## On Feynman's Proof of the Maxwell Equations\*

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Dyson<sup>†</sup> has presented a derivation of the free space Maxwell Equations and the Lorentz force starting from (1) Newton's Second Law and (2,3) the commutation relations between  $x_i, x_j$  and  $\dot{x}_k$ . He attributes the proof to Feynman. Why it "works" is puzzling. Our finite and discrete reconciliation between relativity and quantum mechanics<sup>‡</sup> offers a less problematic logical chain. Define mass ratios using deBroglie wave interference in a theory which necessarily entails the commutation relations (2,3). We show that this route implies Newton's Third Law. Following Mach, (1) then becomes a *definition* of force, and given this the Lorentz Force (4) becomes a *definition* of the electromagnetic fields. Our use of the relativistic Zitterbewegung with step length h/mc consistently introduces the limiting velocity c into the calculation, and removes a puzzle about dimensions from Feynman's result. By adopting the Wheeler-Feynman point of view that the energy and momenta of massless quanta are defined by the sources and sinks, we claim that we can derive the inhomogeneous Maxwell equations from quantum particle physics which Feynman was unable to do - and hence establish classical electromagnetic theory as a well defined continuum approximation to our fully discrete relativistic quantum mechanics.<sup>§</sup> Exploration of quantum gravity along these lines appears to be promising.

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