



# Kuhn Losses Regained: Van Vleck from Spectra to Susceptibilities

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We follow the trajectory of John H. Van Vleck from his 1926 Bulletin for the National Research Council (NRC) on the old quantum theory to his 1932 book, *The Theory of Electric and Magnetic Susceptibilities*. We highlight the continuity of formalism and technique in the transition from dealing with spectra in the old quantum theory to dealing with susceptibilities in the new quantum mechanics. Our main focus is on the checkered history of a numerical factor in the Langevin-Debye formula for the electric susceptibility of gases. Classical theory predicts that this factor is equal to  $1/3$ . The old quantum theory predicted values up to 14 times higher. Van Vleck showed that quantum mechanics does away with this "wonderful nonsense" (as Van Vleck called it) and restores the classical value  $1/3$ . The Langevin-Debye formula thus provides an instructive example of a Kuhn loss in one paradigm shift that was regained in the next. In accordance with Kuhn's expectation that textbooks sweep Kuhn losses under the rug, Van Vleck did not mention this particular Kuhn loss anywhere in his 1926 NRC Bulletin (though he prominently did flag a Kuhn loss in dispersion theory that had recently been regained). Contrary to Kuhn's expectations, however, he put the regained Kuhn loss in susceptibility theory to good pedagogical use in his 1932 book. Kuhn claimed that textbooks must suppress, truncate, and/or distort the prehistory of their subject matter if they are to inculcate the exemplars of the new paradigm in their readers. This claim is not borne out in this case. Because of the continuity of formalism and technique that we draw attention to that Van Vleck could achieve his pedagogical objectives in his 1932 book even though he devoted about a third of it to the treatment of susceptibilities in classical theory and the old quantum theory in a way that matches the historical record reasonably well.

Comments: This paper will be published in: Massimiliano Badino and Jaume Navarro (eds.), *Research and Pedagogy: A History of Early Quantum Physics through its Textbooks*, Berlin: Edition Open Access, forthcoming. This volume is part of a larger project on the history of quantum physics of the Max Planck Institute for History of Science in Berlin

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