Treating the detection of transient phenomena as a statistical problem

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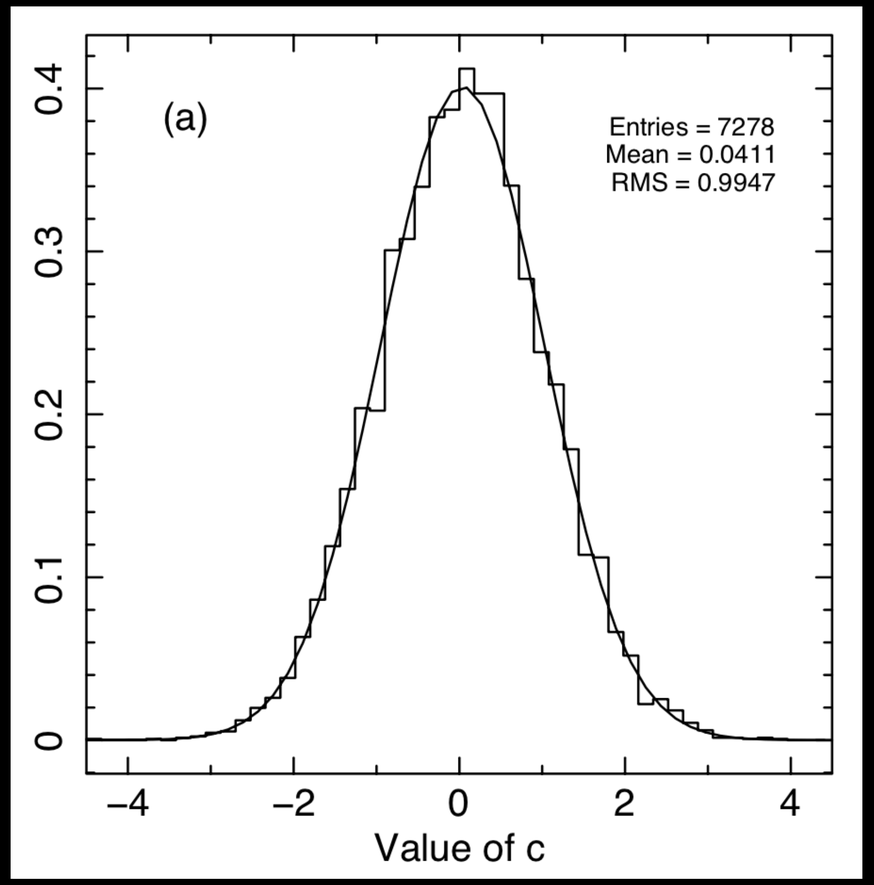
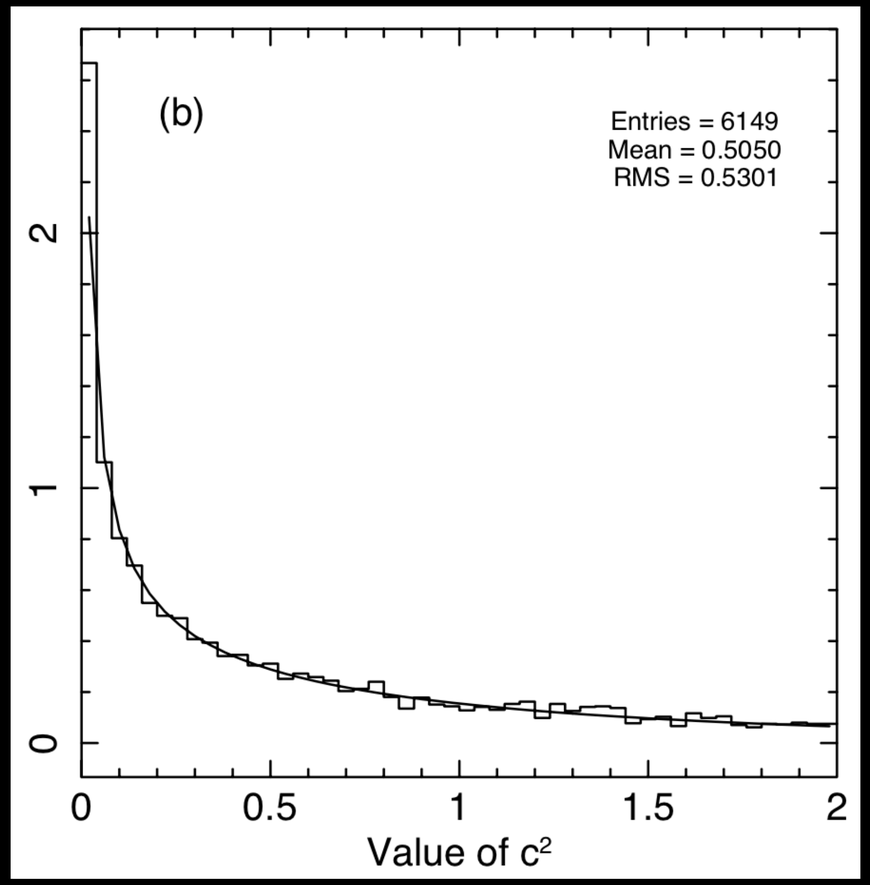
$$R^2 = 2N(C^2 + S^2)$$

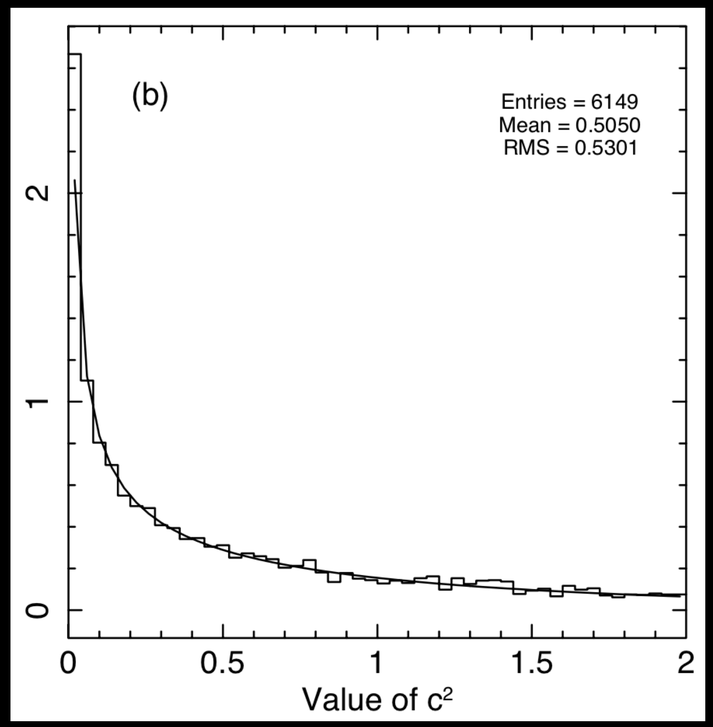
$$C = \frac{1}{N}\sum_{i=1}^{N}\cos\phi_i \quad \text{and} \quad S = \frac{1}{N}\sum_{i=1}^{N}\sin\phi_i.$$

2

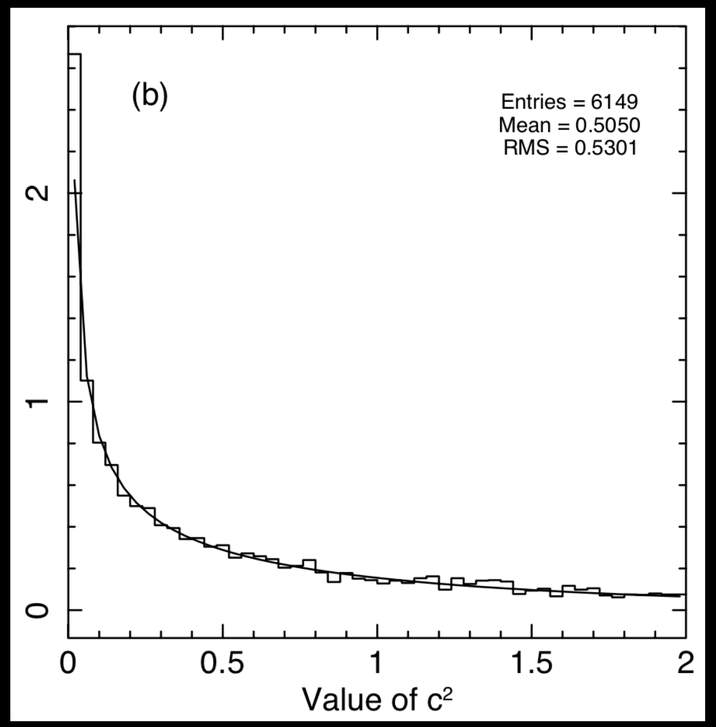

(a)
Entries = 7278
Mean = 0.0411
RMS = 0.9947
0
0.1
0.2
0.3
0.4
−4
−2
0
2
4
Value of c

=

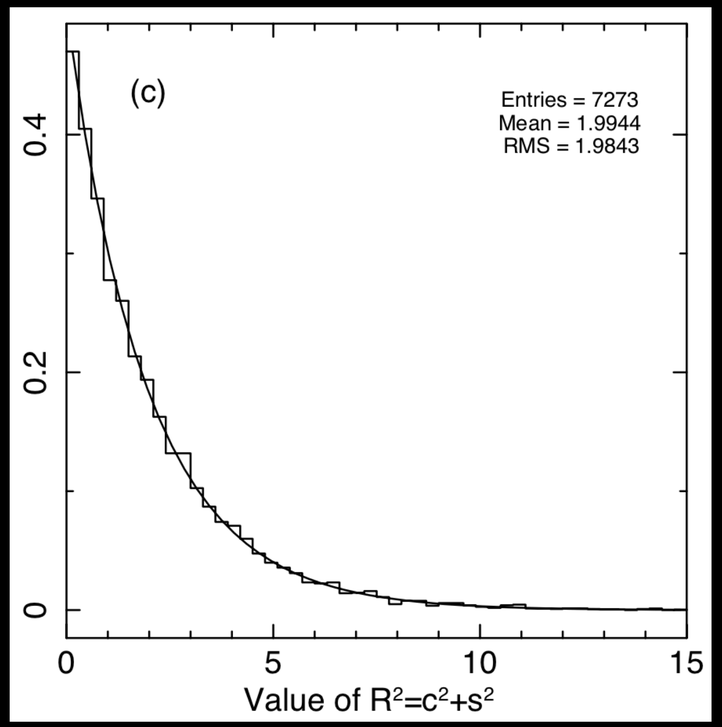

(b)
Entries = 6149
Mean = 0.5050
RMS = 0.5301
0
1
2
0
0.5
1
1.5
2
Value of c²

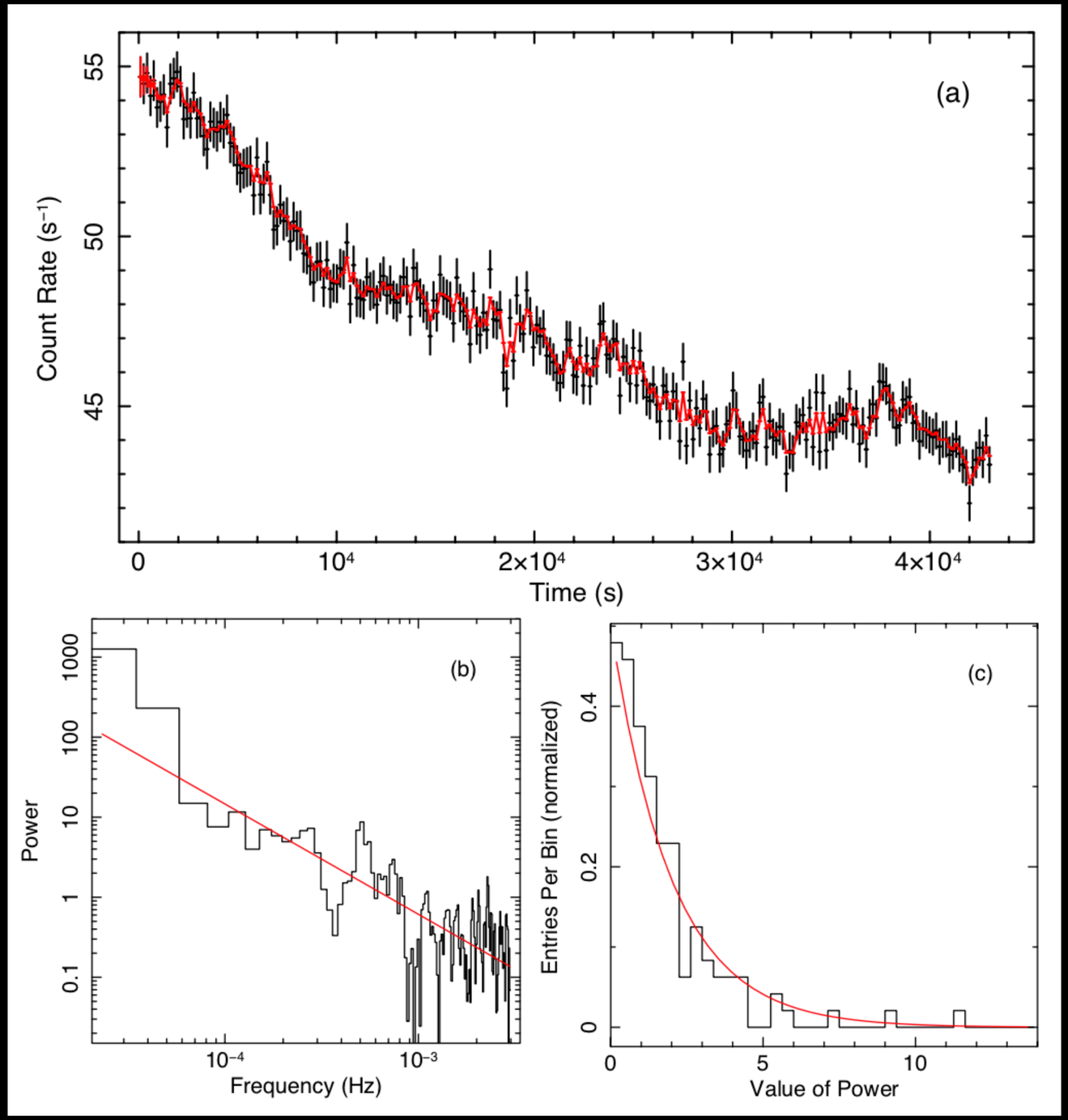

(b)
Entries = 6149
Mean = 0.5050
RMS = 0.5301
0
1
2
0
0.5
1
1.5
2
Value of c²

+

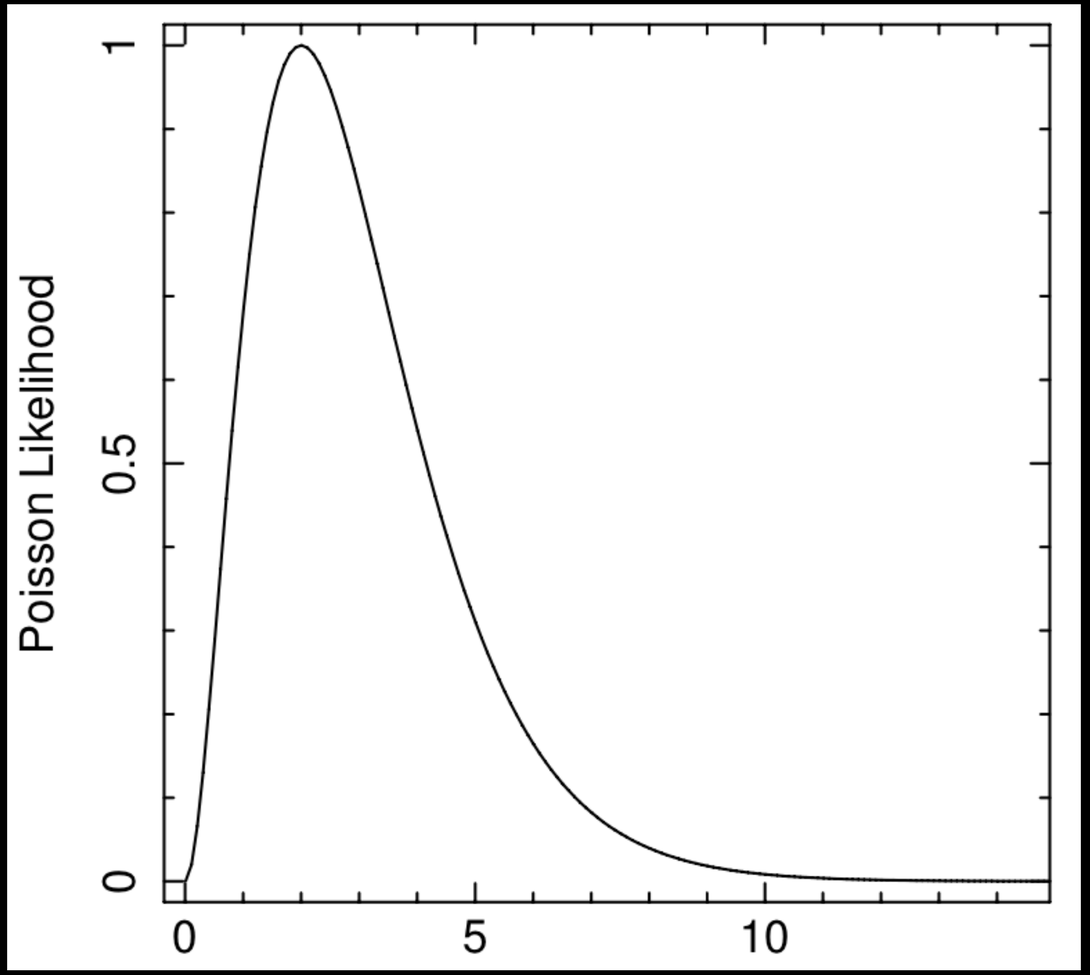

(b)
Entries = 6149
Mean = 0.5050
RMS = 0.5301
0
1
2
0
0.5
1
1.5
2
Value of c²

=

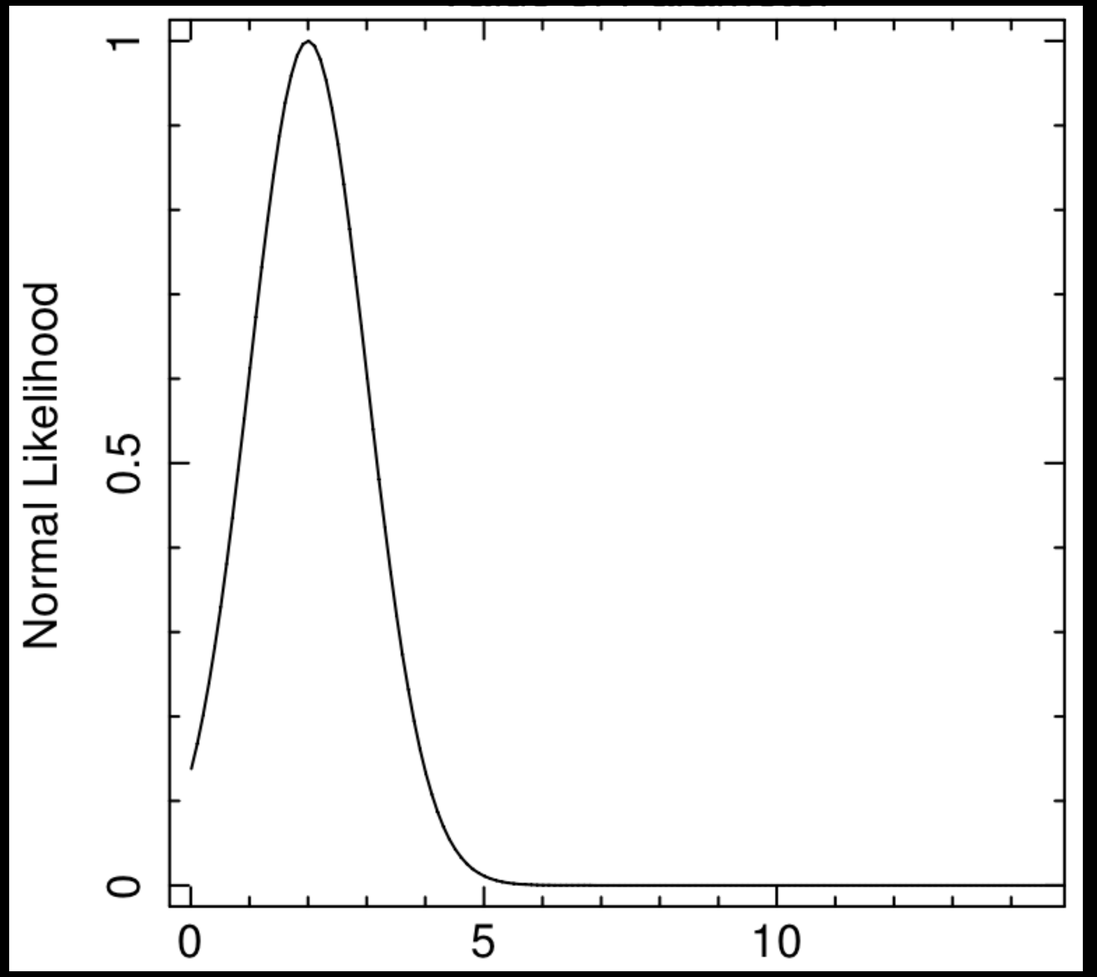

(c)
Entries = 7273
Mean = 1.9944
RMS = 1.9843
0
0.2
0.4
0
5
10
15
Value of R²=c²+s²


(a)
Count Rate (s^{-1})
55
50
45
0
10^4
2×10^4
3×10^4
4×10^4
Time (s)
(b)
Power
1000
100
10
1
0.1
10^{-4}
10^{-3}
Frequency (Hz)
(c)
Entries Per Bin (normalized)
0.4
0.2
0
0
5
10
Value of Power

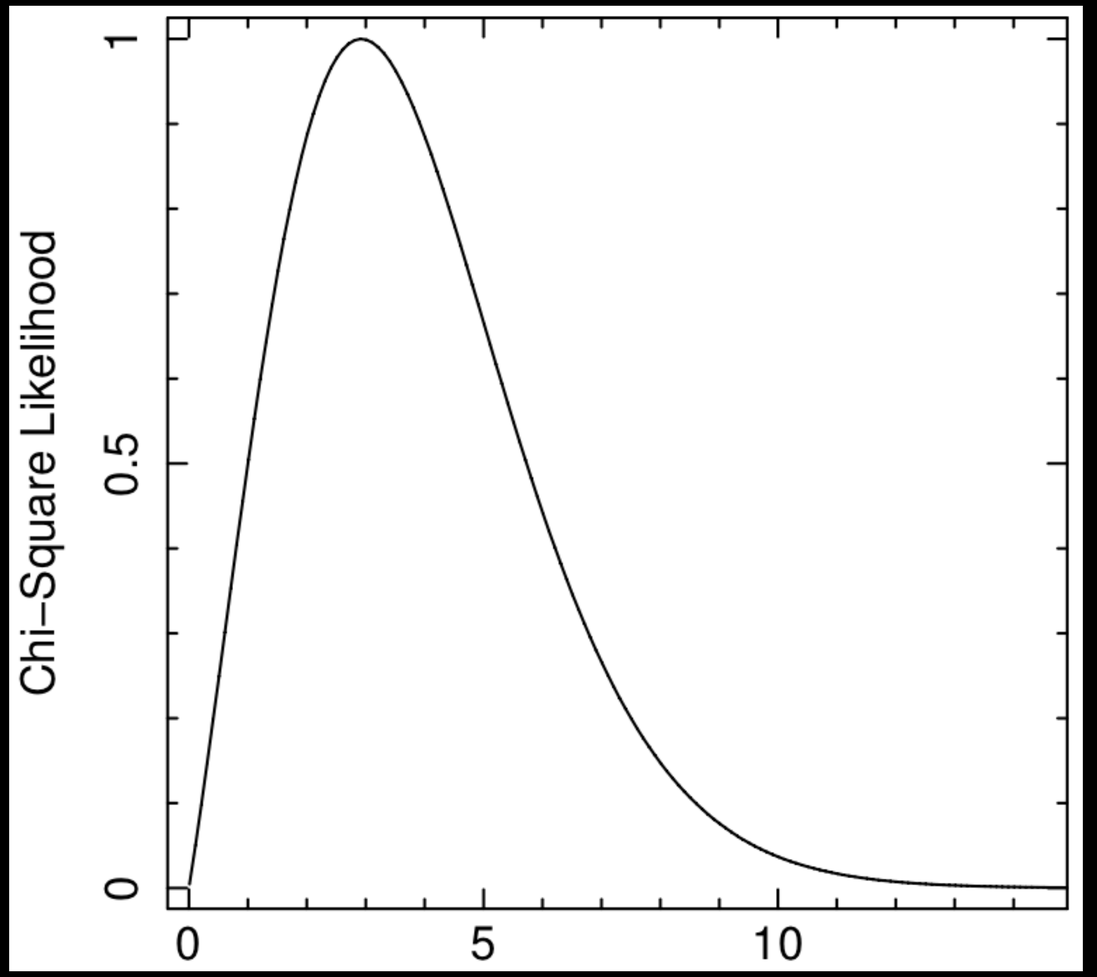
$$L(\boldsymbol{\nu}|\boldsymbol{n}) = \prod_i \frac{{\nu_i}^{n_i} e^{-\nu_i}}{n_i!}$$



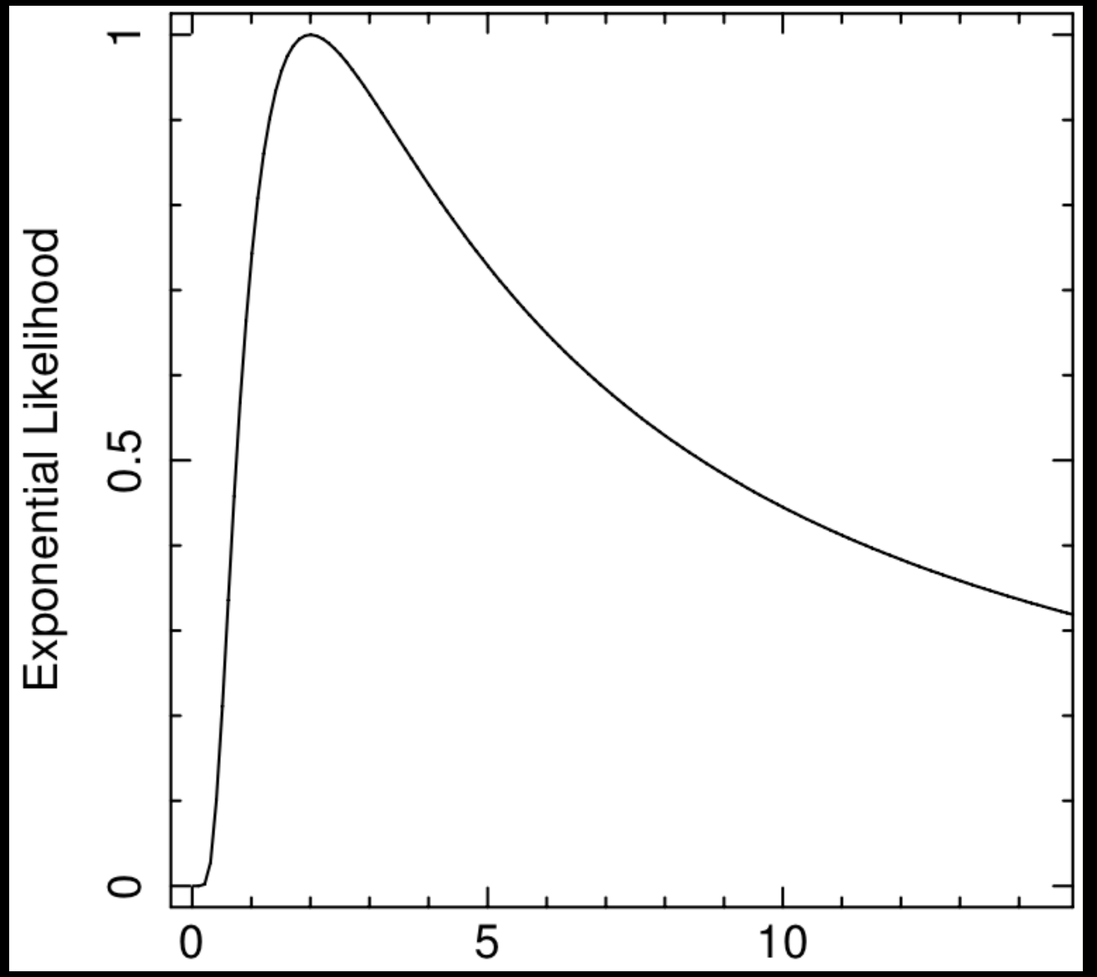
$$L(\boldsymbol{\mu}, \boldsymbol{\sigma} | \boldsymbol{x}) = \prod_i \frac{1}{\sqrt{2\pi\sigma_i^2}} e^{-(x_i - \mu_i)^2 / 2\sigma_i^2}$$



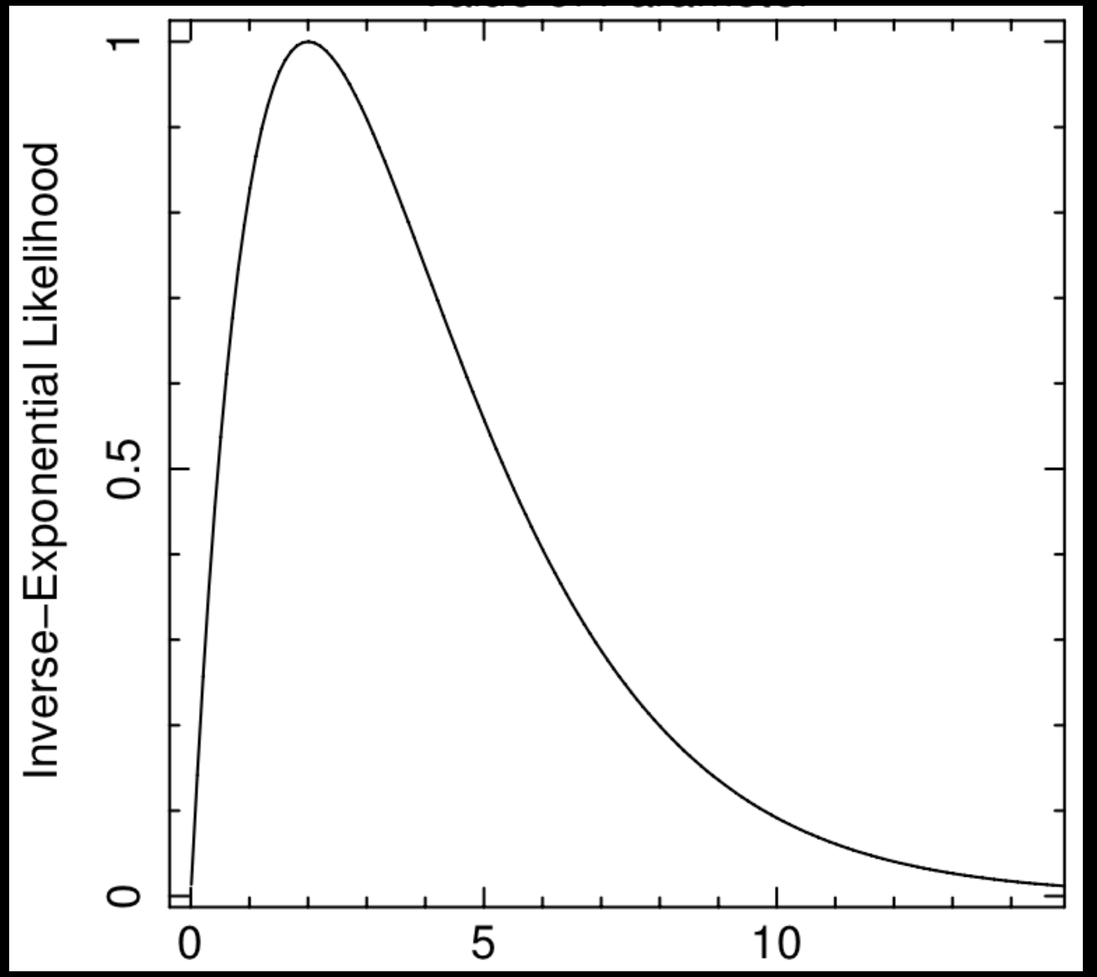
$$L(\boldsymbol{k}|\boldsymbol{x}) = \prod_i \frac{1}{2^{k_i/2}\Gamma(k_i/2)} x_i^{k_i/2-1} e^{-x_i/2}$$

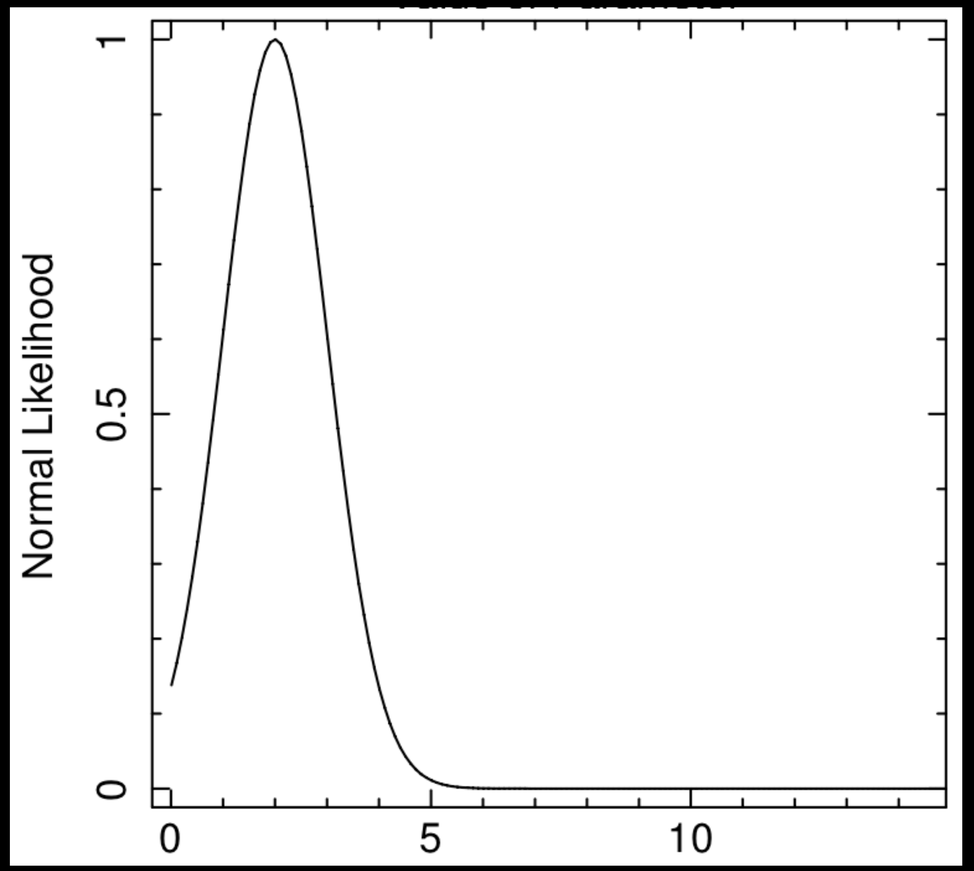


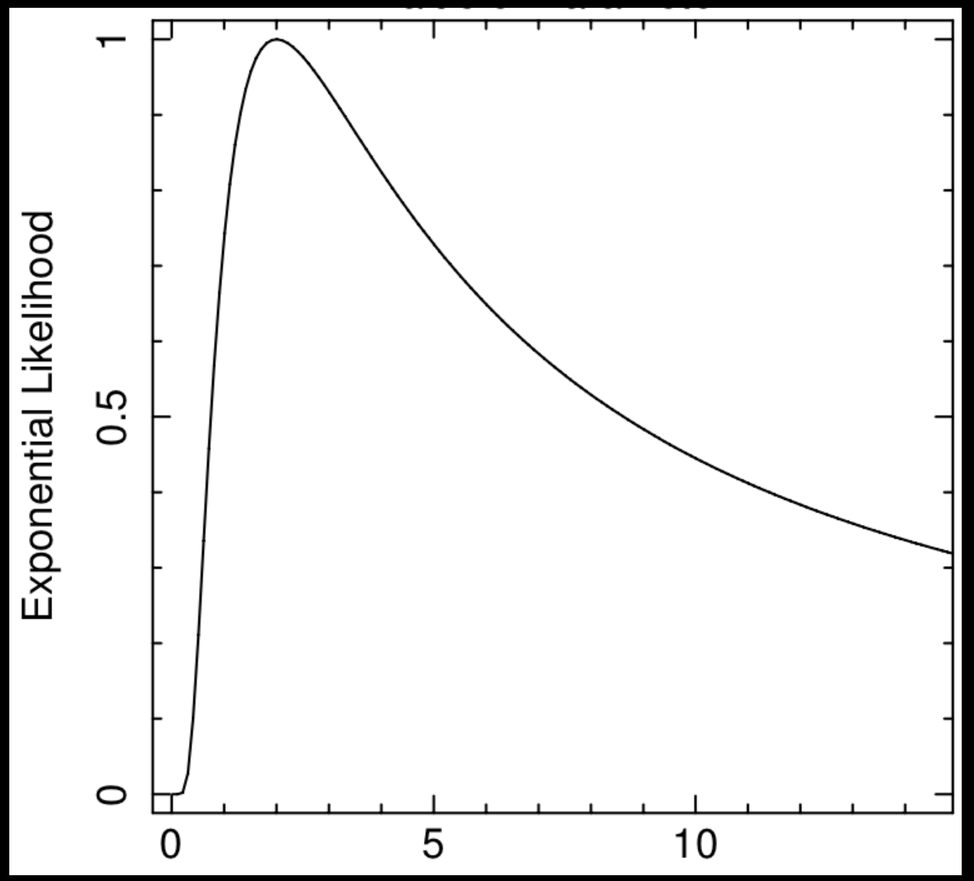
$$L(\boldsymbol{\tau}) = \prod_i \frac{1}{\tau_i} e^{-x_i/\tau_i}$$

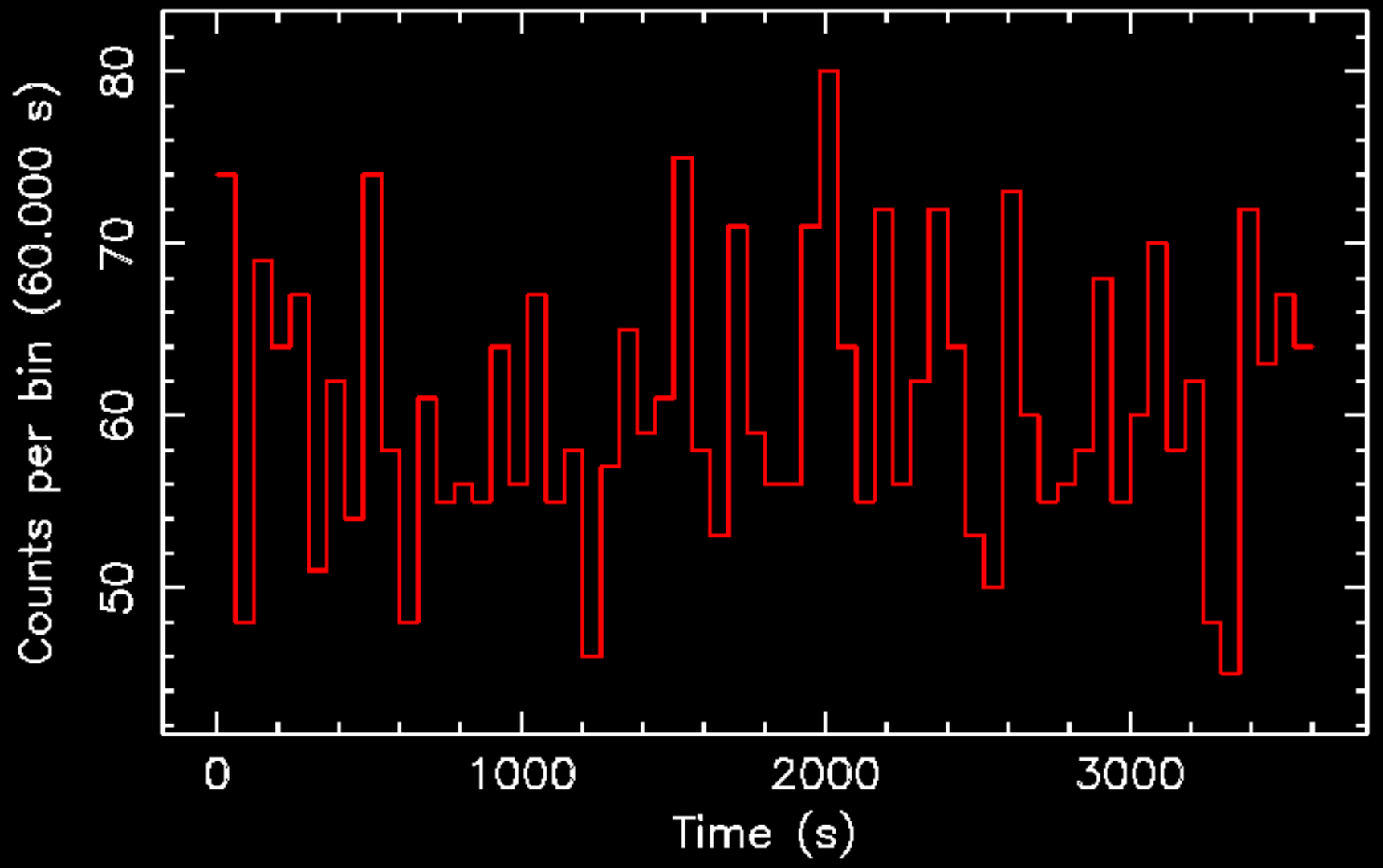


$$L(\boldsymbol{t}) = \prod_i \frac{t_i}{x_i{}^2} e^{-t_i / x_i}$$

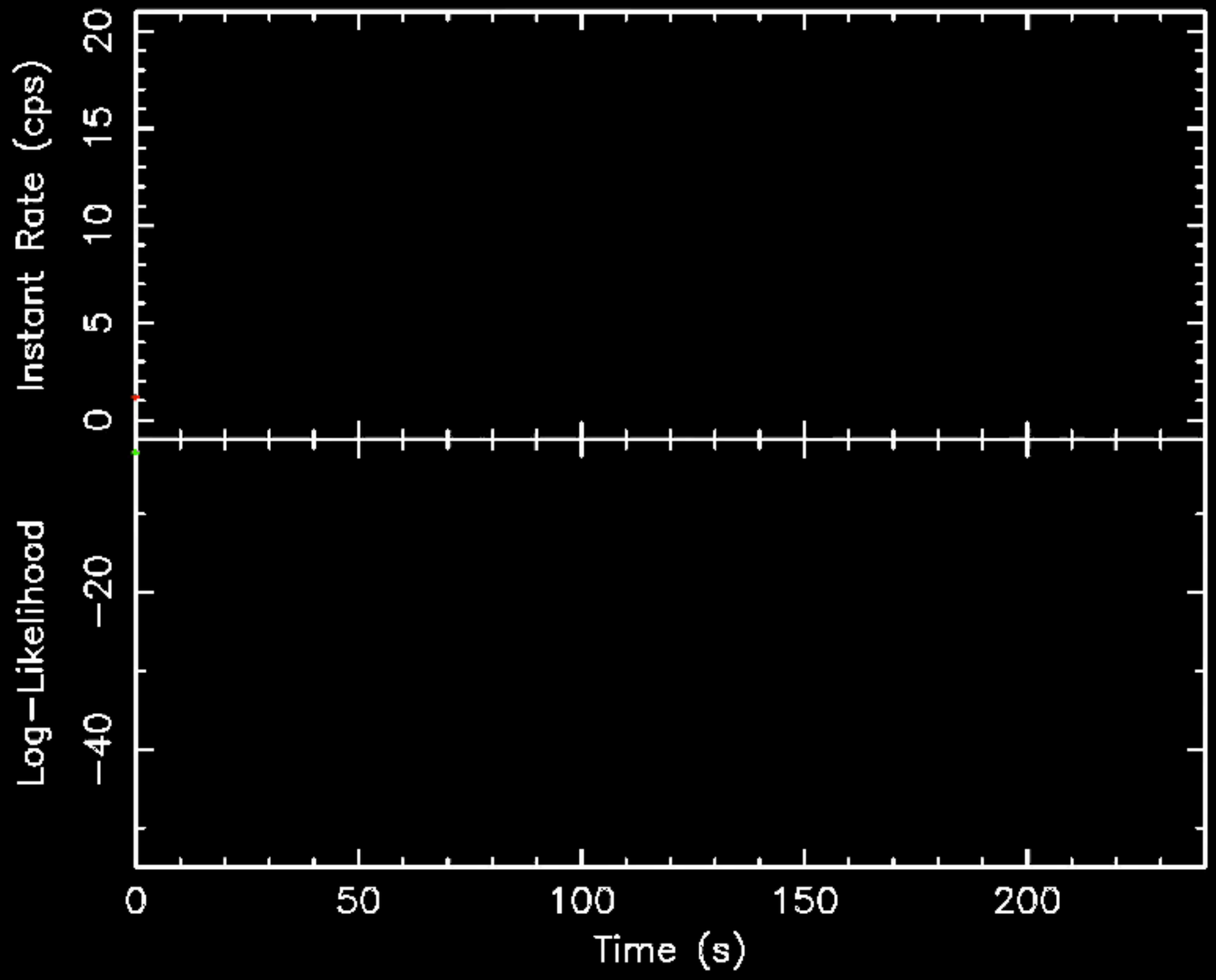



Normal Likelihood
0
0.5
1
0
5
10

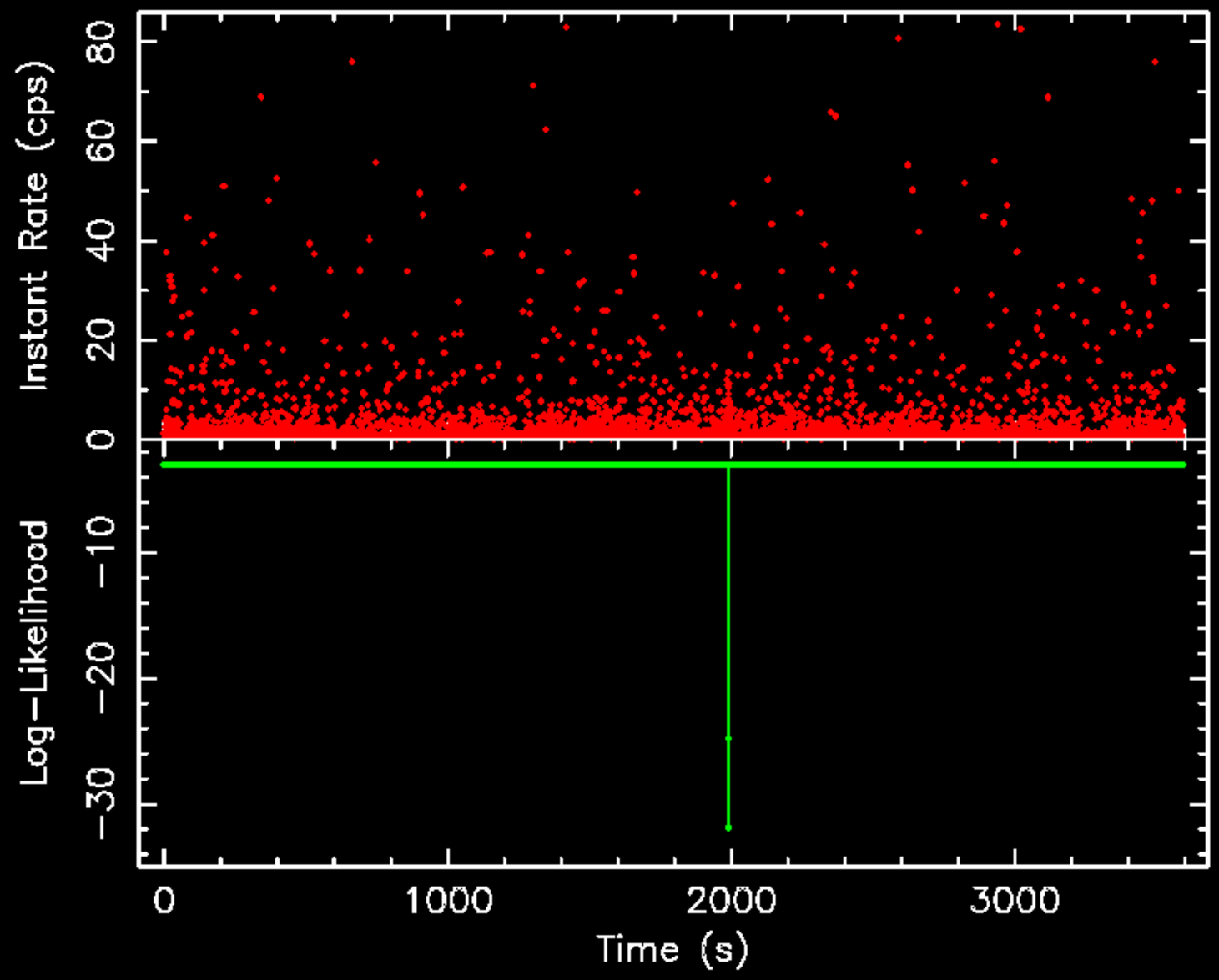

Exponential Likelihood
0
0.5
1
0
5
10



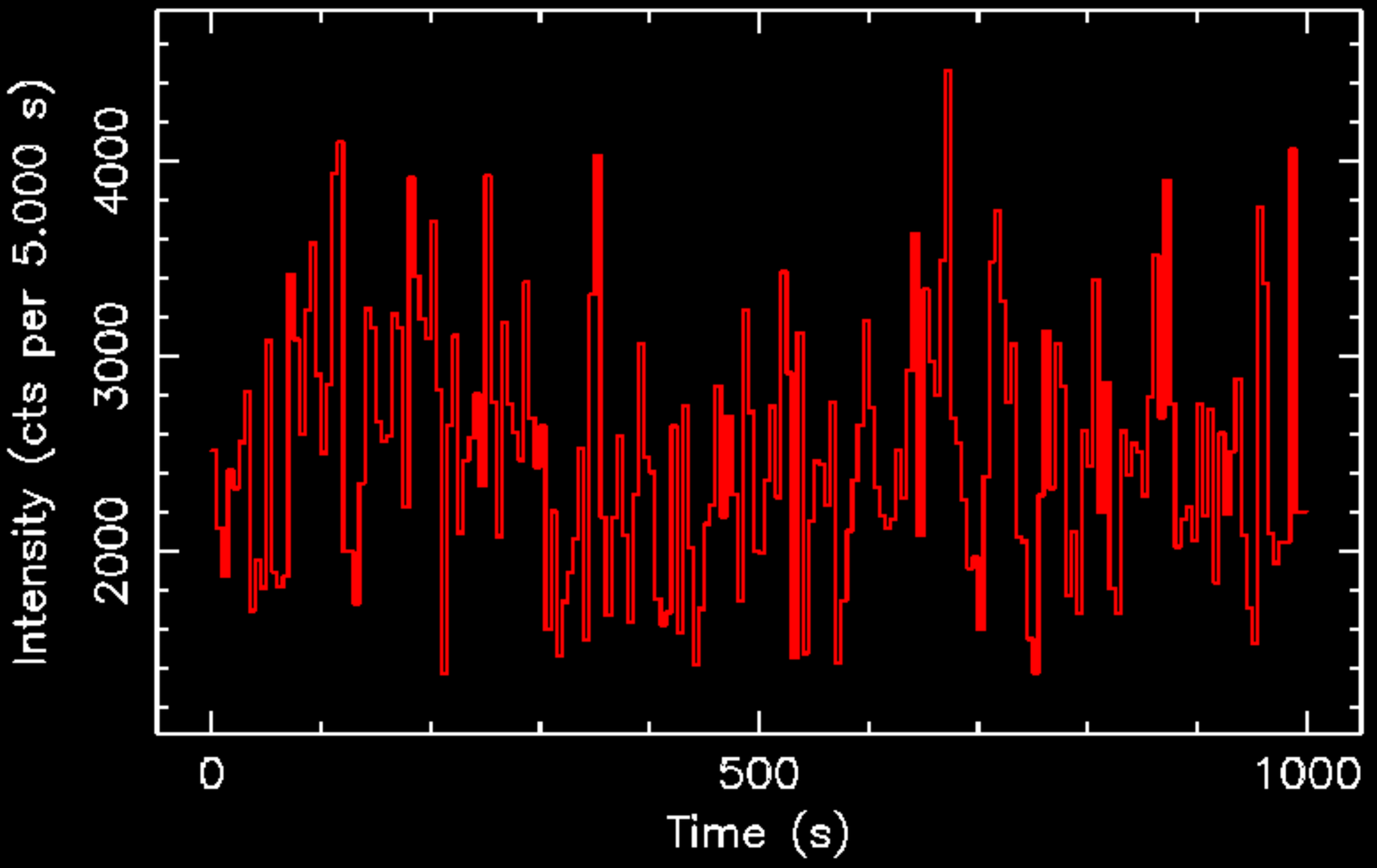
T=3600 s, mu=1 cps, dt=60 s



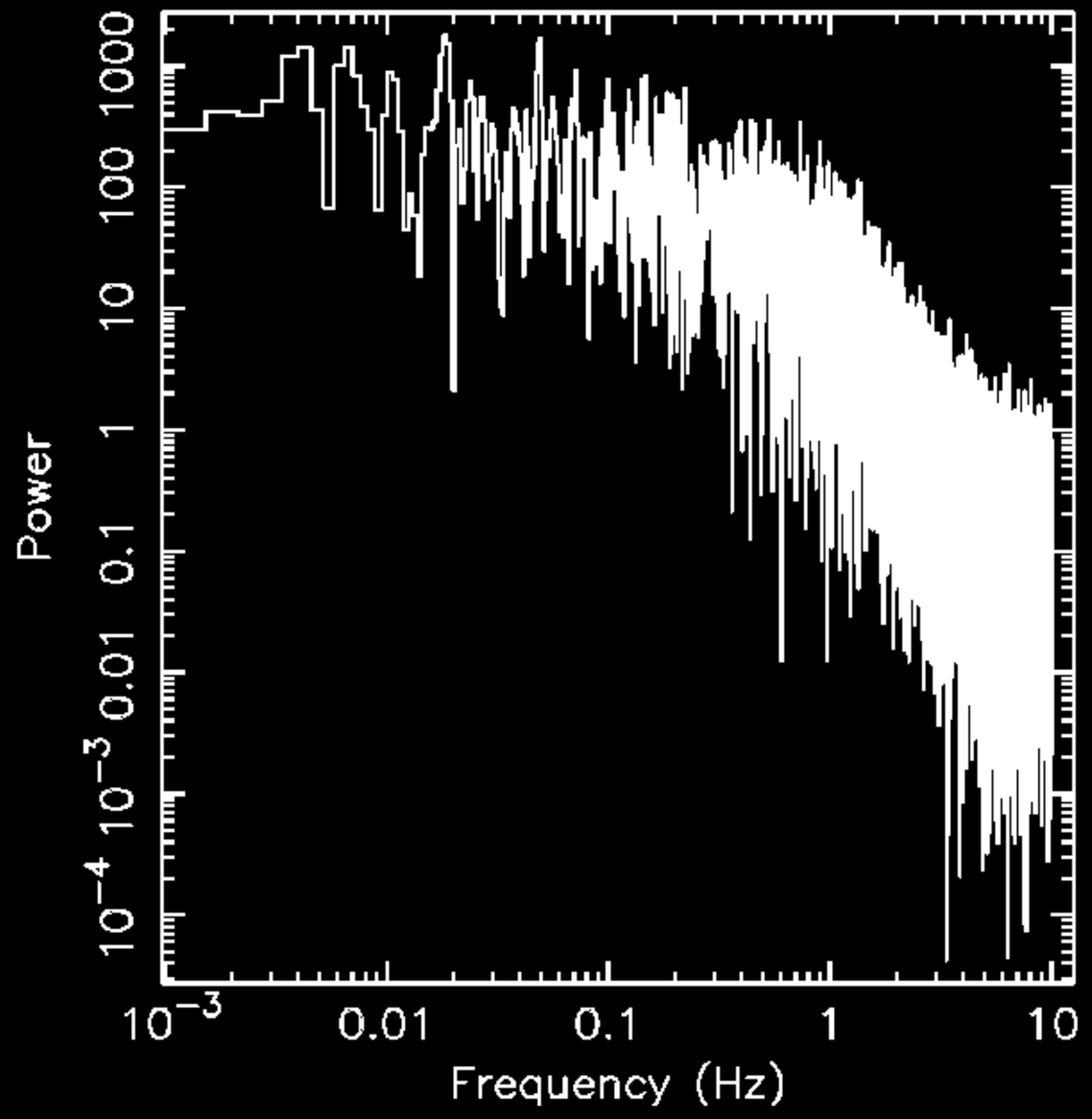
Neutron star: Burst at 2000 s



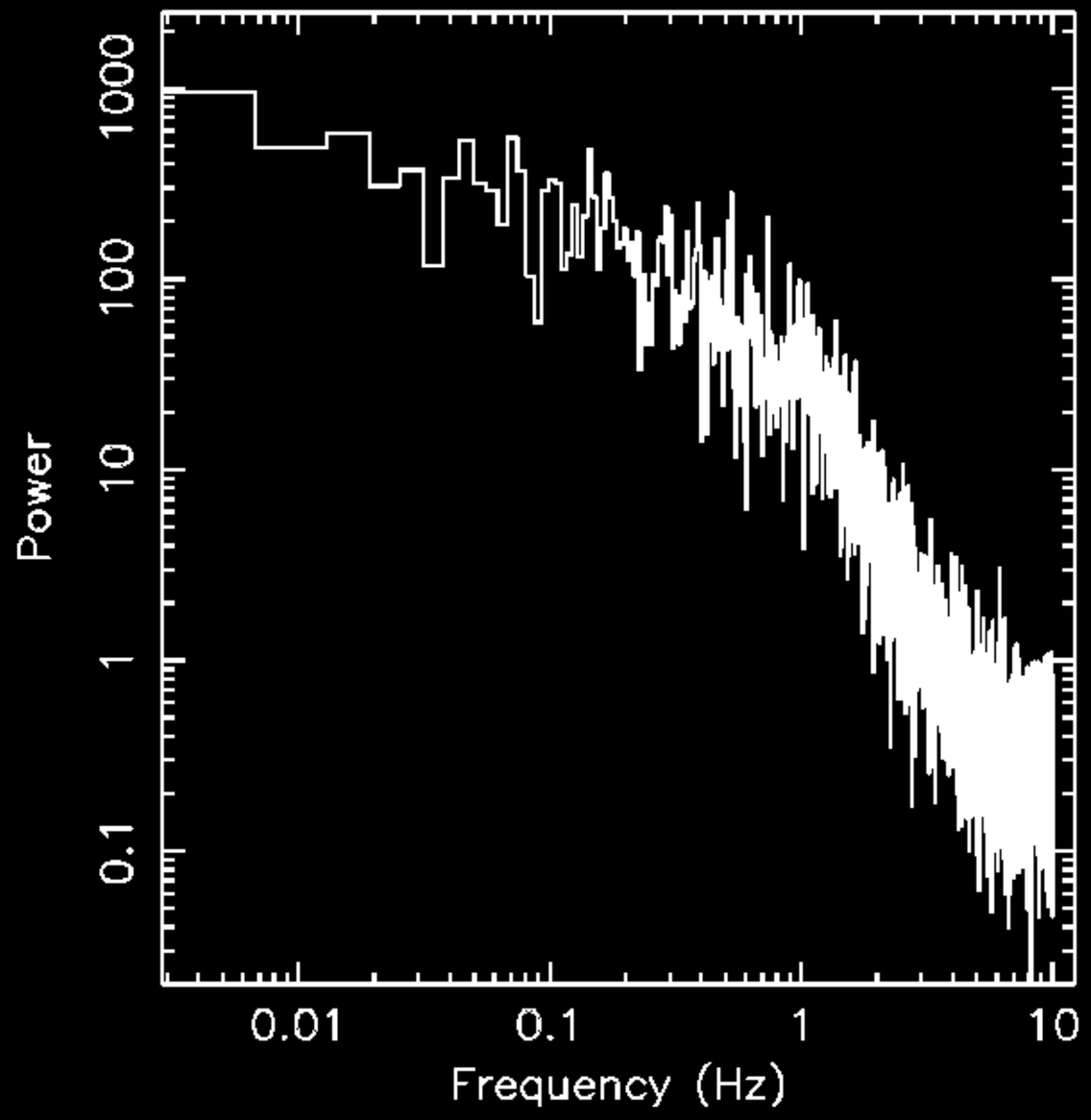
Burst: 30 s, 33 events



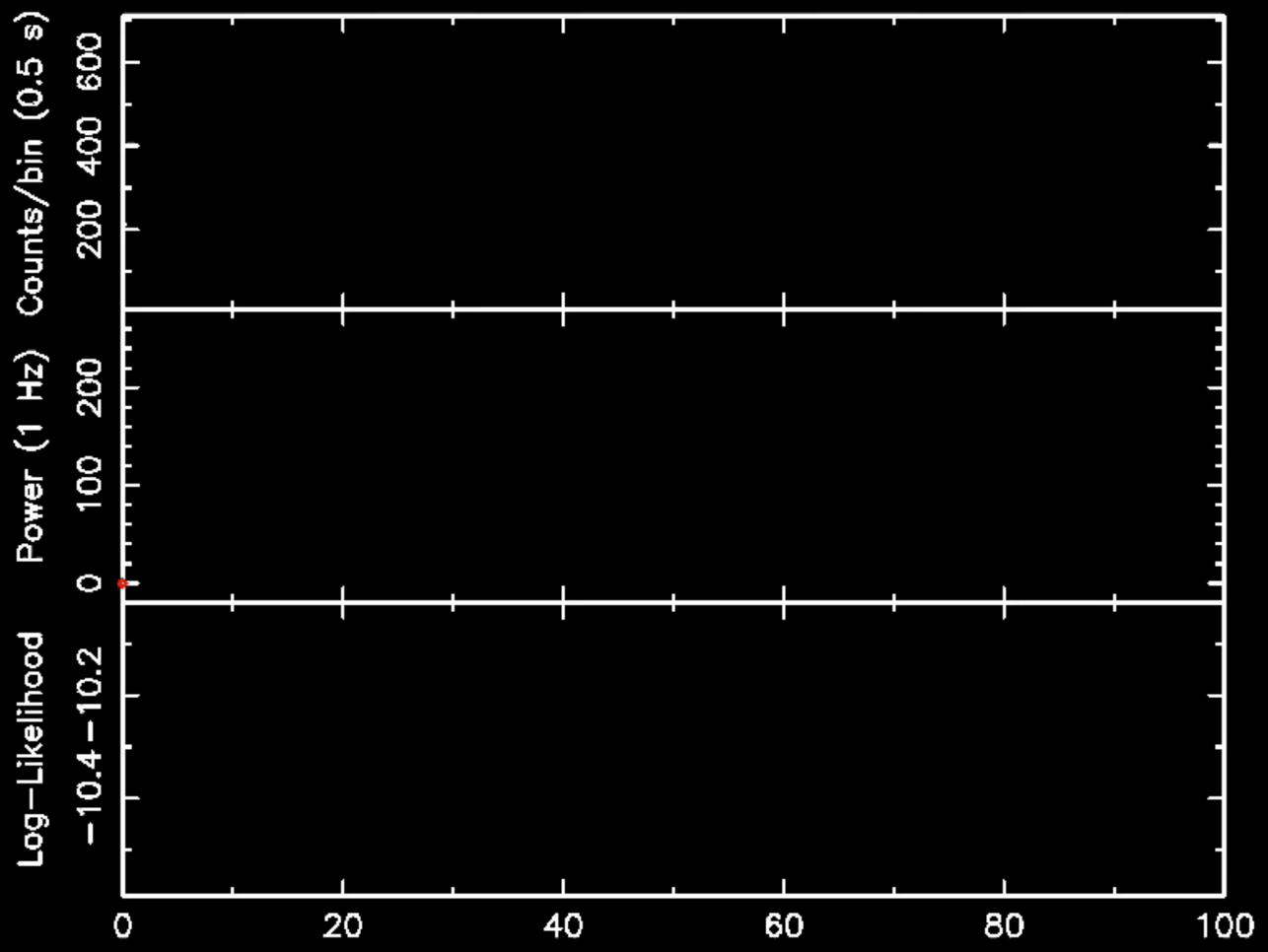
Black Hole: T=1000 s, mu=400 cps, dt=5 s

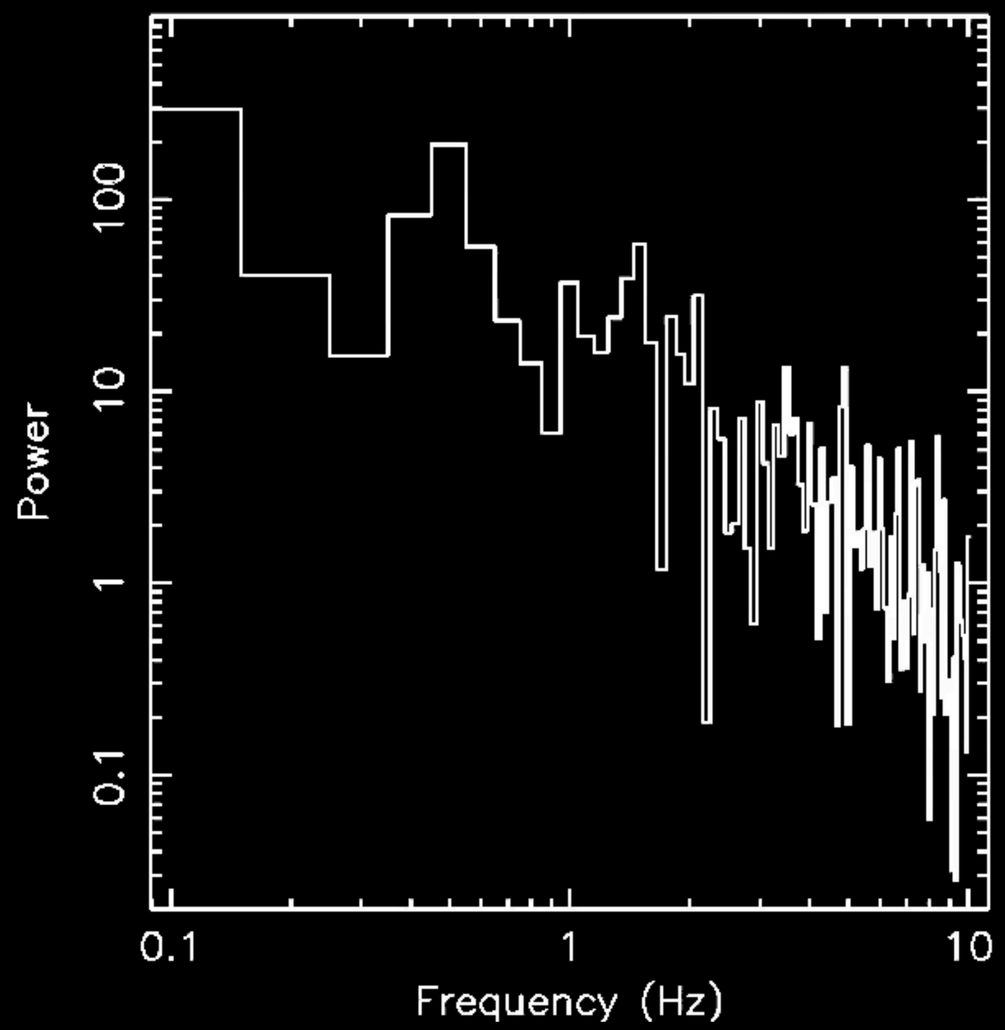


Two-zones with transition @ 1 Hz

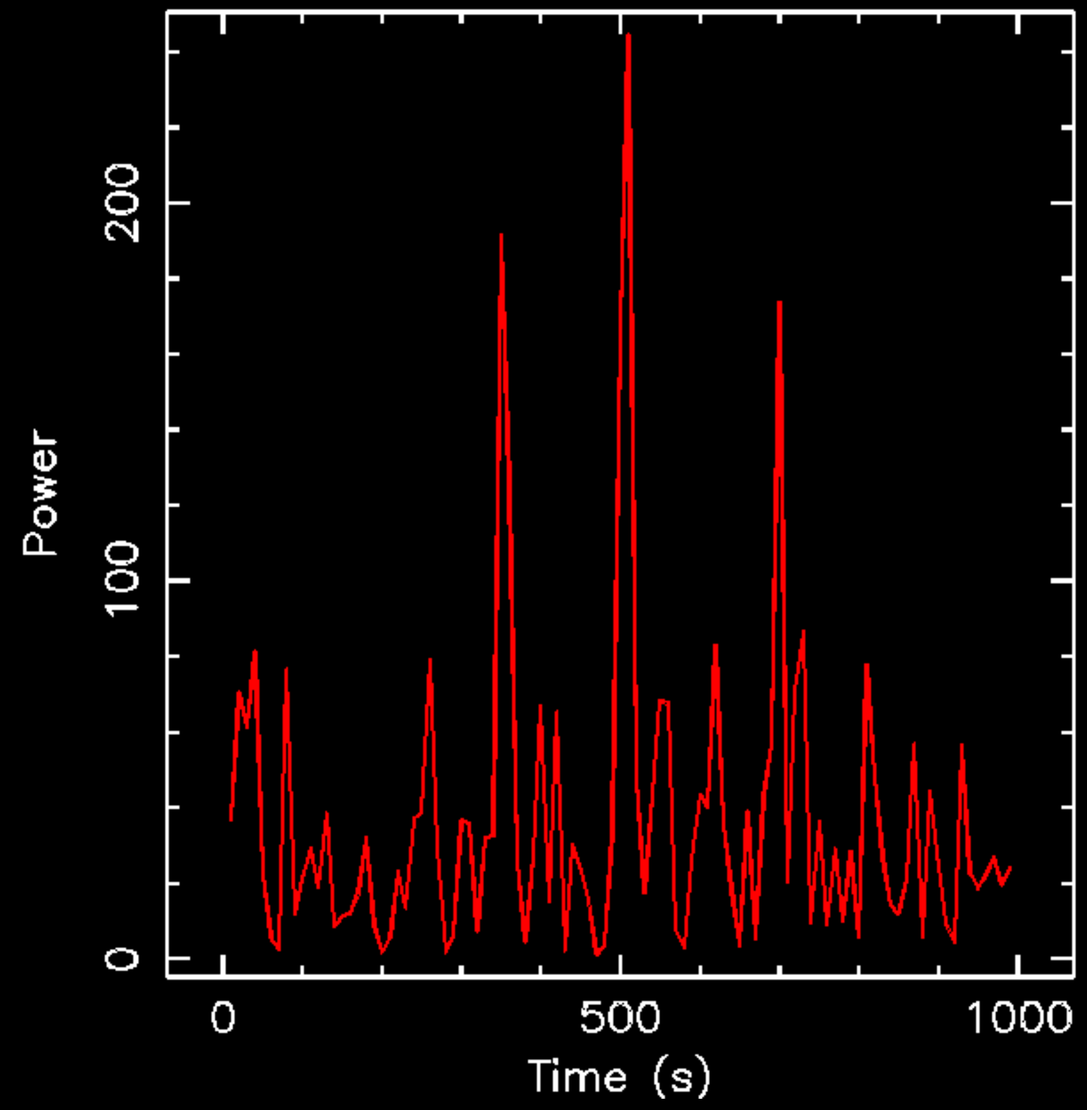


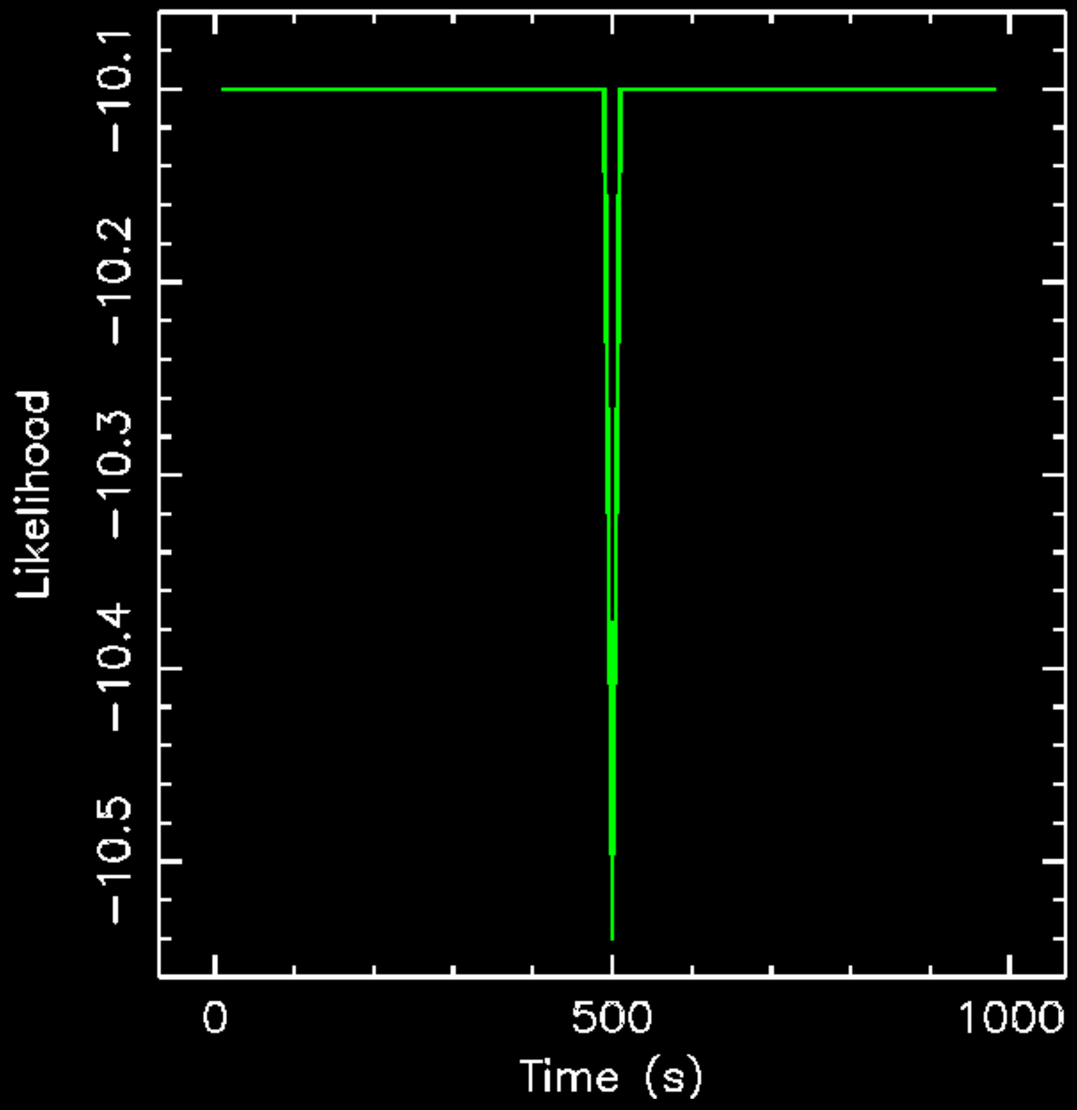
Kalman filtered data

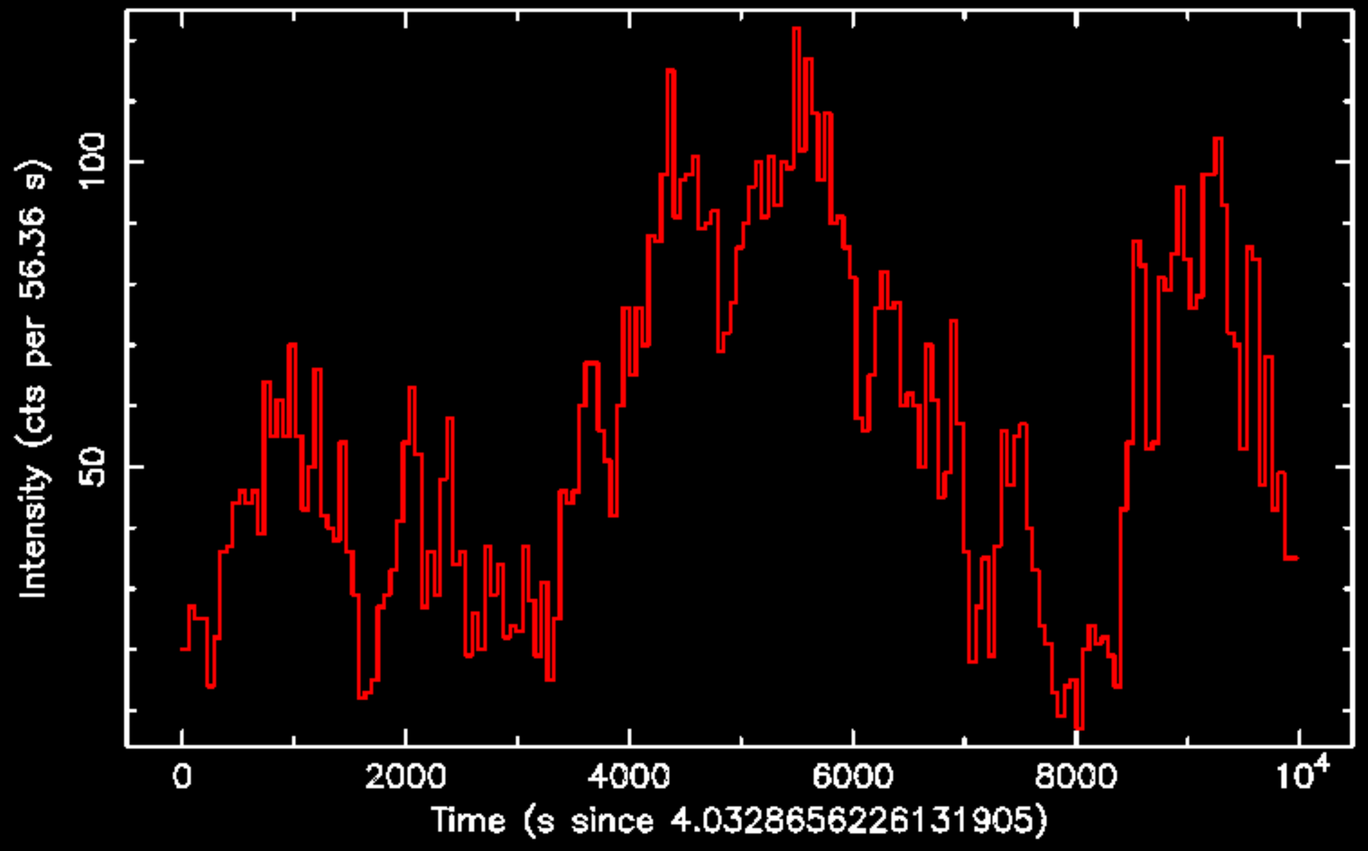


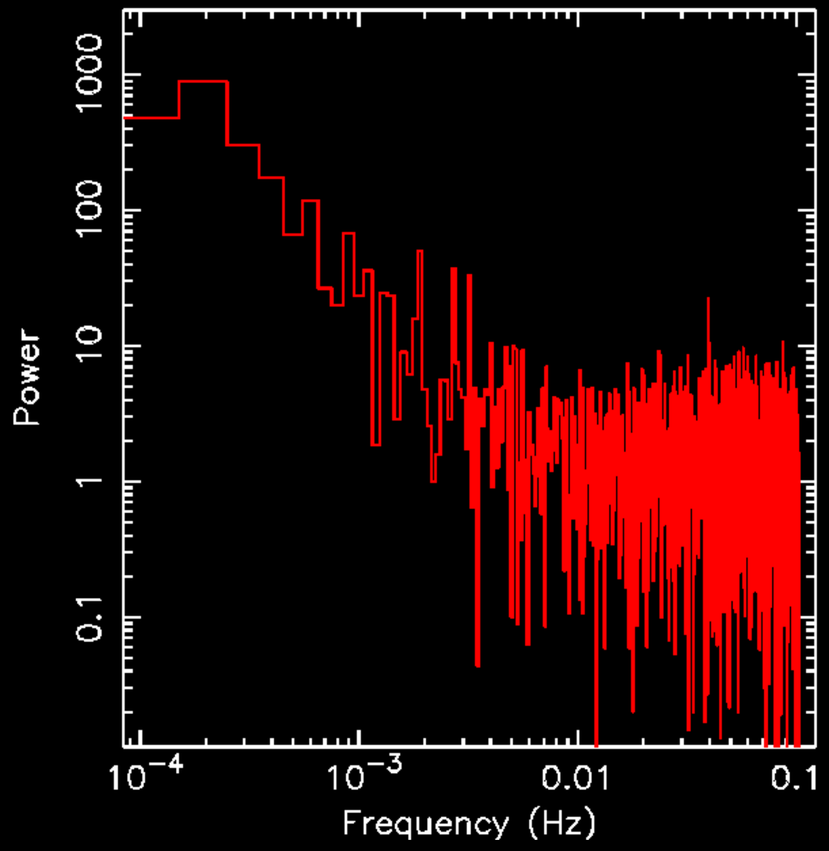


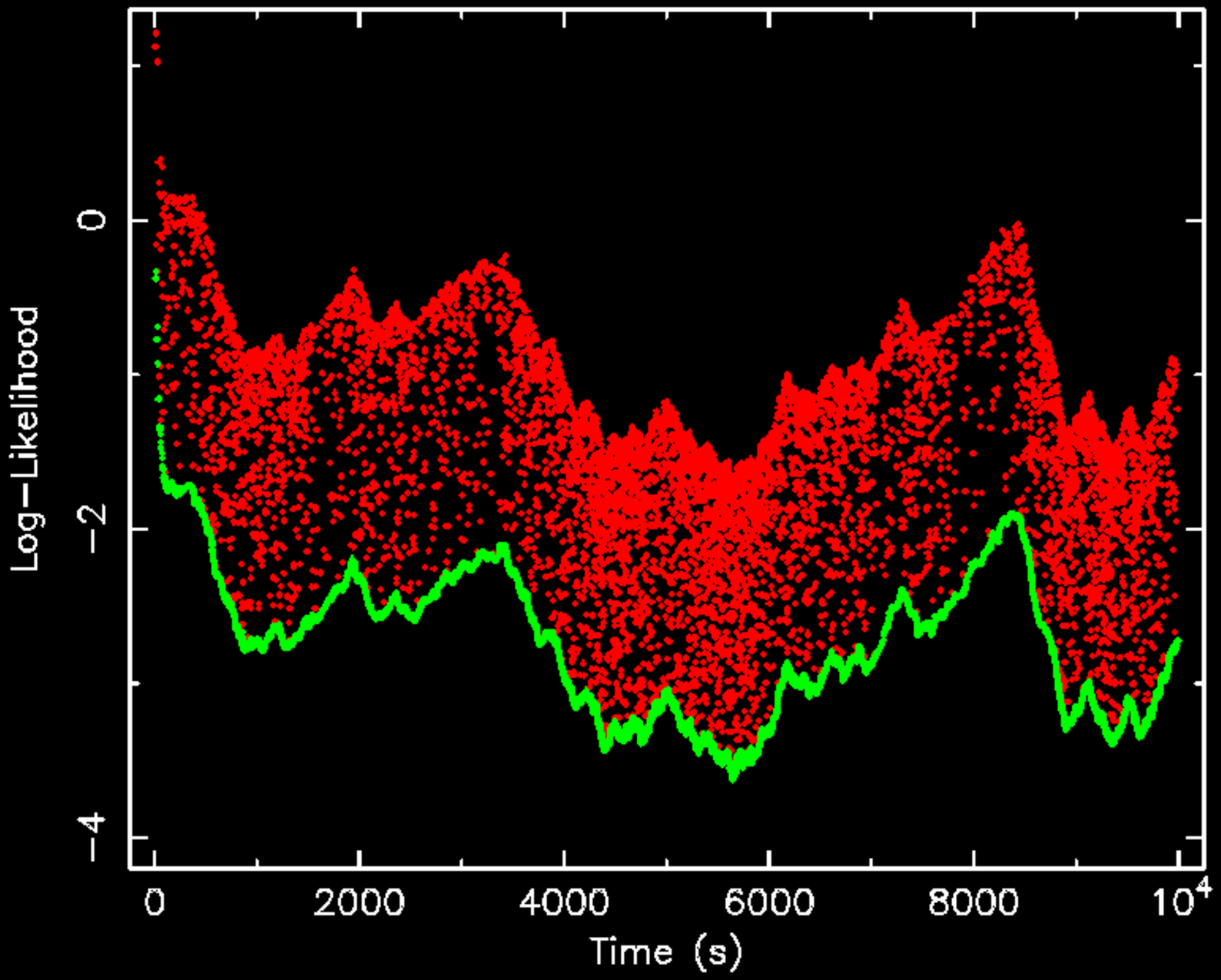
QPO @ 1 Hz: t= 500 s, dt=30 s (3 points)


Power
0
100
200
0
500
1000
Time (s)


Likelihood
−10.1
−10.2
−10.3
−10.4
−10.5
0
500
1000
Time (s)


Intensity (cts per 56.36 s)
50
100
0
2000
4000
6000
8000
10^4
Time (s since 4.0328656226131905)


Power
0.1
1
10
100
1000
10^{-4}
10^{-3}
0.01
0.1
Frequency (Hz)


Log−Likelihood
0
−2
−4
0
2000
4000
6000
8000
10^4
Time (s)

Thank you
for listening