# Sensitivity of Pulsar Timing Arrays towards Polarizations of Gravitational Waves

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We extend our investigation[1] on the sensitivity towards polarizations of gravitational waves of current and future experiments to pulsar timing arrays (PTA). Up to now PTA's did not yet manage to become sensitive enough to measure gravitational waves, but this will hopefully change in near future.

The focus of our upcoming paper lies on giving a complete derivation[2, 3] of the redshift formula for all six possible polarizations including modifications to general relativity[4]. We will discuss its mathematical properties and their physical consequences. We find a correction term, which depending on the pulsar frequncy and gravitational wave frequency range one could to measure, becomes relevant. From our mathematical discussion we conclude, that the redshift has to be split differently into polarization part (pattern functions) and interference part[5–8], to avoid discontinuities and singularities in the pattern functions. Those pattern functions are in agreement with the formula one uses for interferometers[9] for a single detector arm.

We present the sensitivity towards polarizations under the assumption that a maximum likelyhood method on filtered (matched filtering) and cross correlated signals is used, to distinguish the polarizations for a gravitational wave background and the case of point sources.

As an example we present an order of magnitude estimate of the sensity of the pulsar set which NANOGrav[10] used for their 11 year data. We compare the sensitivity formulas we derived to the ones for interferometers and investigate the scaling with the number of pulsars, total observation time and the average noise.

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