

# Overview of Hardware and Software Needs for Operating the Horn Telescope

## Hardware Needed

- computer running on Linux to run GnuRadio
- NOTE: GnuRadio can be run on Windows or MACOS, but installation is a little more complicated. The instructions below are for systems running on Linux.
- Airspy software defined radio dongle.

## GnuRadio

GNU Radio is very popular and robust software defined radio (SDR) package. It is open source and is relatively very easy to use. All “coding” is done using flowgraphs comprised of interconnected Digital Signal Processing (DSP) blocks. Most commonly used blocks come predefined as part of the software package however one can program their own blocks as well.

### Installation Guide

(taken from the *Digital Signal Processing in Radio Astronomy* website at <http://wvurail.org/dspira/labs/01/>)

It is relative very easy to install if you are installing on Linux. We would recommend working on linux however installing on a macOS or windows system is, albeit very hard, possible. First, we install dependences.

Open the terminal, (open by right clicking on desktop and choosing open terminal from menu)

```
sudo apt-get install git
sudo apt-get install libyaml-dev
sudo apt-get install libssl-dev
sudo apt-get install python-dev
sudo apt-get install python-pip
sudo apt-get install python-apt
sudo pip install pyopengl pyopengl_accelerate
sudo apt-get install gnuradio gr-osmosdr
sudo apt-get install limesuite airspy
sudo apt-get install gqrx-sdr
```

Restart Computer once everything is installed for good measure.

Plug in the box into the USB port. Open terminal and type `airspy_info`. It should display some hardware info about the device.

## GnuRadio Out-of-Tree (OOT) Radio Astronomy Package

The following describes how to install the files from the `gr-radio_astro` repository, which contains the files necessary to operate the telescope, especially the `spectrum_w_cal.grc` Gnuradio program.

1.) Clone the repository into an appropriate folder/repository:

```
git clone https://github.com/WVURAIL/gr-radio_astro.git
```

2.) Go to the `gr-radio_astro` folder/repository, create a build directory inside the repository:

```
cd gr-radio_astro  
mkdir build
```

3.) run `cmake` inside the build directory:

```
cd build; cmake ..
```

4.) run `make` inside build directory

```
make
```

5.) If no errors, install

```
sudo make install
```

Blocks should now be available in `gnuradio-companion`.

### Additionally install `h5py`

```
sudo pip install 'h5py==2.7.0'  
sudo pip install pyephem
```

Blocks should now be available in `gnuradio-companion`, in the `'radio_astro'` section.

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### Updating software

```
# go to gr-radio_astro directory  
git pull # pull updated changes to software  
cd build # change working directory to build  
cmake ..  
make  
sudo make install
```

This will install the updated software.

