Boscovich’s Theory and its Relation to Faraday’s Researches: An Analytic Approach

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Introduction and Summary

In perusing the results of recent scholarship in the history of nineteenth century physical science, one confronts, with increasing frequency, the assumption that a profound connection existed between the general theory of ROGER JOSEPH BOSCOVICH and the experimental researches of MICHAEL FARADAY. The germinal position for this provocative point of view is clearly that of Professor L. PEARCE WILLIAMS; to wit: “An interesting study could and should be made of the penetration of Boscovich’s ideas into nineteenth-century science. I have tried to show that they are fundamental to an understanding of Faraday’s development.”

Professor WILLIAMS had introduced his novel view in earlier publications and has since used it as a unifying theme in his recent biography of FARADAY. In this most recent work one reads that “Although he did not publicly announce his commitment to the [Boscovich] theory of point atoms until 1844, Faraday worked within this framework from his earliest productive years.” (pp. 77—78)

On page 130 WILLIAMS is somewhat more specific. “The theory of point atoms was utilized in his electrical researches from 1831 on,... so that he must have become a convert sometime between his last lecture to the City Philosophical Society in 1819 [when, according to WILLIAMS (p. 88) “... Faraday preferred a kind of hybrid theory ...”] and 1831. It is entirely possible that the theory simply grew on him as he delved more deeply into the complexities of nature. If, however, a precise date can be suggested, the spring of 1823 would appear to have much to recommend it.”

The persistence and profundity of FARADAY’S commitment to BOSCOVICH, as postulated by Professor WILLIAMS, may be indicated by the following passages. “The reasoning here [relative to electrochemical decomposition investigations in 1832—1833] should be carefully noted for it reveals clearly Faraday’s continuing

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use of the hypothesis of point atoms. ... to Faraday the addition and subtraction of the forces represented by Boscovich's curve was a necessary concomitant of all chemical action." (p. 245) Relative to FARADAY's researches into specific inductive capacity, WILLIAMS claims that "Such specificity of action was insisted upon only by the theory of point atoms and from this theory Faraday had deduced the existence of specific inductive capacity." (p. 292) Furthermore, "The effect also seemed [to FARADAY] inexplicable on any other but Boscovichean terms." (p. 294)

The duration of FARADAY's presumed commitment may be seen from the following excerpts, also taken from Professor WILLIAMS' biography. In relating the 1845 discovery of what is now termed the FARADAY Effect, WILLIAMS insinuates a dualism the subsequent reduction of which also serves to terminate conveniently FARADAY's Boscovicheanism. "Faraday, therefore, now had two types of polarity to work with; one was associated with the particles of matter and followed directly [we are told] from the theory of point atoms. ... The other involved the line of force. At this point, Faraday did not (nor could he) dissociate the line of force from matter but such a separation was later to become necessary." (p. 391) After considering FARADAY's investigations into diamagnetism and magnecrystallic force, WILLIAMS poses the following question for FARADAY. "Might not the line of force be the key to the unity of force phenomena for which he had so long been seeking?" (p. 435) If so, the particles of matter and with them the theory of point atoms will, of course, cease to be of interest. Professor WILLIAMS' answer appears on his next page. "Again, the essential relationship appeared to be between the lines of force and the mass of the diamagnetic body as a whole. This relationship, Faraday realized dimly in 1845, was one of position and not necessarily one of mutual attractions and repulsions. The discovery of magnecrystallic force in 1848 served to reinforce Faraday's growing suspicion of central forces and their importance." And none too soon for, as appears on page 445, FARADAY was about to speak out his commitments. "The character of his thought also changed about this time. Before 1850 he had rather carefully hidden his theoretical ideas from the scientific world, using them to guide him from discovery to discovery. ... The decade of the 1850's, rather, was to be spent in the exposition and defence of his theories."

It is clear that Professor WILLIAMS is committed to his thesis of a twenty-five year long, profound, even determinative, influence of BOSCOVICH's theory upon FARADAY's researches. Professor WILLIAMS does not present the basis for his thesis from the vast literature of the period, published and unpublished, which he has studied. Nor indeed could he. As he has noted, FARADAY first made explicit reference to BOSCOVICH and his theory in 1844. As will be shown, this initial mention, as well as FARADAY's second and final reference to BOSCOVICH (in 1846), falls far short of constituting an announcement of commitment on his part.

The basis for Professor WILLIAMS' commitment is not far to seek. It consists in his inability to make sense of FARADAY's investigations, save in terms of his own conception of BOSCOVICH's theory. Professor WILLIAMS' method involves the derivation, ultimately grounded in "Boscovichean atomism", of extremely plausible theoretical arguments and their experimental implications. By conjecture these derivations and arguments are presented as having been FARADAY's