Abstract Submitted
for the TSS21 Meeting of
The American Physical Society

How unbiased statistical methods lead to biased scientific discoveries: A case study in the analysis of Gamma-Ray Bursts CHRISTOPHER BRYANT, JOSHUA OSBORNE, AMIR SHAHMORADI, University of Texas at Arlington — Statistical methods are frequently built upon assumptions that limit their applicability to certain problems and conditions. Failure to recognize these limitations can lead to conclusions that may be inaccurate or biased. An example of such methods is the non-parametric Efron-Petrosian test statistic used in the studies of truncated data. We argue and show how the inappropriate use of this statistical method can lead to biased conclusions when the assumptions under which the method is valid do not hold. We do so by reinvestigating the evidence recently provided by multiple independent reports on the evolution of the luminosity/energetics distribution of cosmological Long-duration Gamma-Ray Bursts (LGRBs) with redshift. We show that the effects of detection threshold have been likely significantly underestimated in the majority of previous studies. This underestimation of detection threshold leads to severely incomplete LGRB samples that exhibit strong apparent luminosity-redshift or energetics-redshift correlations. We further confirm our findings by performing extensive Monte Carlo simulations of the cosmic rates and the luminosity/energy distributions of LGRBs and their detection process.

Christopher Bryant
University of Texas at Arlington

Date submitted: 15 Mar 2021 Electronic form version 1.4