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Magnetism in matter before the discovery of quantum spin: Bohr's less well-known contribution to the transition from classical to quantum physics. JEAN-FRANCOIS VAN HUELE, Brigham Young University — How does one explain magnetic effects in matter when one views matter as a collection of classical charges in motion? The answer is: not at all! This is one of the points that Niels Bohr made in his doctoral dissertation in 1911, two years before addressing the issue of the stability of the hydrogen atom. The result, later rediscovered by H.J.van Leeuwen was amplified and formalized in Van Vleck's 1932 text on electric and magnetic susceptibilities and it is currently known as the Bohr-van Leeuwen theorem. We will review Bohr's two derivations, one statistical and one based on the motion of individual electrons. We will then propose reasons why this result, unlike that on the stability of hydrogen, did not lead to a major development in quantum theory but, instead, had to wait until after the introduction of spin and exchange forces in quantum mechanics to become generally known.

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