Abstract Submitted
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Self-force from a conical singularity without renormalization MICHAEL LAHAYE, ERIC POISSON, Univ of Guelph — We develop an approach to calculate the self-force on a charged particle held in place in a curved spacetime, in which the particle is attached to a massless string and the force is measured by the string's tension. The calculation is based on the Weyl class of static and axially symmetric spacetimes, and the presence of the string is manifested by a conical singularity; the tension is proportional to the angular deficit. A remarkable and appealing aspect of this approach is that the calculation of the self-force requires no renormalization of the particle's field. This is in contract with traditional methods, which incorporate a careful and elaborate subtraction of the singular part of the field. We implement the approach in a number of different situations. First, we examine the case of an electric charge in Schwarzschild spacetime, and recover the classic Smith-Will force. Second, we turn to the case of electric and magnetic dipoles in Schwarzschild spacetime, and correct expressions for the self-force previously obtained. Third, we replace the electric charge by a scalar charge, and recover Wiseman's no-force result. And fourth, we calculate the force exerted on extended bodies such as Schwarzschild black holes and Janis-Newman-Winicour objects.

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