

# NIELS BOHR AND THE MYSTICISM OF NATURE

by *John Honner*

*Abstract.* Some authors have described Niels Bohr as “never being open to anything transcendental.” Wolfgang Pauli, on the other hand, spent many years trying to persuade Bohr to admit to a kind of mysticism. This study offers support to Pauli’s claims. First, a distinction between what is vague on the one hand, and what is necessarily circular on the other, clarifies the work of Bohr. This discussion leads to comments on Bohr’s attitude towards the mutuality of spirit and matter and of reason and mysticism. Finally, some reflections are made about the relevance of Bohr’s covert transcendental philosophy for theological endeavors.

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“I am at present, with all my power, pushing myself to enter into the mysticism of nature.”<sup>1</sup> Thus wrote Niels Bohr to his protégé Werner Heisenberg in 1925. Bohr was reflecting on his struggle to solve the coupling problem in atomic physics, but he might equally well have been describing his lifelong preoccupation with the exploration of “that nature of which we ourselves are part.”<sup>2</sup> Although friends and colleagues like Wolfgang Pauli would press Bohr to admit to a kind of mysticism, there are others who will state with S. L. Jaki that Bohr was “never sympathetic to anything genuinely transcendental.”<sup>3</sup>

In this study, through reference to Bohr’s correspondence and notes, it will be shown that Pauli’s assessment is more accurate than Jaki’s: Bohr did indeed practice a “rational mysticism” and did have profound ideas about the mutuality of spirit and matter. These issues are of interest here, as are the character of Bohr’s objections to the churches, his partial reluctance at being drawn into religious debate, his views on science and religion, and the relevance of his thought to

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current debates about the status of theological and natural science. It is but a short step between the viewpoint which Bohr and Ludwig Wittgenstein viewed as *mystisch* and the holists' appreciation of scientific knowledge so lacking anchorage that "only a God can save us."<sup>4</sup>

#### BOHR AND RELIGIOUS BELIEF

One must respect the measured judgment of Léon Rosenfeld, Bohr's colleague and biographer, on Bohr's attitude to the church and to religious belief:

He [Bohr] also soon came to share the negative attitude of the progressive bourgeoisie to which his family belonged towards the church and religious beliefs in general; but it is characteristic of his candour and independence of judgement that he only arrived at this conclusion after he had convinced himself that the church upheld doctrines that were logically untenable and shunned the pressing task . . . of alleviating a still widespread pauperism. He never found any occasion in later life to depart from the position of the free-thinker which he maintained with tolerance and humanity.<sup>5</sup>

The word which Bohr used most frequently in his remarks on belief in God was "providence." He found the idea of the personification of such providence untenable for reasons which were identical to his defense of the complementarity of classical and quantum descriptions of nature.<sup>6</sup> That is, there is a limit to the objectivity of ordinary everyday concepts. What is applicable within those limits may not be applicable beyond them.<sup>7</sup> Bohr thus spoke of classical physics as an "idealization" in much the same way that a critical theologian might describe too anthropomorphic an account of God as "idolization" or idolatry.<sup>8</sup>

Bohr's attitude towards organized religion is unsympathetic, but this antipathy rests on his profound insight into the incomprehensibility of the human situation: on the one hand the subject stands over against nature and on the other hand as part of nature.<sup>9</sup> Bohr's grappling within this circle may have shaped his rejection of too subtle notions of God, but it also encouraged others to describe him as a mystic.

#### BOHR AND MYSTICISM

The honor (or taint) of mysticism was perhaps first laid on Bohr by his patron Carl Oseen in a description of Bohr's original quantum theory as "a fruitful mysticism."<sup>10</sup> Similar labels were applied by Max Born and Albert Einstein in comments on the Copenhagen approach as "*sehr mystisch*" and "tranquilizing philosophy—or religion."<sup>11</sup> Reacting to this, Bohr declared to Pauli in 1929 that his "predilection for neologisms does not so much arise from a compulsion to mysticism, but from the striving to avoid this mysticism with the help of language

itself."<sup>12</sup> Here Bohr is equating mysticism with irrationality and, some twenty years later, he would repeat the disclaimer with precisely the same understanding. "Indeed," he wrote to Pauli, "contrary to what some of our common friends seem to believe of me, I have always sought scientific inspiration in epistemology rather than in mysticism."<sup>13</sup>

There is however a second meaning of mysticism: the embrace of and reflection upon the deepest paradoxes of human aspiration and the human limitation. On the surmounting of the bounds to human endeavor Bohr could speak most movingly:

It is not the recognition of our human limitations but our efforts to investigate the nature of these limitations that marks our time. It would only give us a poor picture of our possibilities if we were to compare our limitation with an insurmountable wall. . . . From a deeper and deeper exploration of our basic outlook greater and greater coherence is understood and thus we come to live under an ever richer impression of an eternal and infinite harmony, although we can only feel the vague presence of this harmony but never really grasp it. At every try, in accordance with its nature, it slips out of our hands. Nothing is firm, every thought—yes every word is only suitable to underline a coherence that in itself can never fully be described but always more deeply studied. These are then the conditions for human thought.<sup>14</sup>

There is evidence in Bohr's notes that the word "mysticism" meant for him an escape into vagueness.<sup>15</sup> The above quotation, however, and his remarks about Sir Isaac Newton's mysticism reveal Bohr's approval of a second meaning of the word. He describes Newton's "deep occupation" as "tending almost to mysticism" and then warns that "all talk of distinguishing between rationalism and mysticism is essentially ambiguous."<sup>16</sup>

This curious attitude towards rationality and mysticism can also be detected in Bohr's exchanges with Pauli, who was convinced of the importance of one kind of mysticism. In 1950 Pauli sent Bohr a long letter in which he moved from a discussion of epistemological issues in the interpretation of quantum theory to reflections on mysticism, the possibility of a personal God, and the anonymity of the God of Eastern mystics.<sup>17</sup> Bohr's response was to concede that "they understood each other so well."<sup>18</sup> Two years later, immediately after returning from a visit to Copenhagen, Pauli wrote a more pressing letter to Bohr. He said that he wished "to come back to our talk of yesterday on the connection between the concepts 'God' and 'knowledge'." Pauli then went on to discuss various possible views of God as if to challenge the narrowness of Bohr's opinion of "providence." "I only wish to emphasize," wrote Pauli, "that one has to *know* all this extra-church-tradition if one discusses such questions as you did yesterday."<sup>19</sup>

Bohr did not seem to appreciate Pauli's references to the *via negativa* and to the mystics' knowledge of God as the unknowable one.

In the letter of October 1950, for example, Pauli had referred to the nonpersonal God of Buddha or Lao Tzu, the interiorly discovered God of Meister Eckhart, and the God known only through a knowledge of what God is not.<sup>20</sup> Bohr's reply to all these suggestions lay in his abiding insistence on "the logical difficulties which the perception of a personified providence meets."<sup>21</sup> Pauli expressed his dissatisfaction by replying that he had "hoped to hear more about" Bohr's views.<sup>22</sup>

If Bohr did not concede ground to Pauli, his notes at this time show a trace of fresh questioning. In the sketches for his essay on "Physical Science and the Study of Religions" there is the cryptic undeveloped heading, "Mysticism and Atomic Theory."<sup>23</sup> But, towards the conclusion of his correspondence with Pauli, we can see Bohr perhaps washing his hands of the matter. Thus in 1955 when Pauli wrote that he did "find sometimes scientific inspiration in mysticism" and that "the 'Unity' of everything has always been one of the most prominent ideas of the mystics," Bohr simply replied that "it is a pure discussional accident which words, like mysticism or logical systematism, the one or the other of us uses."<sup>24</sup>

However there may be more than hand washing or hand waving in Bohr's response. First of all one is reminded of his remarks about Newton's rational mysticism made a decade before. Second, one must also take into account his equally paradoxical comments about the mutuality of spirit and matter. Among Bohr's notes from 1954 can be found observations like the following:

The very problem of a spirit behind existence is certainly undefinable [?] if it shall not merely mean a symbol for an ultimate harmony which according to the very word cannot be analyzed nor capable of objective description.

The question is not about subjective belief but about serious endeavour at analyzing the situation and definition of the words by which it can be objectively described.

As regards the question of spiritual truth, I shall not repeat what has already been said of the inherent inseparability of materialistic and spiritualistic views.

Materialism and spiritualism, which are only defined by concepts taken from each other, are two aspects of the same thing.<sup>25</sup>

Remarks like these can only be properly understood in the context of Bohr's interpretation of quantum theory. One problem with which he struggled was this: quantum theory is a more general and more satisfactory account of nature, and yet it depends on the everyday concepts of classical physics if it is to provide objective description. How is it, Bohr asked, that something can depend on that which it both surplants and underpins? His reflections on the limits to the possibil-

ity of unambiguous communication led him to prescribe the principle of strong and circular complementarity. That is, the most complete description would be provided by giving together all the relevant descriptions, even if they appeared contradictory in the everyday classical framework, because the limitations of that causal spatio-temporal frame had now been exposed. In the paradigm case it therefore was not inappropriate to describe electrons as both wave and particle in character. These are both inadequate descriptions, but they are the best we can have (or their substitutes will be little better) according to Bohr. So also, with respect to his comments on mysticism and rationality or spirit and matter, Bohr can be taken to be referring to the inadequacies of our conceptions. If it makes sense for Bohr to speak of the problems in describing that nature of which we ourselves are part, so also does it make sense for him to speak of the mutuality of spirit and matter; and if he views his prescription of complementarity as a solution to the paradox of quantum theory and a rational generalization,<sup>26</sup> then it is also consistent that he claims a similarity between the rational and the mystical. To this end would Bohr often quote Johann von Schiller,

*Nur die Fülle führt zur Klarheit  
Und im Abgrund wohnt die Wahrheit.*

Only the whole leads to clarity  
And truth dwells in the unfathomable.

In a similar vein, or with impish humor, he would annotate a paper with the remark, "Much obscurity, great hope."<sup>27</sup>

Physicists of a more classical frame of mind like Einstein and Henry Margenau could not abide Bohr's embrace of paradox: "Bohr does not ask science to make a choice—he asks science to resign itself to an eternal dilemma," says Margenau.<sup>28</sup> For the theologian however, Bohr's solution of the problem of describing that which transcends ordinary human experience has a familiar ring. In Paul Tillich, Karl Rahner, and John Macquarrie for example, one finds the discussion of correlation, paradox, complementarity, and asymptotic conformity to be prominent in their defense of a theological approach to problems about the human and the divine.<sup>29</sup> Before discussing the significance of Bohr's views for reflection on faith in general, let us take note of his own specific comments on science and religion.

#### BOHR ON SCIENCE AND RELIGION

While he was convinced that religion and science began from "essentially different starting points,"<sup>30</sup> Bohr's eighty-one pages of notes for an essay on "Physical Science and the Study of Religions" also reveal his desire to discover the extent of the overlap between these two

aspects of human questioning. As he put it elsewhere, "the very words 'sciendum' and 'religio' both mean order."<sup>31</sup> In his notes we find the following interest in a similarity of epistemic issues faced by physicists and theologians:

It is perhaps difficult to conceive of two more contrasting themes than the endeavour to reach a logical description common to all mankind of our experiences regarding that nature in which we ourselves are parts and the religions with a [*sic*] aim of standardizing and harmonizing the emotional attitude towards life. . . .

Nevertheless, the study of the history of science and of the religions reveal common traits of the endeavour/position of man in adjusting to fundamental human problems, and notwithstanding the essential different aims and approach, the knowledge of the development and peculiarities of religious views offer inspiration as regards the contributions which physical science may hope to give in reaching an attitude of ever larger universality and harmony.<sup>32</sup>

A few weeks later Bohr developed this theme further:

a whole new background for the relationship between scientific research and religious attitude has been created by modern development of physics which has demanded a revision of the presumptions for the unambiguous application of our most elementary concepts and thereby brought epistemological problems to the foreground in an unsuspected manner. . . .

It will be attempted to show the development in our time has forced us to look into epistemological problems of a kind which recalls the common problems of the religions.<sup>33</sup>

These notes not only indicate Bohr's interest in the epistemological problems common to theological and quantum theoretical descriptions, but they also show that Bohr's objections to religion and mysticism were objections to what might be termed "mystery religions." Indeed, it is the mentality that deifies natural forces in order to explain the puzzles of the environment which Bohr rejects as irrational mysticism: "religion may in earlier days be taken to embrace all knowledge beyond the most elementary necessities from daily life, and even what appears as most phantastic [*sic*] phantasies [*sic*] about creation," says Bohr. Or again, "despite endeavours of a rational philosophy . . . the great Greek school made essential use of a mysticism which is not too clearly distinguished from a sort of knowledge characteristic for religious like enlightenment in trance and so-called divine revelation."<sup>34</sup> Such an attitude can also be found in Bohr's earlier writings, as in his key article in the first volume of the *International Encyclopedia of Unified Science*: "Our only way of avoiding the extremes of materialism and mysticism . . . is the never-ending endeavour to balance analysis and synthesis."<sup>35</sup> "Mysticism" as Bohr understands the term has to be rejected as capricious subjectivism, and pure "materialism" is equally unattractive because it fails to recognize

the aspiration of the human subject to surmount the bounds of experience.

Bohr's essay on science and religion contains no special insights which are not to be found in his other reflections on atomic physics and human knowledge. "Due to the short time I had for preparing it," he wrote to C. F. von Weizsäcker, "I had to make do with a few suggestions and pass over the deeper considerations."<sup>36</sup> His suggestions however are clear enough, for on the one hand he dismisses the old grounds for warfare between science and religion, and on the other hand he points to the epistemological difficulties in claiming classical scientific objectivity. The rise of science, Bohr writes,

brought about a veritable schism between science and religion. On the one hand, many phenomena, once regarded as manifestations of divine providence, appeared as consequences of general immutable laws of nature. On the other hand, the physical methods and viewpoints were far remote from the emphasis of human values and ideals essential for the religions. Common to the schools of so-called empirical and critical philosophy, an attitude prevailed of a more or less vague distinction between objective knowledge and subjective belief.

By the lesson regarding our position as observers of nature, which the development of physical science in the present century has given us, a new background has, however, been created just for the use of such words as objectivity and subjectivity.<sup>37</sup>

Or, as he had put it in his essays on *Atomic Theory and the Description of Nature*, referring to the effect of quantum discontinuity on the classical point of view: "Indeed, in consequence of this state of affairs, even words like 'to be' and 'to know' lose their unambiguous meaning."<sup>38</sup>

Bohr's philosophical argument, it can be shown, rests on considerations more general than those of the quantum condition itself.<sup>39</sup> The impossibility of making a strict separation between event and observer, subject and object, and words and reality is his ultimate starting point. In stating such a case, Bohr anticipates the thoroughgoing holism which Richard Rorty attributes to the later Martin Heidegger, to Willard V. O. Quine and Wilfrid Sellars, and to philosophers of science like Thomas Kuhn and Paul Feyerabend.<sup>40</sup> Thus Bohr's circular complementarity belongs to the same family as Heidegger's hermeneutic circle, Kuhn's relativism, and Quine's holism. For our present interests the most important of these figures is Heidegger. This is because of the influence of Heidegger's account of Being and human existence on theologians as prominent as Rahner, Tillich, and Macquarrie.

Before turning to our concluding reflections, two remarks about the appropriateness of drawing Bohr's thought into theological discussion are in order. First, over a period of several years Bohr refused to allow one of his essays to be printed in the journal *Kerygma und*

*Dogma*, because he wished to avoid any misunderstanding of his interpretation of quantum theory and in particular any abuse of the notion of complementarity.<sup>41</sup> Second, after the Gifford lectures which he gave in 1949, Bohr is supposed to have said to John Baillie, "I think you theologians should make much more use than you are doing of the principle of complementarity."<sup>42</sup>

#### COMPLEMENTARITY, MYSTICISM, AND HOLISM

The principle motif on the coat of arms which Bohr designed for himself is the Chinese circle of Yin and Yang. Around this circle he placed the words "Contraria sunt Complementa."<sup>43</sup> If these are the emblems of Eastern mysticism, Bohr's reasons for adopting them are based partly in the nature of quantum theory and partly in philosophical considerations of a kind quite prominent in contemporary thought. Enough has been said, I think, to justify Pauli's assessment of Bohr's rational mysticism. It is also surely possible to demonstrate that many theologians would side with Bohr in cautioning against glib claims to knowledge of God. "This nameless something which we can neither grasp nor circumscribe," writes Rahner for example, "is both revelation and mysticism; as creation it always lies behind us and as the absolute future it lies ahead of us, confronting us with the concreteness of our individual and collective history and bidding us enter. . . . For the present we are held suspended in the very midst of it."<sup>44</sup> But most interesting of all is the comparison of Bohr on the one hand and thoroughgoing holists like Rorty on the other, since questions have to be asked about the possibility of scientific advance in the context of such a relativist view of knowledge and reality.

Such questions have been recently put to Rorty by H. L. Dreyfus. Their discussion, which includes Charles Taylor, is worth eavesdropping on inasmuch as it highlights the choices we have to make between an ineffable God and an emptiness of promise.

RORTY: But there is no answer to the question, "How did the scientists manage to do it?" any more than there's an answer to the question, "How did the novelists manage to do it?" In particular, I don't think it helps to offer as an answer to the latter question, "Because they found some subject-independent terms." But that's because I don't think *anything* would help.

DREYFUS: . . . I want to attribute to the later Heidegger the view that "only a God can save us." As I understand it, this refers to a very particular problem, namely the problem of finding a new paradigm . . . that can focus our dispersed inherited micropractices and linguistic practices. . . .

TAYLOR: . . . Rorty seems to be holding that his is not a question, that nothing can be said, that our natural sciences work but that nothing can be said about why they work. What can we converse about if we encounter ineffability everywhere?



RORTY: It seems to me that we don't encounter ineffability if we think that a question probably doesn't have a usable answer. . . . Kuhn's reduction of philosophy of science doesn't point to an ineffable secret of success; it leaves us without the notion of a secret of success.<sup>45</sup>

But Bohr did implicitly believe in something like a secret of success. The sense of an eternal and infinite harmony despite insurmountable walls, the hope in obscurity, and the instinct that truth lies in the unfathomable—all this is testimony to his position. If the ineffable remained always ineffable for him, that is not to say that he was closed to anything genuinely transcendental. His high standards suggest the very opposite. What brought Bohr to these convictions, finally, was a rare balance of reflections on the conditions for the possibility of knowledge and on the implications of the quantum condition for our everyday, classical account of the world.

The term "mysticism" has a variety of meanings. It has not been our intention to label Bohr as a mystic so much as to show the error in describing him with terms such as "pragmatic materialist." Bohr's makeup is more subtle than that; his mysticism of nature is of a kind which accepts the paradox of spirit in the world. In rejecting a spirit-matter dualism he stands with the holists, both thoroughgoing and moderate, in the establishment of a fresh approach to language-fact, word-world, and theory-observation questions. While accepting and affirming the role of reason on the one hand, he offers us a caution about the range of our ordinary frameworks on the other. By such considerations he argues for the reasonableness in accepting contradictory descriptions if one is to provide the full story. His rationalism is not a narrow materialism or positivism.

It might be said that Bohr is René Descartes in reverse. While Descartes attempted to give philosophy the precision of mathematical science, Bohr gave mathematical science the insecurity of philosophy. And if the rise of classical science did have its consequences for philosophy and theology, it is possible that Bohr's thought has its significance for philosophy and theology today. It is with the hope of prompting such reflections, as well as in defense of Bohr, that this study of his struggle to enter the mysticism of nature has been written.

#### NOTES

1. Niels Bohr to Werner Heisenberg, April 18, 1925, Bohr scientific correspondence, microfilm 11 (hereafter cited as BSC:11), from the German "*die Mystik der Natur*." Microfilm of the Bohr Archive holdings may be found in the Bohr Institute in Copenhagen and in the *Sources for the History of Quantum Physics Project* archives in Philadelphia and Berkeley.

2. Niels Bohr, *Atomic Physics and Human Knowledge* (New York: Wiley, 1958), p. 1.

3. S. L. Jaki, *The Road of Science and the Ways to God* (Edinburgh: Scottish Academic Press, 1978), p. 203.

4. Reference here is first to Ludwig Wittgenstein's *Tractatus Logico-Philosophicus* (London: Routledge & Kegan Paul, 1961), nos. 6.44, 6.45, and 6.522, and second to H. L. Dreyfus's reference to the later Martin Heidegger in H. L. Dreyfus, Richard Rorty, and Charles Taylor, "A Discussion [of Holism and Hermeneutics]," *Review of Metaphysics* 34 (1980): 53-55. For an account of Heidegger, Wittgenstein, and a thoroughgoing holism in the philosophy of science, see Richard Rorty, *Philosophy and the Mirror of Nature* (Oxford: Blackwell, 1980).

5. Léon Rosenfeld, "Biographical Sketch" in *Niels Bohr, Collected Works*, ed. Léon Rosenfeld (Amsterdam: North-Holland, 1972), 1:xx-xxi.

6. See Bohr to C. F. von Weizsäcker, December 30, 1953 and June, 1956, BSC:33. See also a note in Danish and English, August 24, 1954, in Bohr manuscripts (Bohr Institute, Copenhagen), microfilm 21 (hereafter cited as MSS:21).

7. For a detailed account of Bohr's philosophical approach, see John Honner, "The Transcendental Philosophy of Niels Bohr," *Studies in History and Philosophy of Science* 13 (1982): 1-29.

8. See, for example, Niels Bohr, *Atomic Theory and the Description of Nature* (Cambridge: Cambridge University Press, 1934), p. 5. On one occasion Bohr was taken to use "idolization" in the same context: see the transcript of an address given at Roosevelt University, February 4, 1958, MSS:23, p. 4.

9. Bohr repeatedly referred to the aphorism of Lao Tzu that "We are both actors and spectators on the stage of life." See Bohr, *Atomic Theory*, p. 119, *Atomic Physics*, pp. 20, 63, and 81; and *Essays 1958-1962 on Atomic Physics and Human Knowledge* (London: Wiley, 1963), p. 15. His account of the conditions for the possibility of experimental knowledge, given such a view, is discussed in Honner, "The Transcendental Philosophy of Niels Bohr."

10. As reported in H. A. Kramers to Bohr, January 27, 1919, BSC:4. "A Fruitful Mysticism" is also the title of a chapter in Peter Robertson's history of the Niels Bohr Institute, *The Early Years* (Copenhagen: University of Copenhagen Academic Press, 1979).

11. Max Born to Albert Einstein, July 15, 1925, in M. Born, ed., *The Born-Einstein Letters* (London: Macmillan, 1971), p. 84, where "sehr mystisch" has been weakly rendered as "rather mystifying." See Einstein to Erwin Schrödinger in Karl Przibram, ed., *Letters on Wave Mechanics* (London: Vision, 1968), p. 31.

12. Bohr to Wolfgang Pauli, July 31, 1929, BSC:14, from the German.

13. Bohr to Pauli, March 2, 1955, BSC:30.

14. Bohr address given in Copenhagen, September 21, 1928, MSS:11, p. 4.

15. See the eighth draft of "The Unity of Human Knowledge," September 27, 1960, MSS:24, p. 7.

16. See the second draft of "Newton's Principles and Modern Atomic Mechanics," MSS:18, p. 27, and note dated August 12, 1946, MSS:17, p. 10.

17. Pauli to Bohr, October 3, 1950, BSC:30. This is a nine-page letter in barely decipherable German. See pp. Ia, IIa.

18. Bohr to Pauli, December 23, 1950, BSC:30.

19. Pauli to Bohr, June 15, 1952, BSC:30, Pauli's English and Pauli's emphasis.

20. Pauli to Bohr, October 3, 1950, BSC:30, see p. IIa.

21. Bohr to Pauli, December 31, 1953, BSC:30, p. 4, from the Danish.

22. Pauli to Bohr, February 19, 1954, BSC:30.

23. See note dated August 8, 1953, MSS:20. Bohr's "Physical Science and the Study of Religions" appeared in the Festschrift, *Studia Orientalia Ioanni Pedersen* (Copenhagen: Munksgaard, 1953), pp. 385-90.

24. Bohr to Pauli, March 25, 1955, BSC:30, Bohr's English.

25. See the notes under the heading "Spiritual Truth," September 1 and 4, 1954, the typed draft, August 21, 1954, and the note dated August 19, 1954, MSS:21.

26. "Rational generalization" was Bohr's frequently used description of the correspondence and complementarity principles. See *Atomic Theory* (n. 8 above), pp. 70, 87; *Atomic Physics* (n. 2 above), pp. 73, 85, 90, 100.

27. This remark is written in Danish at the foot of a manuscript that will be reproduced in the forthcoming *Niels Bohr, Collected Works*, vol. 5 (Amsterdam: North-Holland).

28. Henry Margenau, *The Nature of Physical Reality* (New York: McGraw-Hill, 1950), pp. 422, 426. For the Bohr-Einstein debate, see the relevant contributions in P. A. Schilpp, ed., *Albert Einstein, Philosopher Scientist*, Library of Living Philosophers, vol. 7 (Evanston, Ill.: Northwestern University Press, 1949), or Bohr's *Atomic Physics* (n. 2 above), pp. 32-66.
29. See Paul Tillich, *Systematic Theology* (London: James Nisbet, 1953), 1:7-30, 63, 167; Karl Rahner, *Foundations of Christian Faith* (London: Darton, Longman and Todd, 1978), pp. 11-23, 24, 54, 71, 181-83, 208-10; John Macquarrie, *Principles of Christian Theology* (London: SCM, 1966), pp. ix, 132. I hope to present soon a study of theological accounts of the complementarity and correspondence of grace and nature, spirit and matter, revelation and history, with particular reference to the work of Rahner.
30. Bohr, *Atomic Physics* (n. 2 above), p. 80.
31. Undated fragment of a note, MSS:20.
32. Note dated June 15, 1953, MSS:20, in Bohr's inventive English.
33. Notes dated August 26, 1953, and August 27, 1953, MSS:20.
34. Note dated August 3, 1953, MSS:20.
35. Niels Bohr, "Analysis and Synthesis in Science," in *Foundations of the Unity of Science: Toward an International Encyclopedia of Unified Science*, ed. Otto Neurath, Rudolf Carnap and Charles Morris, 2 vols. (Chicago: University of Chicago Press, 1938), 1:28.
36. Bohr to von Weizsäcker, December 30, 1953, BSC:33, from the Danish.
37. Bohr, "Physical Science and the Study of the Religions" (n. 23 above), p. 386. For a similar passage, see *Atomic Physics* (n. 2 above), pp. 80-81.
38. Bohr, *Atomic Theory* (n. 8 above), p. 19.
39. See Honner (n. 7 above).
40. Rorty (n. 4 above), especially pp. 170-73, 180-81, 368, 382.
41. See Bohr to E. Schlink, editor of the journal *Kerygma und Dogma*, October 23, 1943, and Bohr's correspondence with von Weizsäcker, who had requested the article, at the same time, BSC:33.
42. John Baillie, *Our Sense of the Presence of God* (London: Oxford University Press, 1962), p. 217. Bohr's Gifford lectures were never published and only scraps of notes remain: see MSS:19.
- 43: "Contraries are complementaries." The coat of arms was designed to hang in the castle church in Hillerød in recognition of Bohr's achievements in Denmark.
44. Rahner, *Theological Investigations* (London: Darton, Longman and Todd, 1972), 9:141-42. Compare this with the quotation from Bohr at n. 14 above.
45. Dreyfus, Rorty, and Taylor (n. 4 above), pp. 53-55.