

## **Introductory Note to “Dialectical Materialism and Modern Physics” by Max Born (1955).**

Olival Freire, Universidade Federal da Bahia, Brazil.

Christoph Lehner, Max Planck Institute for the History of Science, Berlin.<sup>1</sup>

“Dialectical Materialism and Modern Physics” is a previously unpublished manuscript written by Max Born (1882–1970) and sent to Léon Rosenfeld (1904–1974) in November 1955<sup>2</sup> in response to a paper by Rosenfeld defending the compatibility of Bohr’s doctrine of complementarity with dialectical materialism.<sup>3</sup> The manuscript offers interesting insights into both philosophy and politics of the time. Born’s and Rosenfeld’s views differed even though they both saw themselves as defenders of Bohr’s position on quantum mechanics. Politics clearly pitted Born against Rosenfeld, Liberal against Marxist, especially given the heightened sensitivities of the Cold War climate. Nevertheless, it is puzzling why Born felt motivated to protest against Rosenfeld’s position in this rather elaborate form, and why he never published the manuscript. The text shows that, beyond the obvious political disagreement, Born was opposing Rosenfeld’s characterization of the role of epistemology and ontology in physics. Therefore, the text throws light on Born’s philosophical position, which is not discussed extensively in the literature on this central figure in the development of quantum mechanics.

In the rising controversy over the interpretation of quantum mechanics during the 1950s, both scientists were in the same camp, supporting the complementarity view and aligned with Niels Bohr, Wolfgang Pauli and Werner Heisenberg. The modern term ‘Copenhagen interpretation’ for the position of Bohr and his supporters was only just emerging at the time; Rosenfeld objected rather vehemently to it.<sup>4</sup> Critics of Bohr’s position included physicists like Albert Einstein and Erwin Schrödinger, who were discontent with the methodological implications of Bohr’s interpretation. On the other hand, Soviet physicists (like Dimitri Blochinzev) and philosophers criticized complementarity on ideological grounds, claiming it was an idealistic and therefore bourgeois view. David Bohm, a Marxist like Rosenfeld, suggested a deterministic hidden-variable interpretation of quantum mechanics that seemed more easily

reconcilable with materialism than Bohr's position. All this put Rosenfeld in an uncomfortable position. He was Bohr's closest aide for philosophical subjects. Being a Marxist, he was an obvious target of the materialist critique of complementarity. Rosenfeld responded with the paper quoted above and attacked both David Bohm and the Soviet physicists claiming that complementarity was compatible with dialectical materialism and a direct consequence of the experience.

Born could not accept Rosenfeld's claims: "Our attitudes to some of the fundamental questions of physics are very similar—though not identical. The main difference is that you claim complementarity has something to do with 'dialectical materialism.' This I most emphatically deny."<sup>5</sup> The manuscript presents Born's critique of the Hegelian-Marxist concept of dialectics: He accuses it of ambiguity between epistemology and ontology, and he charges that neither use is warranted by the facts. To prove his point, Born considers three possible uses of dialectics: as a principle of logic, as a principle of scientific methodology, and as an ontological principle "governing the behaviour of the actual world" (p. 2).

Especially instructive for Born's position on the interpretation debate is the second and most extensive section, Born's discussion of scientific methodology. Right at the beginning of the section, Born aligns himself with Einstein's critique of positivism and denies that complementarity, like any high-level theoretical concept, is a direct consequence of experience, as he had already told Rosenfeld in a previous letter: "If the situation is carefully analysed a lot of non-empirical intermediate steps are easily discovered which one could call metaphysical."<sup>6</sup> Nevertheless, he wants to maintain that the concept of complementarity is a precise theoretical term warranted by the empirical facts of wave-particle duality, whereas 'dialectics' is a vague notion that misrepresents both physics and its history. Subsuming complementarity under dialectics "means a derogation of the efforts of several generations of physicists and in particular of Bohr's genius." (p. 6)

It might seem somewhat surprising that Born invokes Einstein as arbiter of scientific methodology, given that the two had long disagreed on the merits of quantum mechanics, which Einstein never accepted as a fundamental theory of nature. But this hint reveals a striking symmetry in the intellectual position of Rosenfeld and Born: Just as Rosenfeld was trying to defend complementarity as a manifestation of dialectical materialism to his fellow Marxists, so Born had long tried to defend quantum mechanics to Einstein as the logical continuation of the critical empiricism

of Einstein's theories of relativity. The—at times rather heated—exchanges between Einstein and Born and Born's reflections on them are presented in Born's edition of their correspondence.<sup>7</sup> Born's comments there show how much he admired Einstein's work and how much he was hurt by Einstein's refusal to accept quantum mechanics as a theoretical achievement equal to relativity. Therefore, it is quite significant that Born's central charge against Rosenfeld, the ambiguity of the concept of dialectics, mirrors Einstein's fundamental critique of Bohr's doctrine of complementarity:

Einstein maintained that Bohr illegitimately blurred the distinction between matters of objective fact (the values of physical quantities) and the question of our knowledge of those facts (the measurability of these values).<sup>8</sup> To Einstein, Bohr's concept of complementarity was unwarranted metaphysics, just as dialectical materialism was to Born. It is somewhat speculative, although not implausible, to assume that Born's attack on aligning complementarity with dialectics was motivated not so much by his political dislike of communism, but by his fear of this alignment with “speculative metaphysics” being grist for Einstein's mill (although posthumously).

Born never published the manuscript nor gave a public lecture about it, as far as we know. The reasons seem to be related to Born's political stance in the Cold War context. He had no sympathies toward the Soviet and Eastern social and political regimes, as he made plain to Rosenfeld:<sup>9</sup>

I have been again in East Berlin as a ‘greatly honoured guest.’ But I cannot be bribed. I measure the state of affairs not by the bigness of the motorcar put to my disposition, the splendour of the dinner parties, the pleasant houses of my colleagues etc. but by the ordinary people. And I had some opportunity to see something of their life. I have been born in Eastern Germany and spent there the first quarter of my life. It was then a flourishing country with a happy cheerful population. It is rather heart-rending to see what it is now.

However, Born did not want to raise the political tension with his criticisms of Marxism. He asked Rosenfeld not to circulate the manuscript, since he wished “to remain in good terms with the Russians and East-Germans ... until they themselves will abandon the more excessive and nonsensical Marxist-Engelist [sic] doctrines.”<sup>10</sup> Born later decided to abandon the subject completely, seeing signs of change in the socialist bloc<sup>11</sup> Although repulsed intellectually by Rosenfeld's blending of Marxism and complementarity, Born did not want to get involved in a public struggle against Marxists in Cold War times, and chose to keep the dispute with Rosenfeld private.<sup>12</sup>

---

<sup>1</sup> The authors thank Martin Jähnert and Christian Joas for helpful comments on the draft of this note, as well as Lindy Divarci for proofreading the manuscript.

<sup>2</sup> Both physicists were at the time living in the UK, the former in Edinburgh and the latter in Manchester. The typescript was found enclosed in a letter to Rosenfeld, November 14, 1955, at the Rosenfeld Papers (in the following referred to as RP), Box Correspondence particulière (1), folder 1, Niels Bohr Archive, Copenhagen. For a more extensive discussion of the content, see O. Freire, “Science, Philosophy and Politics in the Fifties – On the Max Born’s Unpublished Paper Entitled ‘Dialectical Materialism and Modern Physics’,” *Historia Scientiarum*, 10 (3), 248-254 (2001).

<sup>3</sup> L. Rosenfeld, “Strife about complementarity,” *Science progress*, 163, 393–410, (1953), reprinted in Robert Cohen and John Stachel, eds., *Selected papers of Léon Rosenfeld*, Dordrecht (1979). On Rosenfeld, see A. Jacobsen, “Léon Rosenfeld’s Marxist Defense of Complementarity,” *HSPS*, 37 (Supplement), 3–34 (2007).

<sup>4</sup> See K. Camilleri, “Constructing the Myth of the Copenhagen Interpretation,” *Perspectives on Science*, 17 (1), 26-57 (2009).

<sup>5</sup> Born to Rosenfeld, October 24, 1955. RP.

<sup>6</sup> Born to Rosenfeld, January 28, 1953. RP.

<sup>7</sup> *Albert Einstein. Max Born. Briefwechsel 1916–1955*. Nymphenburger, Munich, 1969.

<sup>8</sup> See C. Lehner, “Einstein’s Realism and His Critique of Quantum Mechanics.” In: M. Janssen and C. Lehner (eds.), *The Cambridge Companion to Einstein*, Cambridge UP, Cambridge, forthcoming.

<sup>9</sup> Born to Rosenfeld, October 24, 1955. RP.

<sup>10</sup> Born to Rosenfeld, November 14, 1955. RP.

<sup>11</sup> “I have no intention to follow up this matter. Since I wrote these pages the situation has rather changed and it has happened what I always hoped, namely that the whole ‘intellectual’ system would not be accepted any more by the younger generation in the eastern countries.” Born to Rosenfeld, January 21, 1957. RP. Born presumably refers to the Hungarian revolution of 1956, in which student protests played a central role.

<sup>12</sup> Later on, Max Born also engaged in a private exchange of views about politics in Eastern Germany with the Marxist historian Friedrich Herneck. See K.-F. Wessel and M. Koch, “Lügen ist überhaupt das Kennzeichen unserer Zeit - Über einen

---

unveröffentlichten Briefwechsel zwischen Max Born und Friedrich Herneck”,  
*Berichte zur Wissenschaftsgeschichte*, 18, 27–33 (1995).