"Clarity at the price of . . . a partial view"

Superposition and Interaction: Coherence in Physics

R. Schlegel
314 pp. U. Chicago P., 1980. $22.50

Reviewed by Katherine S. Arima

In *Superposition and Interaction: Coherence in Physics*, Richard Schlegel presents ideas that he has been developing with remarkable consistency for about 30 years concerning physical theory, such as the clock paradox of relativity and statistical interpretation in quantum physics. Again he examines the philosophical implications: the completeness, for instance, of scientific explanation and the role of subjectivism. These are worthy topics, of course, that have long challenged scientists and philosophers of science. However, their very familiarity raises basic critical points. Is there anything new in Schlegel's book? How does Schlegel's achievement stand up to work by others? What motivates yet another study of these subjects?

Schlegel claims "three novel ideas." First, by the "interaction hypothesis," he extends the well-known interaction between observer and physical system required by the Copenhagen interpretation of quantum theory to the formalism of special relativity: Observations of Lorentz transformations involve physical interactions in which the objects are themselves transformed instead of involving the usual transformation of measuring rods and clocks. Second, Schlegel modifies the notion of superposition of states for quantum systems and postulates a "restricted superposition hypothesis," whereby the only allowed states are related by Lorentz transformations on velocity, spatial translation and rotation, space but not time inversion, and charge conjugation. Third, he proposes that superposition applies also to relativistic systems insofar as any object system is defined by the superposition of all possible, Lorentz-transformed, inertial systems. Thus the Lorentz transformations act as a "unifying principle," giving both the transformed states of relativity and the transitions between different quantum substates.

Whether or not these ideas are new, they are not arresting scientifically or philosophically, in Schlegel's exposition. No conclusive experimental evidence supports his interaction hypothesis; his interpretations do not contribute significantly to the explanatory or predictive power of science. If Schlegel's views do not especially alter the content of theory, they cannot, in his terms, much affect epistemology, for Schlegel considers knowledge in physics largely as what is embedded in the principles and concepts of physical theory.

Evidently Schlegel wants to resolve the outstanding problem of twentieth-century physics, the conflict between quantum and relativity theories. The company he keeps—beginning with Niels Bohr and Albert Einstein—is naturally illustrious. By comparison, in his method Schlegel is neither as scientifically rigorous as similarly motivated physicists in A. Held's *General Relativity and Gravitation* nor as philosophically exacting as the contributors to C. A. Hooker's *Contemporary Research in the Foundations and Philosophy of Quantum Theory*. Furthermore, although mindful of historical illustration, Schlegel's orientation is not historical, such as is Thomas S. Kuhn's *Black-Body Theory and the Quantum Discontinuity* 1894–1912. What Schlegel has stated about the way of science equally applies to his eclectic approach in "Progress and Completeness in Science" in *Centennial Review* (1978): "simplicity and clarity at the price of. . . a partial view."

Schlegel's perseverance suggests other motivation. Fideism surfaces when he writes "We are seeking a unity which must in some sense exist; for nature is one and theories concerned with a common domain should therefore be altogether consistent." He describes mystic experience. The last section of the book, a conversation among two scientists and a philospher, while stylistically incompatible with the rest, allows informal discussion of God and science. For Schlegel the nonrational experiences reinforce and motivate the search for unity or "coherence." They might also sustain his somewhat isolated position. He acknowledges, for example, that his analysis of the clock paradox contradicts Einstein and other relativists.

Still, Schlegel's varied discussion can prove valuable. The potential audience is broader than the physicists, physics-oriented scientists and philosphers whom he addresses. His exposition is characteristically lucid. For the novice, *Superposition and Interaction* will introduce some of the most difficult, exciting problems in contemporary science and philosophy of science.

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Quantum Physics in America, 1920–1935

K. R. Sopka
Arno, New York, 1980. $42.00

This doctoral dissertation, completed in 1976 and published here as an unrevised "reprint" in the Arno Press collection, *Three Centuries of Science in America*, makes a useful addition to the growing body of scholarship on the history of modern American physics. Sopka proposes that this country's

Edwin Kemble (left) and John Van Vleck in a photograph taken by E.B. Boatner.