Birefringence of light in RW cosmologies

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The standard expression of cosmological redshift hinges on the fact that light travels on null geodesics. We explore the theoretical consequences of the admission of spin in this classical context, and plan to highlight, in particular, the offset of such photonic worldlines from plain null geodesics (birefringence).
To this end, the Mathisson-Papapetrou-Dixon equations are derived by appealing to the principle of general covariance. Upon introducing a specific equation of state, we render this system fully deterministic, and recover the overlooked Souriau-Saturnini equations for massless spinning particles in GR. This approach is moreover shown to be fully coherent with another one starting with the (prequantizable) homogeneous symplectic spaces of the Poincaré group, justifying the choice of the above equation of state.
Specialization to the case of RW backgrounds yields a system of nine coupled ordinary differential equations which we greatly simplify using the Noether quantities associated with the RW isometries. We ultimately end up with a non-autonomous system of three differential equations for the trajectory of spinning photons in comoving coordinates whose solutions remain to be worked out.
Numerical integration of the latter system together with the search of perturbative solutions will be reviewed in a companion talk by T. Schücker. The question of the eventual observation of this tiny offset (of the order of magnitude of the emitted wavelength) may be proposed to experimentalists.