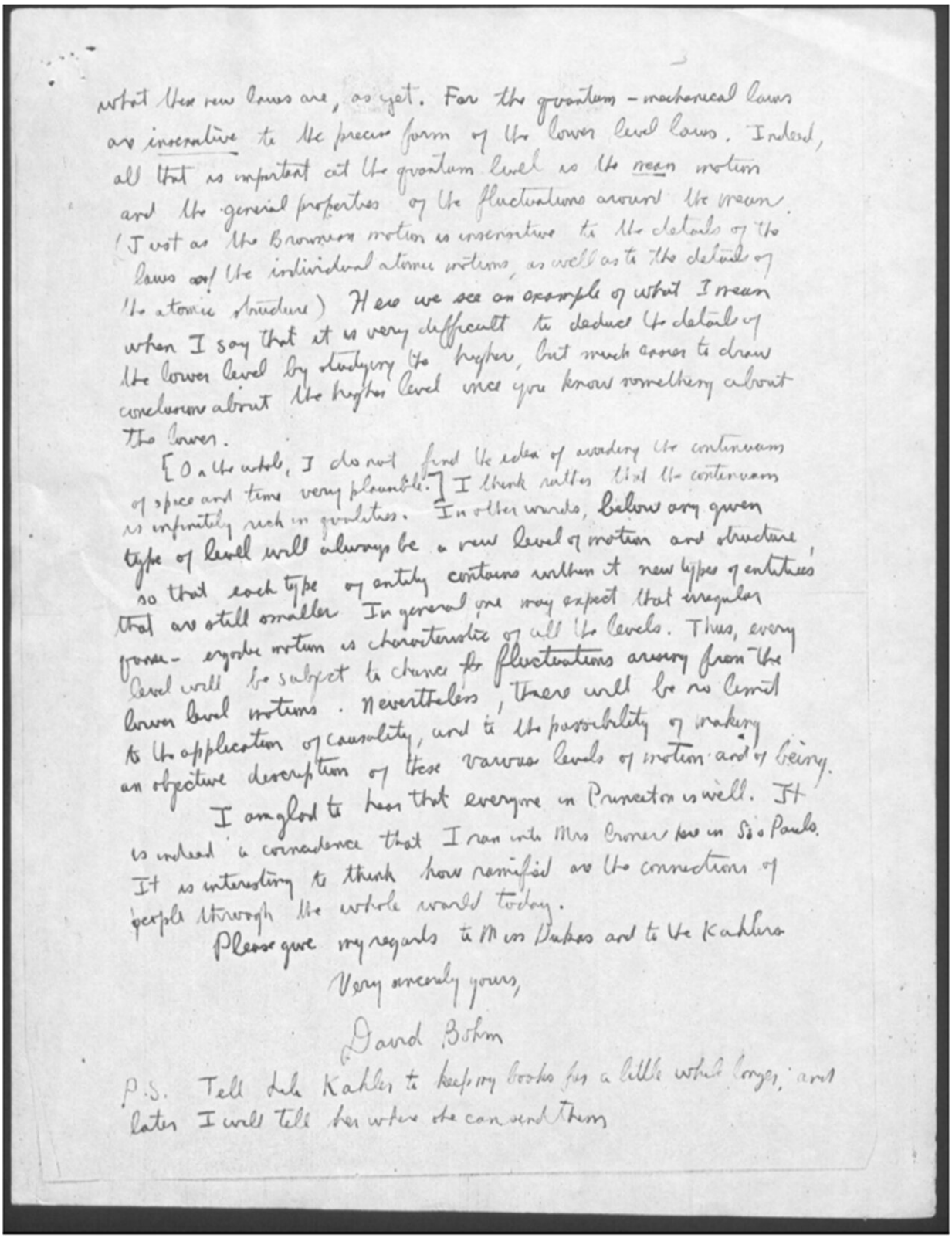
Acquitting a physicist accused of 'obscurantism'

November 8 2023, by Rachel Berkowitz



what these new laws are, as yet. For the quantum-mechanical laws are *inessential* to the precise form of the lower level laws. Indeed, all that is important at the quantum level is the mean motion and the general properties of the fluctuations around the mean. (Just as the Brownian motion is inessential to the details of the laws of the individual atomic motions, as well as to the details of the atomic structure) Here we see an example of what I mean when I say that it is very difficult to deduce the details of the lower level by studying the higher, but much easier to draw conclusions about the higher level once you know something about the lower.

[On the whole, I do not find the idea of assuming the continuum of space and time very plausible.] I think rather that the continuum is infinitely rich in potentialities. In other words, below any given type of level will always be a new level of motion and structure, so that each type of entity contains within it new types of entities that are still smaller. In general one may expect that irregular forms-ergodic motion is characteristic of all the levels. Thus, every level will be subject to chance fluctuations arising from the lower level motions. Nevertheless, there will be no Conflict to the application of causality, and to the possibility of making an objective description of these various levels of motion and of being.

I am glad to hear that everyone in Princeton is well. It is indeed a coincidence that I ran into Mrs Brower here in São Paulo. It is interesting to think how ramified are the connections of people throughout the whole world today.

Please give my regards to Miss Dukas and to the Kahlers

Very sincerely yours,

David Bohm

P.S. Tell Lola Kahler to keep my books for a little while longer, and later I will tell her where she can send them

This is the third page of Bohm's letter to Einstein dated 14 November 1954

containing a paragraph on the infinite structure of reality. Courtesy of the Birkbeck College Archives. Credit: The European Physical Journal H (2023). DOI: 10.1140/epjh/s13129-023-00062-3

American-born British theoretical physicist David Bohm made many significant contributions to physics. But he's most famous for challenging convention and interpreting quantum mechanics in terms of nonlocal or hidden variables. Several eminent contemporaries accused him of defending outdated ideals based in deterministic physics, rather than embracing his contemporaries' non-deterministic views.

In a study published in *The European Physical Journal H*, Andrea Oldofredi, of the University of Lisbon, Portugal, revisits Bohm's private correspondences and academic works to reconstruct the evolution of his philosophical trajectory. The analysis indicates that bias against Bohm was mostly not based on scientific grounds, and instead underlines the originality of his ontological reflections.

Bohm presented his famous pilot wave theory in 1952. In addition to a wave function, that he considered a new kind of physical field, each particle has a definite location, with position changes governed by the quantum potential. These changes occur in a way that depends on what all other particles are doing. Wolfgang Pauli called it a cheap solution; and Leon Rosenfeld called it a positively harmful "new obscurantism."

From texts of correspondences between these two physicists along with Bohm's published works, Oldofredi points out that Bohm was clear about wanting to avoid the philosophies attached to classical physics in the first place: the very ones he was accused of embracing. Indeed, his contemporaries had available the necessary material not to consider him a reactionary scientist. Rather, many had not fully read or understood his

theory and agreed to ignore him on political grounds. Rosenfeld even actively discouraged dissemination and publication of his work.

Oldofredi concludes that rather than being dogmatic, Bohm's perspective can be characterized as a form of internal realism, where physical theories and their laws are not universally valid but describe correctly only limited portions of reality, which is infinitely rich and complex. His work should be embraced in discussions about scientific realism and pluralism.

More information: Andrea Oldofredi, Orthodox or dissident? The evolution of Bohm's ontological reflections in the 1950s, *The European Physical Journal H* (2023). DOI: 10.1140/epjh/s13129-023-00062-3

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