Microscopic and Macroscopic Quantum Realms

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1 AUTHOR:

Moorad Alexanian

University of North Carolina at Wilmington

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ing some guidance about how to make sense of Christian faith "in a scientific world" will not come away disappointed.

Reviewed by Amos Yong, J. Rodman Williams Professor of Theology and Dean, Regent University School of Divinity, Virginia Beach, VA 23464.

Letters

A Response to the Review of *Cleansing the Cosmos: A Biblical Model for Conceptualizing and Counteracting Evil*

I would like to thank Gregory Boyd for his review and critique of my book, *Cleansing the Cosmos: A Biblical Model for Conceptualizing and Counteracting Evil* (*PSCF* 66, no. 1 [2014]: 57–9). As I mention in the book, there is much I admire about his work on evil, and indeed our theologies have much in common. However, I do have a few points of clarification. First, with respect to my understanding of warfare models, I claim that warfare imagery only implies or suggests a view of equal and opposite forces (pp. 24, 125, 213), and I am clear that proponents of warfare models do not endorse a metaphysical dualism or believe that "spiritual warfare" occurs between equal forces (p. 24).

Second, with respect to metaphors, I maintain that Boyd's use of the concept of God at War is not well developed, although his response seems to indicate another point of agreement between us. Linguistic treatments of evil are seldom mentioned in works that affirm the reality of the demonic world; this led me to conclude that proponents of "spiritual warfare" models fail to appreciate the metaphorical nature of biblical references. This lack often leads to a focus on only a few biblical texts (Boyd's work being an exception).

Third, ontology is a secondary theme of my work, and although I attempt to use linguistic avenues rather than philosophical ones, I very much agree with Boyd that metaphorical and metaphysical truth can be difficult to extricate and explicate (this is evident in science as well). I suspect his difficulty in getting "clear what these descriptors mean" is a reflection of the very problem I address: the nature of evil spirits is nebulous. This is why I suggest that using multiple metaphors (not limiting ourselves to warfare ones) may enhance our understanding. Interestingly, Boyd's contention that "nothingness" is "a domain of possibilities that becomes actualized only when free agents, human or angelic, choose to do so against God's will" is a point I make several times, albeit with different language (pp. 116–7, 227, 250, 270, 273–6). In fact, I disagree with Barth that evil is not allowed ontological status; I suggest that it becomes real when humans open a doorway to the demonic through sin.

To further clarify, although I suggest that my spatial model has many advantages over a warfare model, I admit that my model could, in fact, incorporate warfare metaphors (pp. 126, 286). Ultimately, my conclusion is more modest: a spatial/boundaries model offers a viable alternative to a "spiritual warfare" one (pp. 126, 213, 285).

E. Janet Warren
CSCA Member

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The quantum mechanical description of reality and its relevance and implications for the Christian faith plays a central role in the physics theme of the March 2014 issue of *PSCF*. Mann correlates the recent progress in physics with Christian theology by considering typicality, plurality, reduction, quantization, and eternity.[1] Faries emphasizes the challenge of chance and quantum physics to a theological worldview.[2] Carlson and Hine consider the question on how to integrate randomness in the physical world with our theological thinking.[3]

Quantum entanglement lies at the foundation of quantum mechanics. Witness Schrödinger highlighting entanglement with his puzzling cat thought experiment and Einstein deriding it as "spooky action at a distance."[4] Nonetheless, quantum entanglement has been verified experimentally and is essential for quantum information and quantum computing. The quantum superposition principle, together with entanglement, dramatically contrasts the quantum from the classical description of reality. This issue of *PSCF* helps integrate physical reality with a Christian worldview.

The question of the interpretation and the measurement problem in quantum mechanics is important since it clarifies and gives us an insight on how to reconcile physical reality with our Christian faith.5 Van Kampen has written extensively on how quantum mechanics successfully explains macroscopic, objective, recorded phenomena.6 The latter are the experimental data one obtains for microscopic objects

that interact with a macroscopic measuring apparatus prepared in a metastable state, for example, the Wilson cloud chamber and the Geiger counter. Van Kampen emphasizes that the wave function ψ, which obeys the Schrödinger equation, is not observed directly. For instance, in the diffraction of a beam of electrons passing through a crystal, ψ for a single electron is calculated but the physically observed quantity is $N|\psi|2$, where N is the number of electrons in the beam.[7] It is, in this sense, that quantum mechanics provides a complete and adequate description of the observed physical phenomena on the atomic scale.

Van Kampen argues against various interpretations of quantum mechanics, for example, Bohm's hidden variables, de Broglie's pilot wave function, a nonlinear interaction with our consciousness, stochastic, and Everett's many-world interpretations.[8] Van Kampen agrees with Bohr on how to understand the formalism of quantum mechanics but differs from Bohr's theory of measurements and so also differs with what is commonly known as the Copenhagen interpretation. Van Kampen makes it clear how macroscopic observations can be recorded objectively, independently of the observation and the observer, and may be the object of scientific studies.[9]

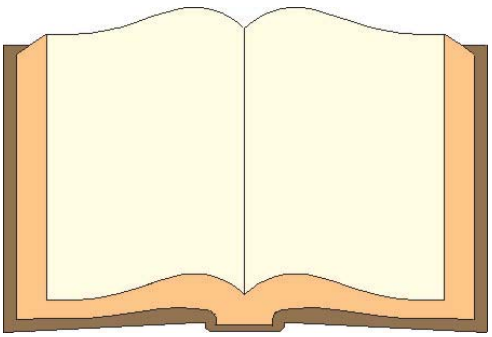
The meaning of a macroscopic object (e.g., as a certain amount of a gas, a crystal, a pointer on a volt meter, a cat, human beings) is crucial since it makes it clear that although also governed by quantum mechanics, nonetheless, the combination of the enormous number of quantum states in the macroscopic object eliminates the quantum interference between macroscopic states, say, two human beings. Accordingly, macroscopic objects deal with probabilities rather than probability amplitudes, namely, a classical description by a density matrix rather than a wave function.[10]

Einstein refused to believe in the notion of the entanglement of two far-apart electrons.[11] This is a consequence of thinking of an electron as a localized particle rather than as a manifestation of a wave function. In fact, the universe is made of quantized fields, not particles, which implies, nonetheless, that fields exhibit many particle-like aspects. Clauser first established experimentally the discreteness of photons in 1974 by results that contradict the predictions by any classical or semiclassical theory.[12]

Notes

[1]R. B. Mann, "Physics at the Theological Frontiers," *Perspectives on Science and Christian Faith* 66, no. 1 (2014): 2–12.
[2]D. W. Faries, "A Personal God, Chance, and Randomness in Quantum Physics," *Perspectives on Science and Christian Faith* 66, no. 1 (2014): 13–22.
[3]R. F. Carlson and J. N. Hine, "Two Interlocking Stories: Job and Natural Evil and Modern Science and Randomness," *Perspectives on Science and Christian Faith* 66, no. 1 (2014): 23–34.
[4]Mann, "Physics at the Theological Frontiers," 12.
[5]Faries, "A Personal God, Chance, and Randomness."
[6]N.G. Van Kampen, "Ten Theorems about Quantum Mechanical Measurements," *Physica A* 153 (1988): 97–113; ____, "The Scandal of Quantum Mechanics," *American Journal of Physics* 76, no. 11 (2008): 989–90.
[7]Van Kampen, "Ten Theorems about Quantum Mechanical Measurements."
[8]Van Kampen, "The Scandal of Quantum Mechanics."
[9]Van Kampen, "Ten Theorems about Quantum Mechanical Measurements."
[10]Ibid.
[11]Mann, "Physics at the Theological Frontiers," 12; Faries, "A Personal God, Chance, and Randomness."
[12]J. F. Clauser, "Experimental Distinction between the Quantum and Classical Field-Theoretic Predictions for the Photoelectric Effect," *Physical Review D* 9, no. 4 (1974): 853–60.

Moorad Alexanian
ASA Member
Department of Physics and Physical Oceanography
University of North Carolina Wilmington
alexanian@uncw.edu



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