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Gravitational wave lensing in wave-optics: a new approach including polarization effects

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An intriguing aspect of gravitational wave lensing is the emergence wave-effects: interference and diffraction patterns in the waveforms due to finite size effects, occurring when the wave's wavelength is comparable to the Schwarzschild radius of the lens.
These phenomena are particularly interesting because they induce frequency dependent modifications in the waveforms, allowing for a better lens'parameter estimation, especially if the lensing event has an electromagnetic counterpart in the opposite optical regime.
Despite the promising potential of wave-optics effects, our current theoretical tools, based on the diffraction integral, rely on two main assumptions that limit their effectiveness: the eikonal and paraxial approximations on one hand, and the neglect of spin effects on the other.
In this talk I will present our new formalism, based on the established proper time technique, illustrating its robustness as the generalization of the existing framework going beyond all of the limitations mentioned.

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