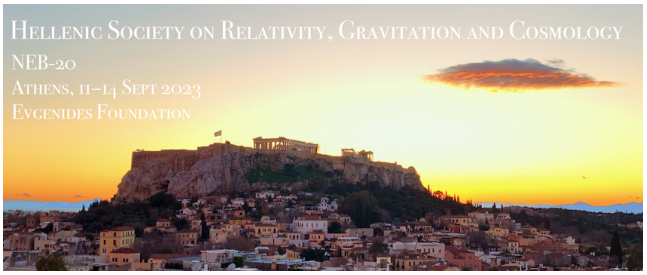

Contribution ID: **101** Type: **not specified**

Heavy-tailed likelihoods for robustness against data outliers: Applications to the analysis of gravitational wave data

In recent years, the field of Gravitational Wave Astronomy has flourished. With the advent of more sophisticated ground-based detectors and space-based observatories, it is anticipated that Gravitational Wave events will be detected at a much higher rate in the near future. One of the future data analysis challenges is performing robust statistical inference in the presence of detector noise transients or non-stationarities, as well as in the presence of stochastic Gravitational Wave signals of possible astrophysical \textbf{and/or cosmological} origin. The incomplete knowledge of the total noise of the observatory can \textbf{introduce challenges} in parameter estimation of detected sources. In this work, we propose a heavy-tailed, Hyperbolic likelihood, based on the Generalized Hyperbolic distribution. With the Hyperbolic likelihood we obtain a robust data analysis framework against data outliers, noise non-stationarities, and possible inaccurate modeling of the noise power spectral density. We apply this methodology to examples drawn from gravitational wave astronomy, and in particular to synthetic data sets from the planned LISA mission.

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