Contribution ID: **8** Type: **not specified**

# Primordial black holes and induced gravitational waves in non-standard cosmologies

Project sketch:
Primordial black holes (PBHs) are hypothetical dark matter candidates that could have formed in the early Universe by mechanisms other than the usual stellar collapse, in particular via gravitational collapse induced by large density fluctuations produced during inflation. The fact that PBH formation requires a large scalar power spectrum leads to an enhancement of the second-order tensor modes of the metric, which are sourced by terms quadratic in first-order scalars in Einstein's equations. If these PBHs form during a radiation-dominated era and comprise the entirety of the observed dark matter, then this stochastic gravitational wave background could potentially be observed by future space-based interferometers such as LISA and DECIGO. Since the abundance and mass of the black holes, as well as the amplitude of the density fluctuations required for collapse to be induced, are known to depend on the equation of state of the Universe at the time of collapse, it is not clear whether the above conclusions remain true if the PBHs do not form during a radiation era. These PBH formation scenarios can be realized, for instance, by varying the equation of state parameter during reheating after inflation. Moreover, the signal is also expected to change depending on how abrupt the transition between reheating and the radiation era is. The focus of the project is to explore these possibilities and compute the stochastic gravitational wave signal produced in each scenario.

Rough fraction of physics/software work that is expected:
A working knowledge of how to solve ordinary differential equations using Green's functions is expected, as well as basic Mathematica coding skills. Some basic knowledge about GR (in particular gravitational waves) would be useful, but not required.

## Field

B5: Theory of Elementary Particles

## DESY Place

Hamburg

## DESY Division

FH

## DESY Group

Theory

## Special Qualifications:

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