Plane Wave Backgrounds in the Worldline Formalism

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Plane-wave backgrounds play a special role in strong-field QED as examples of a non-trivial field configuration that remains simple enough to be treated analytically whilst still implying rich physical consequences.

Although great progress has been made applying standard field theory techniques to QED in-plane wave backgrounds, the calculations tend to be quite long and complicated. Yet, both in a vacuum and in constant backgrounds, the first quantised, string-inspired "Worldline Approach" to field theory has a long history of yielding substantial simplifications and calculational efficiency.

I will present a new, general approach to incorporating plane wave backgrounds into the Worldline Formalism that extends initial work using a semi-classical approach by other attendees of this conference. The method uses resummation techniques to take the background into account non-perturbatively and yields "Master Formulae" for the effective action, the particle propagator and scattering amplitudes in the background. It is hoped that this may offer an alternative tool to studying QED in-plane waves that may streamline otherwise complex calculations.