

This macro designed to access a LAT catalog source list FITS file (1FGL and 2FGL) and produce an xml model for a given ROI. For the 1FGL catalog all point sources are modeled using the PowerLaw spectral type, manual modification of the xml file is necessary for use of other types. For the 2FGL catalog the point and extended sources are modeled using the 'SpectrumType' column of the FITS file. The code automatically detects which catalog FITS file you are using. The macro puts an underscore in front of the 1/2FGL name (avoids parsing issues) and removes the space from the name as well. Common usage is:

```
from make2FGLxml import *
mymodel=srcList('LATsrclist.fits','eventfile.fits','myLATxmlmodel.xml')
mymodel.makeModel('fullpathtodiffusefiles/gll_iem_v02.fits','gal_v02','fullpathtodiffusefiles/isotropic_iem_v02.txt','eg_v02')
```

The above will take the ROI info from eventfile.fits and then the cycle through the LATsrclist.fits file and will make an xml file for sources within ROIradius+5 degrees of the ROI center. The extra five degrees is to account for sources outside the ROI which may contribute at lower energies due to the larger PSF there. Note, however, that if a source is outside the ROI radius all parameters are fixed in the output xml file.

"fullpathtodiffusefiles" should be replaced with the path to the diffuse files on your machine, typing the above exactly as shown will not work. The names given will correspond to the diffuse response columns precomputed in the event files. If no galactic diffuse model is specified, the default gll_iem_v02.fit in the external libraries (included with the ScienceTools) is used. If no isotropic template file is given, the standard isotropic power law component is used.

Alternate usages for the makeModel function are:

```
mymodel.makeModel('fullpathtodiffusefiles/gll_iem_v02.fits','gal_v02') #if not using the isotropic template
```

```
mymodel.makeModel() #to use the gll_iem_v02.fit galactic diffuse and standard isotropic power law component
```

```
mymodel.makeModel(ISOfile='fullpathtodiffusefiles/isotropic_iem_v02.txt',ISOName='eg_v02') #to use gll_iem_v02.fit without specifying it exactly and the isotropic template
```

When using either catalog FITS file you can give the makeModel function the optional argument *radLim=X* where instead of typing X you specify the number of degrees from the center of the ROI beyond which the spectral parameters of all sources are fixed. Additionally, you can give it the optional argument *signif=Y* where instead of typing Y you specify the average significance value for sources in the ROI below which all spectral parameters will be fixed.

In the 2FGL catalog, sources found with significant extension were modeled as extended using template FITS files available for download from the FSSC. When using the 2FGL catalog then you will want to specify *extDir='pathtoextendedtemplates'* where 'pathtoextendedtemplates' is replaced by the full path to the directory where you've stored the extended templates. If you do not have the extended templates or do not wish to use them then you can give the makeModel function the optional argument *psForce=True* which forces all sources to be modeled as point sources. Note that if you use

unbinned likelihood you will have to run `gtdiffrsp` if any extended sources are included in the model unless you set `psForce=True`.

For using the 2FGL catalog there are a few special cases which need to be noted here. The Vela X and MSH15-52 spectra could not be fit in the standard catalog analysis as they are close to bright pulsars which need to be 'turned off' to correctly get the spectra. Therefore, the models for these two sources were held at the best-fit values from the LAT collaboration's papers on them. However, the numbers used are not in the fits file so these two are handled specially to give the exact same xml entries used in the catalog analysis with all parameters held fixed. For some pulsars the significance of a cutoff in the spectrum was $<4\sigma$ and thus a power law was deemed a better fit; however, to be consistent all pulsars are reported with `PLSuperExpCutoff` models and the aforementioned pulsars are assigned cutoff energies >1 TeV (effectively mimicking power law models). For such pulsars the cutoff energies are fixed by default, manual modification of the xml file may be necessary.

The `srcList` object also has a `Print` function which will display the contents of the object, useful to make sure everything is good before making the model. Note, this does not have clobber protection so an existing xml file of the same name will be overwritten. The macro does, however, warn you that this will happen when making the `srcList` object.