Introduction to *pyote*

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pyote is an occultation timing extraction utility program written primarily in python and distributed through PyPI (the python package repository).

1. *pyote* is designed for ease-of-use in the analysis of so-called square wave occultation light curves (defined as occultation recordings that exhibit no detectable diffraction effects). Such light curves are common with star/asteroid occultations when the star is effectively a point source and the asteroid transit speed is such that the disappearance/reappearance events occur much faster than the frame rate of the video recorder.

2. Correlated noise caused by atmospheric scintillation is frequently present in occultation observations recorded at normal video rates of 25 or 30 frames per second. *pyote* utilizes statistically rigorous calculations to properly characterize the increased uncertainty in D/R time estimates due to such correlated noise.

3. Physically realistic models are fit to the light curves with all decisions about details (complexity) of the model used made using the Akaike Information Criterion (AIC). In particular, an AIC calculation is always used to justify or reject sub-frame timing.

4. Maximum Likelihood Estimation is used throughout to determine 'best fit' of model light curves to the actual data.

The Maximum Likelihood Estimation technique requires a good estimate of the noise in an observation. For this reason, before any search for D and/or R values can begin, *pyote* needs the user to select one or more groups of data points that are clearly in the baseline of the light curve. From this selection of points, pyote estimates the needed noise parameters and measures the degree of correlation in that noise. I point this out because it is somewhat unusual and peculiar to MLE methodology.

The gui for *pyote* is designed to lead the user through the necessary steps by enabling the buttons in sequence as each task is performed. So, initially, only two principal buttons are enabled: the 'info' button that brought up this document and the 'Read light curve' button. After reading this document, open a light curve, and follow the enabled buttons.

All of the major buttons have hover text associated. To learn (or refresh) how to use the program to analyze a light curve, spending a little time 'hovering' on the buttons will pay dividends.

pyote will never change the input light curve, so experimentation is encouraged. There is a 'Start Over' button at the bottom that I encourage you to use freely.

Every step you make in the analysis is recorded in a log file. This is done because experience has shown that some light curves are touchy to analyze and it is useful to ask someone more experienced in running the program to look over your work. With the original light curve and a copy of the log file, your work can be exactly duplicated by someone else. And that log file is never deleted once it is opened for a particular light curve; it is simply appended to, so a record of each 'experiment' is thus always available.