

## **Analytical approaches for rapid prediction of gravitational waveforms for relativistic binary systems**

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Most registrations of gravitational waves are made using the matched-filter method, which compares data from detectors (LIGO, VIRGO, KAGRA) with pre-modelled signals (templates). The template banks used by LIGO are based on the post-Newtonian formalism for the inspiral phase and on numerical relativity calculations for the merger and ringdown phases. However, there is a need in faster analytical templates that would effectively identify gravitational wave signals from binary systems at the earliest stages of their evolution.

The report discusses the possibilities of a fully analytical calculation of gravitational waveforms using Maxima and Mathematica computer algebra systems.

A fast method for obtaining fully analytical approximations for the forms of gravitational waves is proposed. The result of the work is a fully analytical formula that allows for the detection of merging binary relativistic systems at the earliest stages.

The obtained approximation formula is compared with the numerical calculation, the formula's accuracy and limits of applicability are revealed.

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