Time and frequency transfers in optical spacetime

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Abstract

Solving the null geodesic equation of a ray of light is a difficult task even considering a stationary spacetime. The problem becomes even more difficult if the signal propagates through a flowing optical medium. Indeed, because of the interaction between light and matter the signal does not follow a geodesic path anymore. However, having a clear description of the time and frequency transfers in this particular situation is of a prime importance in Astronomy. As a matter of fact, satellite and lunar laser ranging, very long baseline interferometry, global navigation satellite systems, or even radio occultations experiments are few examples of techniques involving light propagation in flowing mediums. By applying the time transfer function to optical spacetime, I will show that the time and frequency transfers can be determined iteratively up to any order of approximation for a light ray propagating in a neutral medium. I will present some applications in the context of radio occultations experiments, and discuss possible future application to the modeling of tropospheric delays.

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