Summary: The Special Theory of Relativity and the Theory of the Electron have had an interesting history together. Originally the electron was studied in a non-relativistic context and this opened up the interesting possibility that lead to the conclusion that the mass of the electron could be thought of entirely in electromagnetic terms without introducing inertial considerations. However the application of Special Relativity lead to several problems, both for an extended electron and the point electron. These inconsistencies have, contrary to popular belief not been resolved satisfactorily to date, even within the context of Quantum Theory. Thus they are not merely of historical interest. Nevertheless these and subsequent studies bring out the interesting result that Special Relativity (and the theory of the electron) breaks down within the Compton scale or when the Compton scale is not neglected. This again runs contrary to an uncritical notion that Special Relativity is valid for point particles. Furthermore, it is pointed out that experiments have been recently suggested to test these ideas. These considerations lead to a characterization of the Planck constant in classical terms.

MSC:

83A05 Special relativity
83C10 Equations of motion in general relativity and gravitational theory
83C22 Einstein-Maxwell equations

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