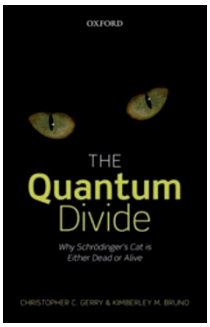
Wanted dead or alive, or both



The Quantum Divide: Why Schrödinger's Cat is Either Dead or Alive

By Christopher C. Gerry and Kimberley M. Bruno

OXFORD UNIV. PRESS: 2013. 197PP. $44.95.

Quantum mechanics and quantum information feature many eccentric characters, from the personality-split photon to the omnipresent Alice and Bob. But without any doubt Schrödinger's cat is the star: John Gribbin's *In Search of Schrödinger's Cat*, with its sequel *Schrödinger's Kittens and the Search for Reality*, as well as science-fiction novels such as Robert Anton Wilson's *Schrödinger's Cat Trilogy* and so on. Few popular science books on quantum mechanics fail to mention "spooky action at a distance", and even fewer omit the famous feline. Why is the cat so popular, and how did it become iconic for quantum mechanics? It may be because it is the only accessible visual representation of a field so full of abstract and counter-intuitive concepts. So to avoid the headache in trying to imagine how simultaneously being a wave and particle would look (don't even try to imagine entangled states), it might be better to think of a dead and alive cat. This image is neither particularly illuminating nor beautiful — perhaps even disturbing for cat-lovers — but at least it feels tangible.

Writing about quantum mechanics in scientifically accurate and yet intuitive terms is hard. There are countless books on the subject, approaching it from every possible angle (for example, *How to Teach Quantum Physics to your Dog*, *Quantum Theory Cannot Hurt You*, *Quantum: A Guide for the Perplexed* and *Who's Afraid of Schrödinger's Cat?*), and it is amazing how many of these have cats on their covers. But *The Quantum Divide: Why Schrödinger's Cat is either Dead or Alive* by Christopher C. Gerry and Kimberley M. Bruno is not just another book on the list. It is an instructive and entertaining read — an excellent example of what 'popular science for scientists' should be. *The Quantum Divide* looks at key concepts in quantum mechanics, illustrating them mainly with quantum optics experiments. The authors do not shy away from maths and diagrams in explaining quantum phenomena such as superposition and entanglement, and the experiments in which they show up.

Gerry and Bruno take the reader from wave–particle duality, through various quantum interference effects to quantum correlations and macroscopic superpositions. On the way they introduce complementarity, quantum tunnelling, delayed-choice experiments and quantum teleportation. The physics behind these quantum phenomena is explained in detail, from the workings of beam-splitters and polarizers to more complex arrangements, such as the Mach–Zehnder and Hong–Ou–Mandel interferometers. And although the authors touch on such varied topics, they manage to maintain a steady flow and an overall sense of coherence (no pun intended).

All the discussions eventually lead to the central theme of *The Quantum Divide*: the question of where to draw the line between the quantum and classical worlds — if this line does indeed exist. But Gerry and Bruno explicitly take on this issue in the last two chapters, where they introduce macroscopic superposition states and the decoherence-induced transition to the classical world. The final chapter gets more metaphysical, tackling wilder notions, such as the many-world interpretation of quantum mechanics or quantum consciousness — a concept the readers are advised to be wary of.

The Quantum Divide does not focus too much on the historical debates or mythical figures, giving due credit to contemporary research and the recent work of various experimental groups worldwide. Relevant references are given at the end of every chapter, and a quantum mechanics timeline is also included. Admittedly Gerry and Bruno do go for a slightly cheesy title and indulge in a couple of geeky *Star Trek* references (unavoidable perhaps when dealing with teleportation), but they stick to a scientific yet light tone, with the right amount of anecdotal digressions. The authors make an effort to avoid the usual quantum clichés and warn against the hyperbole and overstretched metaphors that plague popular science writing.

So does *The Quantum Divide* provide a more intuitive image of quantum mechanics? It does not, but this is neither the authors' intention nor the readers' expectation. Instead it gives a balanced and up-to-date account of fascinating quantum phenomena well beyond the double-slit experiment and Schrödinger's cat paradox. It also advocates a more relaxed approach: "Quantum mechanics is weird, but not that weird." ❐

REVIEWED BY IULIA GEORGESCU

ON OUR BOOKSHELF

Schrödinger's Killer App: Race to Build the World's First Quantum Computer

By Jonathan P. Dowling

TAYLOR & FRANCIS: 2013. 453PP. £25.99.

A quantum code-breaker based on Shor's factoring algorithm could hack into even the securest parts of the Internet, but not those things protected by quantum cryptography. This book discusses the history, philosophy and progress of these state-of-the-art technologies.

Quantum Computing since Democritus

By Scott Aaronson

CAMBRIDGE UNIV. PRESS: 2013. 398PP. £24.99.

Democritus, the 'father of modern science', believed that atoms are the smallest constituents of matter. From these seeds of natural science followed ideas of logic and set theory, quantum computing and cryptography, and the meaning of quantum mechanics.