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Extended source effect with thin light bundles

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Geometric optics limit is considered to be a good-enough approximation for the calculation of distances and image distortions in curved spacetime. It is usually assumed that spherical waves are emitted from a point source and we observe a section of the wavefront. In the geometric optics limit, this section is represented by a thin bundle of rays. Accordingly, the intensity profile on the transverse, observational screen is homogeneous. In this talk, we outline the analogies between the paraxial ray optics of the Newtonian theory and the thin bundles in general relativity. We then propose a method adapted from the paraxial wave optics of the Newtonian theory in order to study the extended source effect. The idea is to use phase space methods and symplectic symmetries to superpose two bundles initiated from an extended source. We explore the possibility of obtaining inhomogeneous intensity profiles on the transverse plane associated with the fundamental Gaussian mode. We observe that their form is preserved throughout the propagation in curved spacetime on account of the symplectic symmetries of the phase space. Finally, we show that the caustics can be avoided with this method.

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