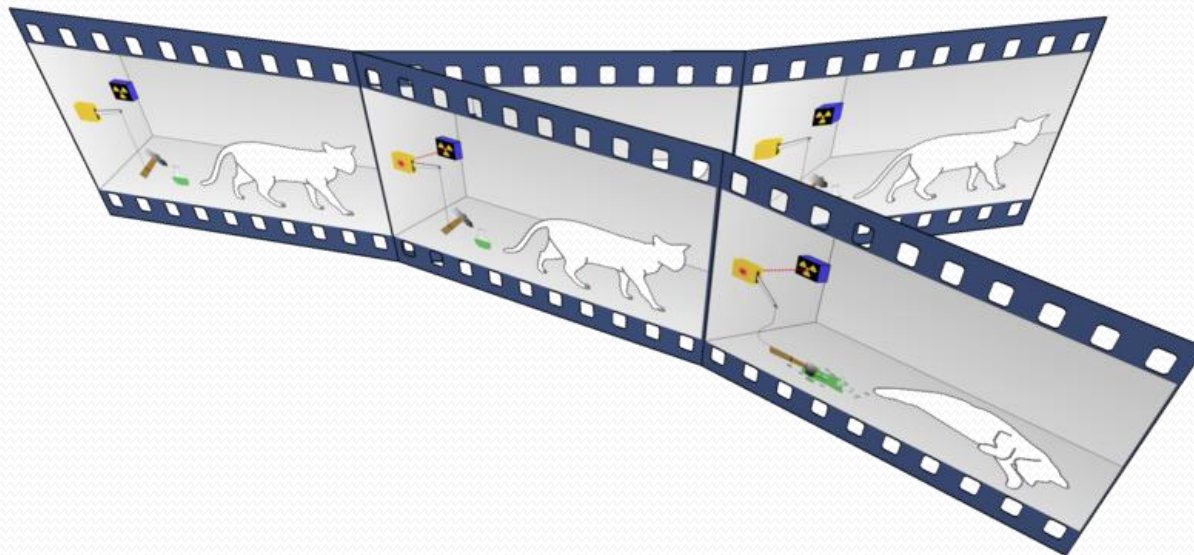
Copenhagen Interpretation

- Werner Heisenberg and Neils Bohr – 1927
- Nature is probabilistic
- All matter exhibits wave-particle duality
- Observation induces a Wave Function Collapse



Many Worlds Interpretation

- Hugh Everett – 1957
- Bryce DeWitt – 1960
- The Wave Function is real
- No Wave Function collapse



References

- “Relative State” Formulation of Quantum Mechanics
 - Hugh Everett, III of Princeton University
 - Published in Reviews of Modern Physics Volume 29, Number 3 (1957)
- Assessment of Everett’s “Relative State” Formulation of Quantum Theory
 - John A. Wheeler of Princeton University
 - Published in Reviews of Modern Physics Volume 29, Number 3 (1957)
- From Newton’s Laws to the Wheeler-DeWitt Equation
 - John W. Norbury of University of Wisconsin – Milwaukee
 - Published in European Journal of Physics Volume 19, pg 143-150 (1998)

References (cont.)

- Quantum Mechanics of Minds and Worlds
 - Jeffery A. Barrett
 - Oxford University Press (1999)
- Stanford Encyclopedia of Philosophy
 - Jan Faye and Lev Vaidman
 - Available online at:
<http://plato.stanford.edu/entries/qm-copenhagen/>
<http://plato.stanford.edu/entries/qm-manyworlds/>
- The Many Worlds of Hugh Everett
 - Peter Byrne
 - Published in Scientific America (Oct 21, 2008)