Abstract Submitted
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On the validity of the paraxial approximation for electron acceleration with radially polarized laser beams[1] VINCENT MARCEAU, Universite Laval, Quebec, Canada, CHARLES VARIN, Universite d'Ottawa, Ontario, Canada, MICHEL PICHÉ, Universite Laval, Quebec, Canada — Radially polarized laser beams possess unique properties that make them of great interest for many innovative applications. In particular, they can be used as driver beams for the acceleration of electrons in vacuum. To model electron acceleration with radially polarized laser beams, it is customary to work in the framework of paraxial wave optics. In other words, the paraxial approximation is made to obtain the lowest-order radially polarized fields, which are used to simulate the trajectory of electrons according to the Lorentz force equation. In this contribution, we question the validity of the paraxial approximation in the above mentioned context. To this end, we use an exact solution to Helmholtz equation as well as its paraxial counterpart, which consists of the lowest-order fields. In a parameter regime where the paraxial approximation was previously considered valid in the literature, we point out significant differences between the results obtained with the exact and the paraxial solutions. The origin of these discrepancies is analyzed with the help of a perturbation series expansion. More specifically, we highlight the important role played by the first nonparaxial corrections to the field components.

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