

REVIEW

MICHEL BITBOL

Schrödinger's Philosophy of Quantum Mechanics

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Bitbol's book, *Schrödinger's Philosophy of Quantum Mechanics*, initially gives the impression of being squarely in the tradition of the *history* of quantum theory, but a preliminary glance through the bibliography soon reveals that the reader is in for something other than a standard history. One finds there references to works such as Simon Blackburn's *Essays in Quasi-realism*, Kochen and Specker's famous 1967 paper, books and essays on the many-worlds and many-minds interpretations of quantum theory, and so on—all of which lead one to suppose that perhaps the book is about some contemporary version of Schrödinger's interpretation of quantum theory.

The book is neither, but is instead an admirable piece of work in the history *and* philosophy of modern physics, a true marriage of the disciplines that, for the most part, reveals the advantages of such a union.

For one, we find in Bitbol's book an illustration of how philosophy can provide history with the resources for understanding the positions taken by historical figures. A beautiful example is Bitbol's use of Blackburn's notion of 'quasi-realism' to come to some understanding of Schrödinger's own attitude towards realism. Schrödinger's statements about realism are, as Bitbol's documentation shows, somewhat cryptic at times. Any attempt to understand Schrödinger's view as a simple case of either realism or anti-realism seems doomed to failure. On the other hand, precisely *because* he has available Blackburn's notion of 'quasi-realism', Bitbol is able to make good sense of Schrödinger's initially confusing claims.

At the same time, history can show philosophy how to see itself *in* the context of a set of ideas. Without this context, philosophy can easily fall into either (or both) of two complementary errors: it can fail to see why a given philosophical position might appear plausible, because it forgets the line of thought that led to the position; and it can fail to see why a given position might

be implausible, because it forgets the rather implausible reasons that led to the position's becoming standard doctrine.

A nice example is again afforded by Bitbol's book. Apart from a few people (whose sincerity, I confess, I have sometimes doubted), the many-worlds interpretation as it is usually expounded today is apt to convince nobody. The idea appears too implausible. By pointing out some similarities between Schrödinger's position and the many-worlds interpretation, Bitbol presents the many-worlds interpretation in a different perspective. One can see how a reasonable line of thought might lead to it. One striking similarity is what Bitbol calls the idea of 'conjunction', the idea that the terms in a superposition represent not a disjunction of possibilities, but a conjunction of (somehow multiply realized) possibilities. Bitbol quotes Schrödinger (p. 127), and the quotation (together with some very clear exposition in other parts of the book) reveals *why* Schrödinger was led to this idea. In so far as one sees Schrödinger's line of thought to be reasonable, and in so far as the many-worlds interpretation makes ontological *sense* of the idea of conjunction, one can, finally, see the many-worlds interpretation as at least not quite as crazy as it earlier appeared.

But doing history *and* philosophy of science has its dangers as well. In particular, one can become insensitive to the important differences between contemporary views and earlier views. It is tempting to read later developments into earlier minds. It is especially tempting to 'save' early attempts to come to grips with quantum theory by reading into them some later, perhaps less confused, account. Indeed, I can use exactly the same example as before—Bitbol's use of Blackburn—to make this point as well. Although Blackburn's notion of quasi-realism does, I agree, make sense of Schrödinger's rather confusing assortment of remarks on realism, it goes too far to claim that Schrödinger *was* a quasi-realist, or that he was 'approaching' that position. We simply do not have enough evidence, I think, to make that supposition. Nor can we make that supposition as a kind of 'inference to the best explanation'—Schrödinger was a quasi-realist because his being so explains what he said. He could have been simply confused. Or, more likely, he could have been groping towards *some* view that was neither simple realism nor simple anti-realism, but that view might not have been quasi-realism.

For the most part, Bitbol does *not* succumb to the temptation to read contemporary views into historical figures. He is careful to point out the differences between Schrödinger's views and contemporary views. None the less, drawing the comparison—an activity that can be, for reasons already mentioned, part of good historical practice—does invite misconception, and occasionally Bitbol goes too far towards emphasizing similarities between Schrödinger's views and contemporary views. In the case of realism, Bitbol has, I think, shown at best that Schrödinger *might* have been groping towards something like Blackburn's quasi-realism, and the statement that 'Schrödinger

can be categorized as one of the most typical quasi-realist thinker[s] of the twentieth century' (p. 40) seems to go further than the evidence warrants.

None the less, it is clear from Bitbol's book that Schrödinger thought a lot about realism, and held, or was working towards, some fairly sophisticated view. And Schrödinger's views about realism are, argues Bitbol, the common thread that connects his earlier and later views of quantum theory. Bitbol argues *against* the standard view of Schrödinger's development, namely, that early in his career Schrödinger held a naïve realist's view of the wavefunction, later he adopted the Copenhagen interpretation, and yet later he returned to his original view. Instead, argues Bitbol, one must see Schrödinger's changing interpretation of quantum theory in the light of his developing views about realism, so that in fact the late Schrödinger would have had a very sophisticated view indeed, encompassing quasi-realism, the idea of conjunction, and the 'reality' (in the quasi-realist's sense) of the wavefunction.

Bitbol tells this story in basically three parts. After a very useful introductory chapter summarizing his argument, he describes (in Chapter 2) Schrödinger's interpretative project as it was very early in his career (roughly 1924–7). Chapter 3 moves to Schrödinger's 'middle' period, where Schrödinger's project took on a sceptical aspect. This scepticism gave Schrödinger the *appearance*—but *only* the appearance, argues Bitbol—of having adopted the Copenhagen interpretation in the face of irreparable problems with his early view. In Chapters 4 to 6, Bitbol comes to Schrödinger's later view, which, Bitbol argues, comes out of his period of scepticism. In this later view, Schrödinger manages to combine the epistemological lessons that he learned from his sceptical period with his early affinity for the wavefunction as the element of 'reality' in quantum theory.

The story is a compelling one. I sometimes found Bitbol's uncritical acceptance of Bohr's critique of realism off-putting—though it does set up Schrödinger quite nicely as the 'saviour' of (some form of) realism—but overall Bitbol's exposition is philosophically acute and historically well informed. I can recommend the book without hesitation to anybody interested in the conceptual foundations of quantum theory.