

Table of Content

1. Introduction	1
1.1. Motivation	1
1.2. Active Galactic Nuclei	2
1.3. Observational characteristics of Blazars	5
1.4. Theoretical Models of Blazars	8
1.5. Previous studies on the characterization of blazars variability	9
2. Observations	11
2.1. OVRO dataset	11
2.2. Data cleaning and data selection	12
3. Modeling variability of blazars	17
3.1. Signal Processing	18
3.1.1. Fourier Transform	18
3.1.2. Convolution	18
3.1.3. Window functions	19
3.1.4. Power Spectral Density	19
3.1.5. Periodogram	20
3.1.6. Aliasing	20
3.1.7. Nyquist frequency	21
3.2. Simulation of light curves	21
3.2.1. Fourier Decomposition	22
3.3. Comparing observed and simulated light curves	25
3.4. Summary	26
4. The PMC-ABC algorithm	28
4.1. Credible Intervals	29
4.2. Approximate Bayesian Computation	30
4.3. Population Monte Carlo	30
4.4. PMC-ABC: The CosmoABC package	31
4.5. Fitting PSD models	34
4.5.1. Prior distributions	35
4.5.2. Distance function	38

5. Testing the PSD fitting method	41
5.1. Selecting good CosmoABC parameters	42
5.2. Simple power-law model	46
5.2.1. Power-law index β	48
5.2.2. Noise level P_{noise}	53
5.3. Broken power-law model	56
5.3.1. Low power-law index β_l	57
5.3.2. Break frequency f_{br}	64
5.4. Comparison against least-squares method	68
6. PSD fit results	70
6.1. Well-defined fit and model selection	71
7. Discussion	78
7.1. Comparison with previous results	84
7.2. Power law with and without break	87
7.3. Break-frequency analysis	91
7.4. FSRQ vs BL Lac	96
7.4.1. Broken model	96
7.4.2. Simple model	97
7.5. γ -ray sources	99
7.5.1. Broken model	99
7.5.2. Simple model	100
7.6. Redshift range	102
7.6.1. Broken model	102
7.6.2. Simple model	104
7.7. Doppler factor range	105
7.7.1. Broken model	105
7.7.2. Simple model	107
7.8. Radio characterization as γ -ray source predictor	108
8. Conclusion	114
Bibliography	116
Annex A. Mathematics and Code	120
A.1. Data cleaning by using spline functions	120
A.2. Light Curve simulation and periodogram binning	121
A.3. Bayes' Theorem	122
A.4. Parseval's Theorem over white noise	122
A.5. Generalized Linear Model in H2O	123
A.6. Doppler correction	123

Annex B. Figures	125
Annex C. Tables	137