

Photo-Reverberation Mapping

Tutorial #5

Nicolás Guerra-Varas

Professor Dragana Ilić

Tutor Isidora Jankov

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The goal of this tutorial was to learn photo-reverberation mapping (photo-RM) methods and techniques, and to get introduced to tools that simulate active galactic nuclei (AGN) light-curves and perform photo-RM. And then, to apply these methods to real observational data.

Task 1

1. Simulating Light-Curves

In the `photRM.py` module, there are functions implemented to generate artificial AGN light curves. The `lc_two_bands` function generates them and returns light-curves that are ready for photo-RM. There are two main components for these light-curves:

- The X band, which covers only the continuum. This one is generated with a Damped random walk (DRW) process [?] [?], which is able to describe optical thermal emission of the accretion disk.
- The Y band, which covers emission lines and its surrounding continuum. It is modeled as described in [?] [?]. The emission line response curve is obtained by convolving the X band light curve with a Gaussian kernel, whose mean and standard deviation depend on the radius of the broad line region. Then this is summed up with another pure continuum curve with appropriate realistic weights.

I generated three pairs of light curves with $\log L = 43, 44$ and $45 L_{\odot}$ respectively. They are 5000 data points long, have redshift $z = 0.1$, have an oscillatory signal with an amplitude of 0.14 magnitudes, noise of a factor of 0.00005, and a random time-lag. In Figures 1, 2 and 3, I plotted the first 1000 detections of these light-curves.

2. Estimating Time-Lags

3. Gapped Light-Curves

Task 2: NGC 4395

[1]

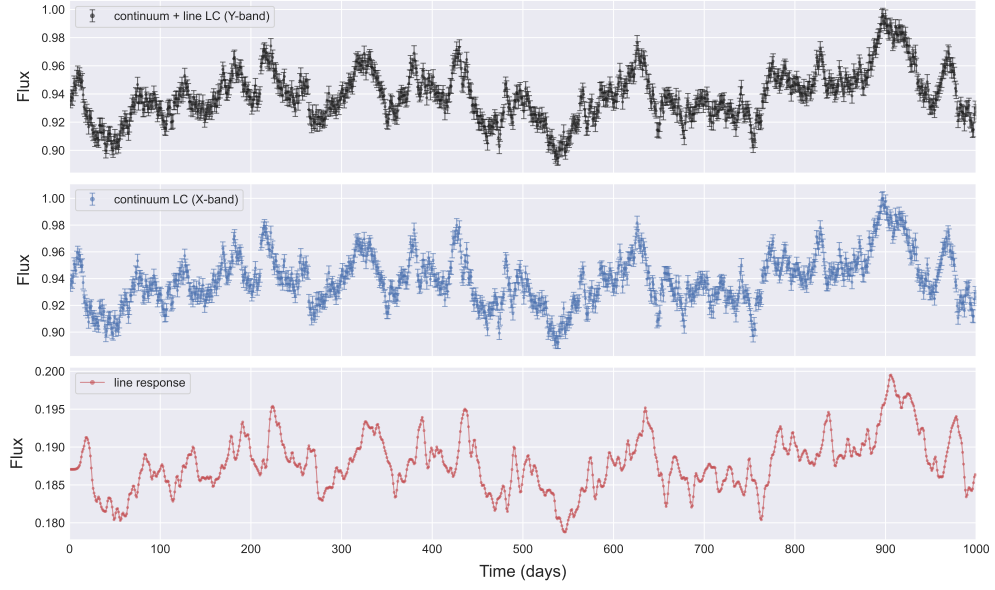


Figure 1: Artificial light-curve of an AGN with $\log L = 43L_{\odot}$

References

- [1] H. Edri, S. E. Rafter, D. Chelouche, S. Kaspi, and E. Behar, “Broadband Photometric Reverberation Mapping of NGC 4395,” , vol. 756, p. 73, Sept. 2012.

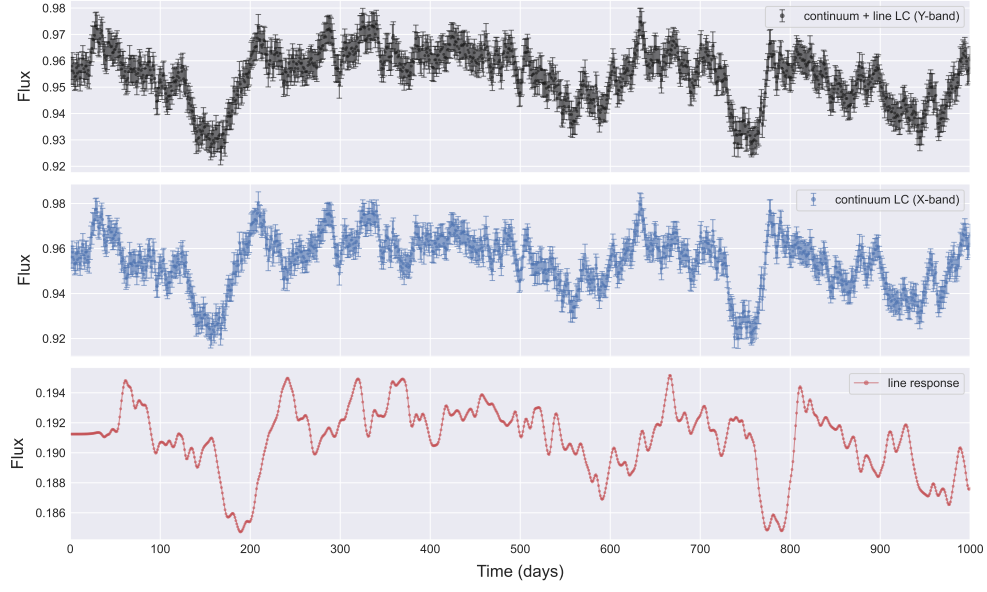


Figure 2: Artificial light-curve of an AGN with $\log L = 44L_{\odot}$.

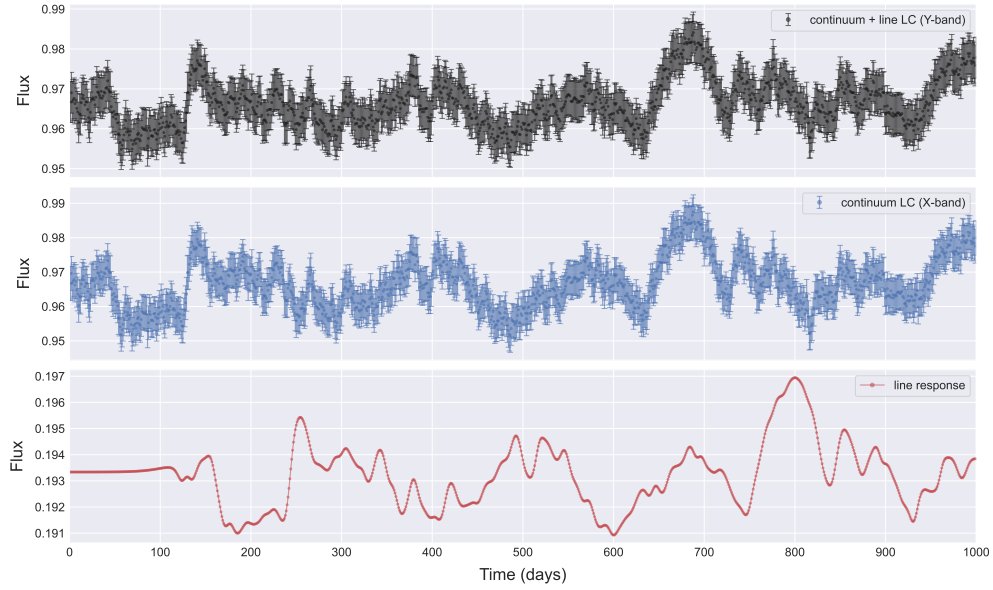


Figure 3: Artificial light-curve of an AGN with $\log L = 44L_{\odot}$.