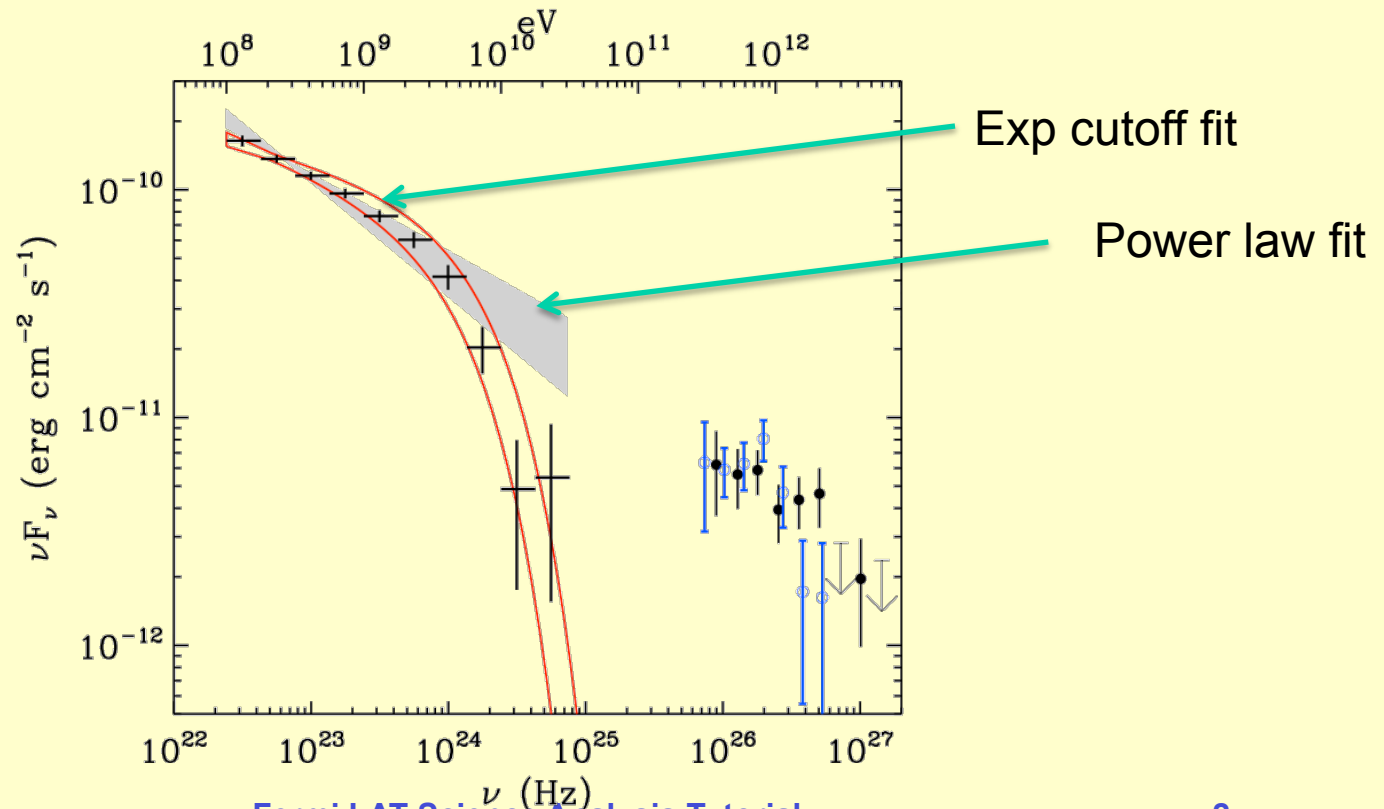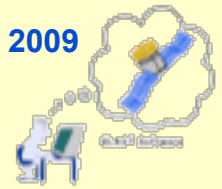# LS I +61 303 Analysis

- **In the galactic plane, but in the suburbs**
    - **Harder than 3C454, but much easier than galactic center**

- **Main differences:**
    - **Stronger diffuse response**
    - **More neighbouring sources**
    - **High latitude**
    - **Well… periodic as well as variable**
    - **Exponential cutoff model – how to decide that**

Spectral Analysis: exponential cutoff

- **Most common form is power law: $AE^{-\gamma}$**

- **Pulsars are usually exponential cutoffs: $AE^{-\gamma}\exp(E/E_{cut})$**

- **Use likelihood ratio to distinguish:**

  - **$2\,\Delta\ln(LL) \sim \chi^2$**
  - **Where the 2 models differ by one degree of freedom**

Source Model for LS I +61 303

```xml
- <source_library title="source library">
  - <source name="ASO0049" type="PointSource">
    - <spectrum type="PowerLaw2">
        <parameter error="0.02587607988" free="1" max="1000" min="1e-05" name="Integral" scale="1e-06" value="0.35557599"/>
        <parameter error="0.04610795554" free="1" max="0" min="-5" name="Index" scale="1" value="-2.463723175"/>
        <parameter free="0" max="300000" min="20" name="LowerLimit" scale="1" value="100"/>
        <parameter free="0" max="300000" min="20" name="UpperLimit" scale="1" value="100000"/>
      </spectrum>
    - <spatialModel type="SkyDirFunction">
        <parameter free="0" max="360" min="-360" name="RA" scale="1" value="35.7983"/>
        <parameter free="0" max="90" min="-90" name="DEC" scale="1" value="62.0212"/>
      </spatialModel>
    </source>
  - <source name="LSI_+61_303" type="PointSource">
    - <spectrum type="PLSuperExpCutoff">
        <parameter error="0.05101360702" free="1" max="1000" min="1e-05" name="Prefactor" scale="1e-10" value="1.001457018"/>
        <parameter error="0.03652337612" free="1" max="0" min="-5" name="Index1" scale="1" value="-2.155549141"/>
        <parameter free="0" max="2000" min="50" name="Scale" scale="1" value="1000"/>
        <parameter error="0.6568489291" free="1" max="100" min="0.1" name="Cutoff" scale="1000" value="4.521075174"/>
        <parameter free="0" max="3" min="1" name="Index2" scale="1" value="1"/>
      </spectrum>
    - <spatialModel type="SkyDirFunction">
        <parameter free="0" max="360" min="-360" name="RA" scale="1" value="40.13194"/>
        <parameter free="0" max="90" min="-90" name="DEC" scale="1" value="61.22933"/>
      </spatialModel>
    </source>
  - <source name="eg_v02" type="DiffuseSource">
    - <spectrum file="/afs/slac/g/glast/users/richard/11moCat/isotropic_iem_v02.txt" type="FileFunction">
        <parameter error="0.06620241349" free="1" max="1000" min="1e-05" name="Normalization" scale="1" value="0.5073942339"/>
      </spectrum>
    - <spatialModel type="ConstantValue">
        <parameter free="0" max="10" min="0" name="Value" scale="1" value="1"/>
      </spatialModel>
    </source>
  - <source name="gal_v02" type="DiffuseSource">
    - <spectrum type="PowerLaw">
        <parameter error="0.01325744209" free="1" max="1000" min="0.001" name="Prefactor" scale="1" value="1.047116876"/>
        <parameter error="0.00453142675" free="1" max="2" min="-2" name="Index" scale="1" value="0.02260198893"/>
        <parameter free="0" max="5000" min="20" name="Scale" scale="1" value="100"/>
      </spectrum>
    - <spatialModel file="/afs/slac/g/glast/users/richard/11moCat/rings_Galaxy_v1renorm.fits" type="MapCubeFunction">
        <parameter free="0" max="1000" min="0.001" name="Normalization" scale="1" value="1"/>
      </spatialModel>
    </source>
  </source_library>
```
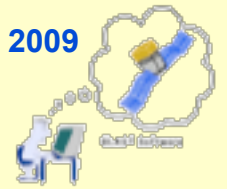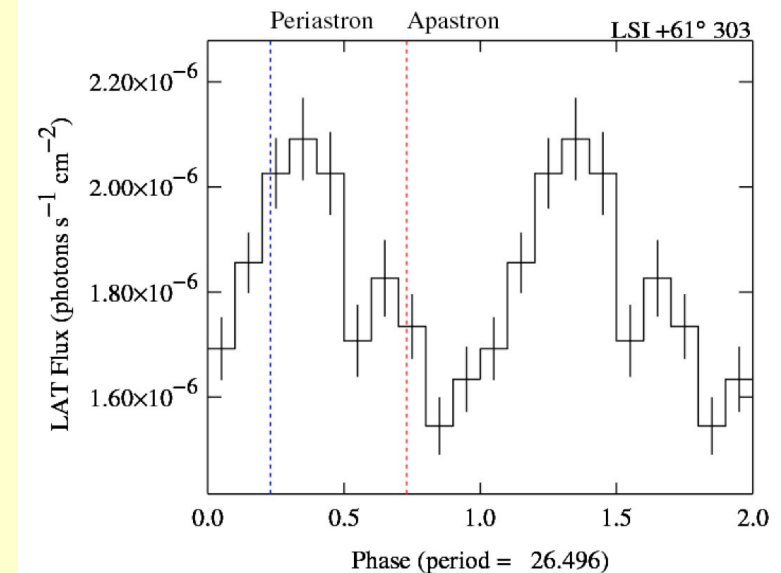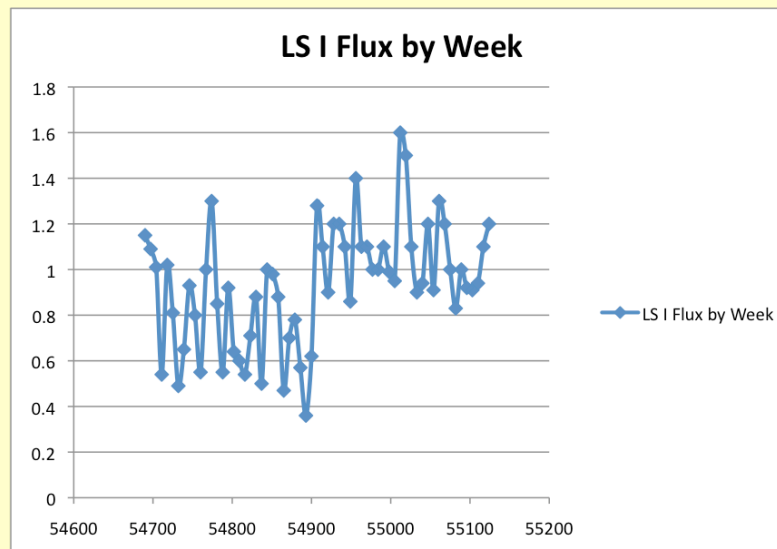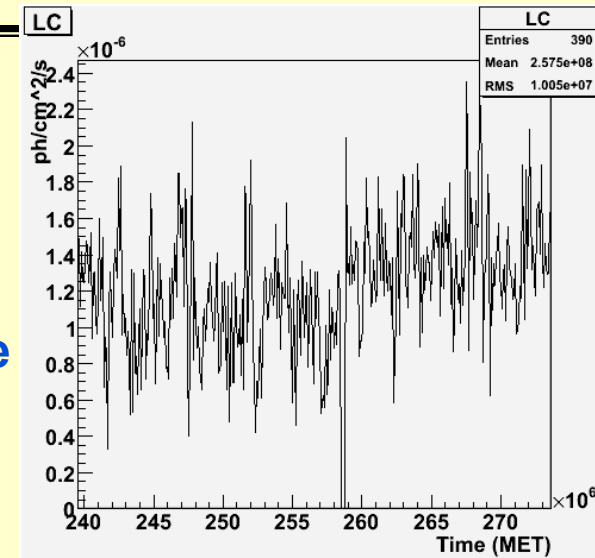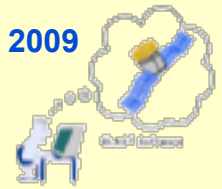
R.Dubois

Timing Analysis: LC and folded LC

- **Aperture photometry**
  - **AKA counting photons in a cone**
  - **Quick and easy**
  - **No modeling!**
  - **Folded LC is average of flux in phase bins**
- **Likelihood fits in time bins**
  - **Needs statistics**
  - **Time consuming to do**

LS I +61 303 Systematics

Systematics summary

what	Flux	Index	Cutoff
baseline	0.82	2.21	6.3
pt like std	0.77	2.19	5.7
pt like full	0.79	2.20	5.8
bracket jeu1	0.89	2.27	6.4
bracket jeu2	0.77	2.18	6.7
zenith 75 deg	0.82	2.15	4.6
old diffuse	0.80	2.17	5.4
max diffs	+0.07 -0.05 7%	+0.06 -0.06 3%	+0.4 -1.7 +6% -22%

Alternate fitting method

"Bracketing" Aeff IRF

Different diffuse model

Vary lower energy cut