

A New Approach to Post-Newtonian Gravity

Tuesday 4 July 2023 15:40 (20 minutes)

I will discuss the covariant non-relativistic expansion of general relativity in powers of $1/c$, using as an example the case of a compact perfect fluid matter source that can radiate gravitational waves. This is a well-studied scenario in the literature that is conventionally done by using the approach developed, amongst others, by Blanchet and Damour. This approach uses the harmonic gauge and a rather strong set of boundary conditions. We are able to improve upon these points by using the covariant $1/c$ expansion of GR in combination with a vacuum multipolar post-Minkowskian expansion far away from the source. This allows us to do the post-Newtonian expansion in any gauge and to investigating the consequences of working with the weakest possible boundary condition that ensures that there is no incoming radiation at past null infinity. Making use of this, I will consider a Coulomb-like gauge and try to make the case that it is an interesting alternative to the usual harmonic gauge. Last but not least, this work paves the way to consider $1/c$ expansions around non-flat backgrounds. It is well-known that the covariant $1/c$ expansion works outside the context of a weak field expansion around flat space and so we would like to see if this can be used as a new approximation scheme in studying radiating sources.

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