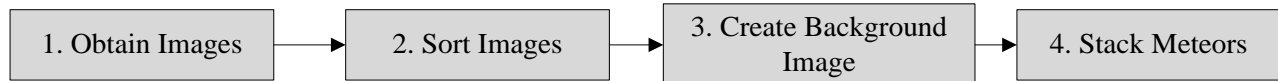


Process Flow



Capturing Meteors

Mount the camera on the back of a telescope for tracking the same region in space.

Equipment

Tripod or Telescope with tracking, Camera capable of supporting an interval meter and has a Bulb settings. Large **Aperture** (Ap) lens ,70mm and up, with low Focal Length abilities.

Camera Setup

Exposure times and settings are dictated by a number of factors including overall exposure of the sky you want, and the length of star trails you can tolerate (if tripod mounted). Generally, idea exposures will show a **Histogram** with the peak centered at about 1/3 to 1/2 of the grid. **F-stop** (F) should be as low as possible for the lens. **Focal Length** (FL) should be set low since higher FL show smaller regions of sky and exacerbate star trails. A typical setup might be: Lens: Ap = 82mm, FL=24, F=2.8, Exposure 25 – 45 sec (depending on sky brightness) with mode set at **Bulb** setting with 5 sec delay between photos. You may also want to take 3-6 dark frames for noise removal when processing images. Also make sure to take high resolution photos. I generally will take RAW and JPG images. The raw images are good for creating the **Background Image** that the meteors can be overlaid on.

Photo Selection

Review each of the photos taken. Remove any photos containing airplane or satellite trails or other items that may make the photo unusable. Sort the photos into the following groups:

- Unusable – Setup photos, photos containing satellite plane trails or other items that make the photo unusable.
- Darks – Dark photos to be used for noise reduction
- Background – Photos that are good representation of the star field and landscape. These can be combined to make a single low noise image (Background Image) that the meteors can be overlaid on when ready to process.
- Meteors – Images containing meteor trails.

Software

- DCRAW – Or other similar file used to convert the Raw images to TIFF images for DeepSkyStacker.
 - REF: <http://www.cybercom.net/~dcoffin/dcraw/> (Freeware)
- DeepSkyStacker – Used to combine Background images and Darks for a single image that can be processed to create the Background Image.
 - REF: <http://deepskystacker.free.fr/english/index.html> (Freeware)
- StarTools – Used to take the single image output from the DeepSkyStacker and process to create the Background Image.
 - Ref: <http://www.startools.org/> (Paid but reasonably priced)
- GIMP 2 – Image manipulation program that will be used to combine the Background Image with the identified meteors.
 - Ref: <https://www.gimp.org/> (Freeware)

Merging Images in DeepSkyStacker

Using DeepSkyStacker software to combine Darks and Background Images into a low noise single image. It is recommended TIFF images that were created with use of the DECRAW program from RAW images be used for this process.

Key DeepSkyStacker Commands

Key Menu(s)	Description
Registering and Stacking Open Picture Files	Load Picture files to be merged
Registering and Stacking dark files	Load Dark Files used for noise reduction
Registering and Stacking flat files	
Registering and Stacking Check All	Select all loaded files for processing
Registering and Stacking Stack checked pictures...	Combine all selected files (Darks, Pictures etc.) into single TIFF image
Processing Save picture to file...	Save stacked image to TIFF file for further processing.

- Open the DeepSkyStacker application
- **Load Pictures** – Load all photos | [Registering and Stacking](#) | [Open Picture Files](#) | that are the focus of this photo session.
- **Load Darks** – Load all darks | [Registering and Stacking](#) | [Dark files](#) | associated with this set of photographs. Darks are photographs taken at the same ISO, exposure, and roughly same temperature as the picture files. They are created by covering the lens and taking a picture. This is typically done at the beginning and end of a photo set. Generally 3-5 photos are taken.
- **Load Flats** – Load all flats | [Registering and Stacking](#) | [flat files](#) | associated with this set of photographs. Flats are images of a flat field to identify optical imperfections that can be subtracted from the final image. Flats are taken at the start or end of a photo session. Exposure time is dictated by the luminance of the flat field. Histogram of this photo should peak at about 1/3 of the graph. ISO and lens focus should remain unchanged. Generally only one Flat is taken. Flats are generally used when taking photo through a telescope and are probably not required for normal camera/lens photographs.
- **Check All Files** – Select all loaded files | [Registering and Stacking](#) | [Check All](#) | for processing.
- **Stack Pictures** – Start the Stacking Process | [Registering and Stacking](#) | [Stack checked pictures...](#) | to combine all selected images into a single image. Generally you should use the Recommended Settings. This process can take some time depending on the volume of pictures you are stacking.
- **Save Picture** -

Stacking Meteors

Using the GIMP 2 software, we combine the Background Image with Images containing meteor trails.

Key GIMP Commands

Key(s) shortcuts	Description	Key Menu(s)	Description
[Ctrl] [o]	Open File	Image Fit Canvas to Layers	Resize canvas to enclose all layers
[Ctrl] [Alt][o]	Open as Layers	Windows New Toolbox	Display toolbox
[+]	Picture Zoom In	Windows Dockable Dialogs Layers	Display Layers dialog box
[-]	Picture Zoom Out	Layer Transparency Add Alpha Channel	Add alpha channel to selected layer
[Shift] [Ctrl] [j]	Fit image to window	Colors Threshold	Convert layer to B/W
[Shift] [Ctrl][d]	Duplicate selected layer	Layer Delete Layer	Delete the active layer
[Shift] [b]	Bucket Fill	Layer Merge Down	Merge the selected layer with the layer below.
[Shift] [o]	Select regions with similar colors	File Export As	Export GIMP project to desired file format
[Ctrl] [i]	Invert Selection		

- Open GIMP 2 application
- **Open Toolbox** - If a toolbox is not open already, Display a new toolbox | [Windows](#) | [New Toolbox](#) |
- **Open Layers Dialog** – If the Layers Dialog box isn't already open. | [Windows](#) | [Dockable Dialogs](#) | [Layers](#) |. This can be docked in the Toolbox by dragging and dropping the Layers tab in the toolbox.
- **Load Background Image** – Load the Background Image into GIMP [Ctrl] [o].
- **Fit The Image** - Fit the Background Image to the window [Shift] [Ctrl] [j].
- **Load Meteor Layer** – Load one of the identified images containing a meteor trail as a layer [Ctrl] [Alt][o]. We are going to take this layer and eliminate all in this image but the meteor trail that will then be added to the Background Image.
- **Hide All Other Layers** – In the Layers Dialog, click on the eye icon on the left most column to remove the icon and hide the selected layer. Do this for all layers except the one you will be working with.
- **Process Meteor Layer** – Follow the steps identified below for each image containing a meteor trail
 - **Duplicate Meteor Layer** – In the Layers Dialog, select the newly loaded Meteor Layer. Duplicate this layer [Shift] [Ctrl][d]. We will be using this layer to define the Meteor trail so we can delete the rest of the image on the original Meteor Layer.
 - **Convert to B/W** – We will convert the Duplicate Meteor Layer to a Black and White Image | [Colors](#) | [Threshold](#) |. Use the slider in the Threshold dialog to make the meteor trail as visible as possible without having the background begin to show, we want the meteor trail well defined from the background.
 - **Color the Meteor Trail** – With the Duplicate Meteor Layer
 - Zoom into the meteor trail [+] and center the image on the trail. This makes filling the meteor trail easier.
 - In the Toolbox, Select the Foreground color icon and select any easily visible color (Green) for the foreground color.
 - Fill the Meteor trail with the foreground color using the Fill Bucket [Shift] [b] tool and clicking in the meteor trail. Make sure you have selected the entire meteor trail and that no areas outside of the trail are colored. You can use the paintbrush or eraser to cleanup any background that was colored.
 - **Select the Meteor Trail** – Use the Select by Color tool [Shift] [o] to select the identified meteor trail. At this point we are done with Duplicate Meteor Layer, you can delete | Layer | Delete Layer |. At this point the Meteor Layer should be the active layer, and the meteor trail should still be selected.
 - **Add Transparency** – Add the Transparency (Alpha Chanel) to the Meteor Trail Layer | [Layer](#) | [Transparency](#) | [Add Alpha Channel](#) |. This will allow us to add the meteor trail to the Background Image later.
 - **Delete Background** – Now we need to delete all but the meteor trail in the Meteor Trail Layer. This is accomplished by first, inverting our selection of the Meteor Trail [Ctrl] [i] so now all but the meteor trail is selected. Select the [Delete] key to delete all the image but the un-selected meteor trail.
- **Arrange Layers** – Make sure the Background Image appears in the bottom of the layers list by selecting it and dragging it down. In the Layers Dialog box.
- **Show Layers** – Preview what the final image will appear as by selecting the left most column for each layer in the Layers Dialog box, this will make the layer visible.
- **Merge Meteor Layers** – Once I determine all the meteors I want to keep, I generally will merge them all together as a single layer. Merge layers using the command | [Layer](#) | [Merge Down](#) | on each of the meteor layers until they are all combined into one layer. I then save the GIMP file | [File](#) | [Save](#) | in case I would like to process it differently (ie reprocess the Background Image in StarTools).
- **Export Image** – Finally, I will export the final image | [File](#) | [Export As..](#) | in either TIFF or JPG format as the final product. DONE!

