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Radiation from Accelerating Electric Charges: The Third Derivative of Position EDWARD BUTTERWORTH, Texas A&M University-Kingsville — While some textbooks appear to suggest that acceleration of an electric charge is both a necessary and sufficient cause for the generation of electromagnetic radiation, the question has in fact had an intricate and involved history. In particular, the acceleration of a charge in hyperbolic motion, the behavior of a charge supported against a gravitational force (and its implications for the Equivalence Principle), and a charge accelerated by a workless constraint have been the subject of repeated investigation. The present paper examines specifically the manner in which the third derivative of position enters into the equations of motion, and the implications this has for the emission of radiation. Plass opens his review article with the statement that "A fundamental property of all charged particles is that electromagnetic energy is radiated whenever they are accelerated" (Plass 1961; emphasis mine). His treatment of the equations of motion, however, emphasizes the importance of the occurrence of the third derivative of position therein, present in linear motion only when the rate of acceleration is increasing or decreasing. There appears to be general agreement that the presence of a nonzero third derivative indicates that this charge is radiating; but does its absence preclude radiation? This question leads back to the issues of charges accelerated by a uniform gravitational field. We will examine the equations of motion as presented in Fulton & Rohrlich (1960), Plass (1961), Barut (1964), Teitelboim (1970) and Mo & Papas (1971) in the light of more recent literature in an attempt to clarify this question.

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