The Equivalence Principle in Reissner-Nordström geometry

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In the first decade of the twentieth century, Albert Einstein, in one of his seminal set of papers, put forth what became known as the Special Theory of Relativity. This theory, besides the prediction of new physical phenomena, also represented a new framework in which most of modern physics is based upon. Despite this, Special Relativity does not describe the gravitational interaction in a suitable manner. This fact led Albert Einstein to pursuit a generalization of Newton's law of universal gravitation. This new theory became known as General Relativity and it claims that the gravitation interaction is, in fact, the result of the non-zero curvature of the spacetime. Starting from Special Relativity, one of the key elements in the development of General Relativity is the Equivalence Principle. This principle states that a freely falling reference frame in a uniform gravitational field is equivalent to a reference frame in uniform accelerated motion in space with no gravitational field. In this work, we analyze the spacetime surrounding a non-rotating charged mass known as Reissner-Nordström geometry and demonstrate, through a coordinate transformation, that this geometry locally manifests the Principle of Equivalence.