Physics 304- Problem Set 0

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1.

$$< \rho >= \left(\sum_{ij} \chi_{ij}^2 \right)^{1/2} \frac{bcT^{\beta}}{\sigma^2 \sqrt{(4\beta - 2)}} \tag{1}$$

Eq. 1 is the 'equal RMS' equation from [1]. This equation is central to my thesis as it gives the average signal to noise ratio, ρ, of the effects of the stochastic background of gravitational waves on a collection of pulsar pairs distributed throughout the sky (i.e. a pulsar timing array, PTA). Here, χ_{ij} is the Hellings-Downs coefficient of a given pulsar pair (i and j), σ is the root mean square of the intrinsic white noise, β is the spectral index of the SMBBH (super massive binary black hole) background ($\beta = 13/3$) and T is the total observing time.The equation is called the 'equal RMS' equation because it assumes all pulsars have equal RMS values, which is in some cases an appropriate approximation. For my thesis, I use this equation (among others) and python in order to produce various types of plots (ρ v Time, ρ v cadence, ρ v number of pulsars, etc) that illustrate the relationships between several parameters of a PTA.

[1] X. Siemens, J. Ellis, F. Jenet, and J. D. Romano, Classical and Quantum Gravity **30**, 224015 (2013), ISSN 1361-6382, URL http://dx.doi.org/10.1088/0264-9381/30/22/224015.