Meteor Reflections
Radio Astronomy

By Mike Hotka

This will be a brief tutorial on how to setup a radio receiver to *listen* to meteor reflections entering our Earth's atmosphere. After listening to this, you will be able to setup and monitor meteor events in our upper atmosphere.
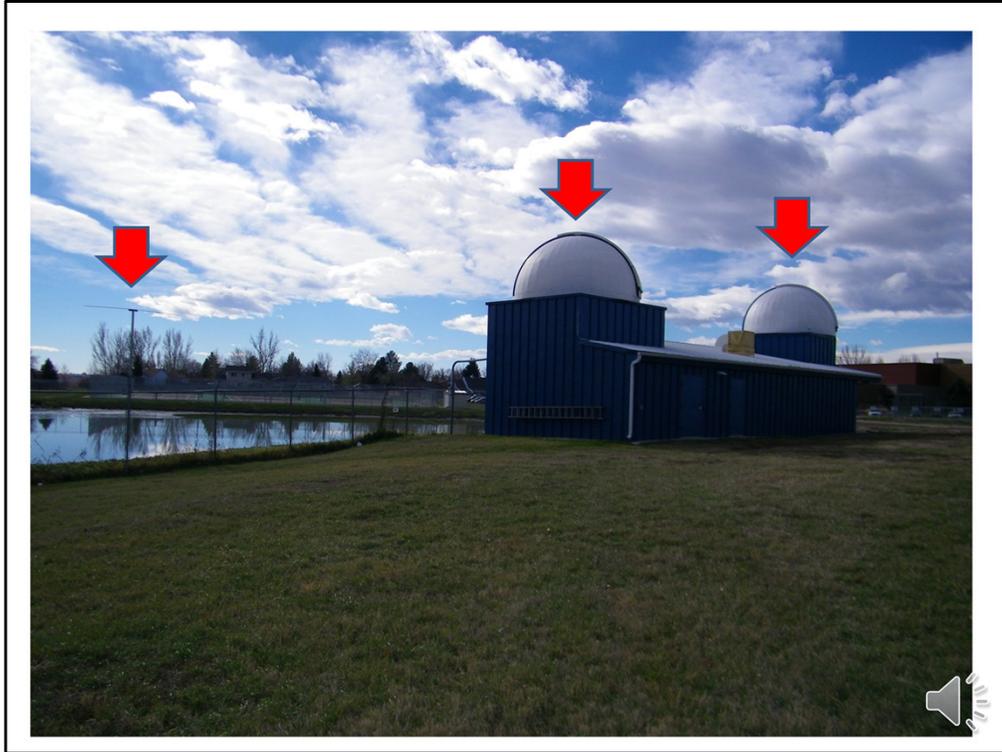
The Little Thompson Observatory is located on the grounds of Berthoud High School in Berthoud Colorado. Even though the observatory is located on school grounds, it is not owned by the school district.

Originally, **+PRESS** the Observatory housed an 18" classical cassegrain telescope in the right dome and recently **+PRESS** a 24" Newtonian telescope in the left dome.

The Little Thompson Observatory also has a set of ever expanding Radio Telescopes. There is the Meteor Reflections monitoring telescope, a Jovian Telescope and soon, a Sudden Ionospheric Disturbance telescope.

+PRESS The Meteor Reflections Monitoring antenna is located on the fence to the left of the Observatory.

Students at Berthoud High School have been using the Meteor Reflections Monitoring Telescope for a couple of years now, constantly monitoring the meteors it records and analyzing the data produced on a number of projects.

The antenna used for the Meteor Reflections Monitoring Telescope is a horizontal, half-wave dipole. **+PRESS** Each dipole of the antenna is 4' 8" long. The dipole is resonate at 55.250 MHz.
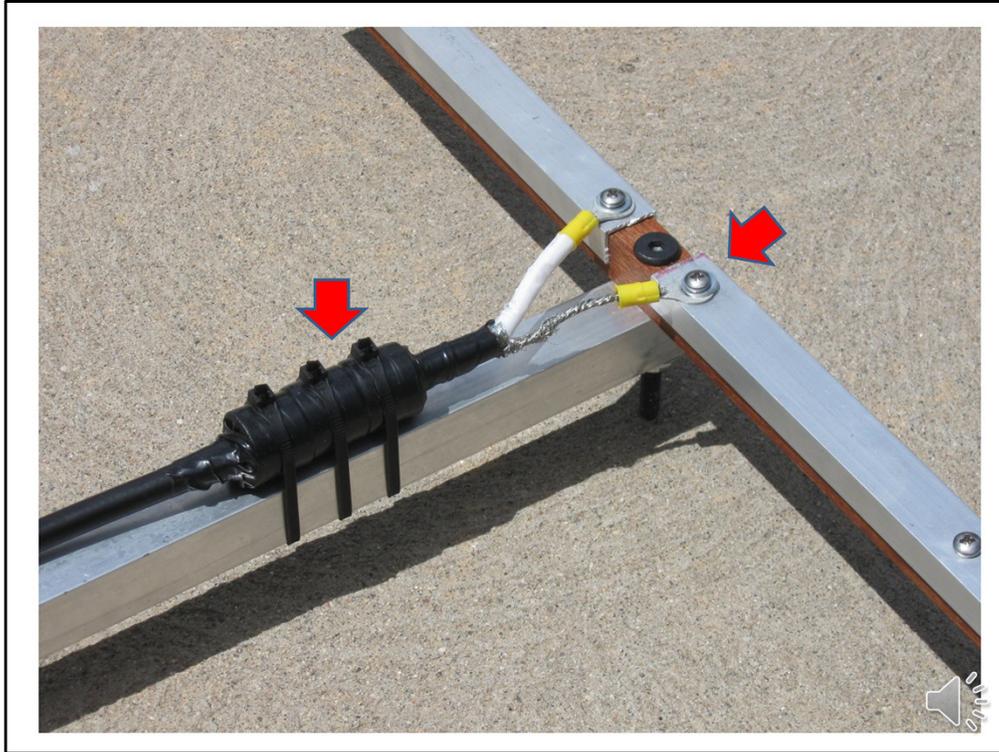
This is a close up view of the travel antenna, which is similar to the permanently mounted outside antenna. You can see it is made of 2 pieces of channel aluminum and **+PRESS** how the 50 ohm RG8U cable is attached to the antenna, with sheet metal screws, in the middle. On the permanent antenna, the joints and exposed coax ends are covered with a weather seal. A tape-like material works better than a paint-on type. **+PRESS** About 6 inches from the coax termination is a single, Type 47 ferrite RF choke. This is not necessary on a receive only antenna, but it is thought that someday this antenna might transmit a signal, hence the need for the choke.
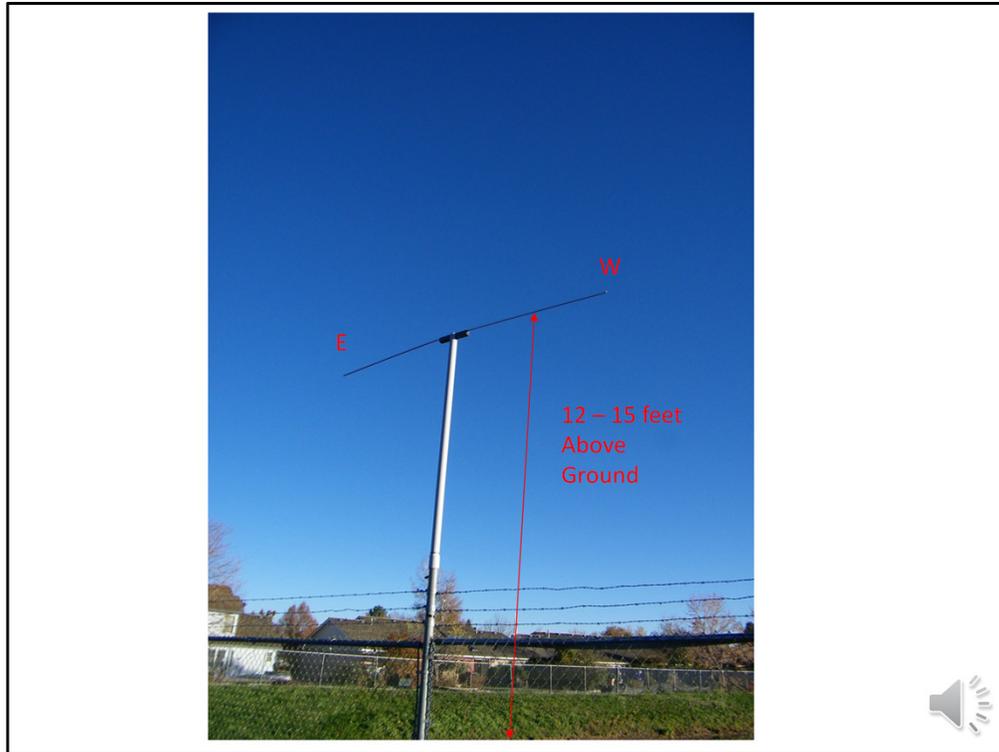
It is mounted approximately ½ wavelength above ground, **+PRESS** about 14' which elevates the radiation pattern. The height above the ground is not critical, as long as the height is about 12-15 feet. If it were lower to the ground or above one wavelength of about 20 feet, the antenna pattern would be more sensitive to interference from the horizon. **+PRESS** The antenna elements run East to West. That results in a beam pattern that favors signals from North and South, with a "pear shape" to the beam in the vertical dimension that reduces interference from the ground while emphasizing signals from higher in the sky.

The receiver is an ICOM 7000 general coverage HF/VHF/UHF receiver, set to receive Single Sideband signals. It is fed with 50-Ohm, RG8U cable from the antenna.

We use meteor trail reflections of Channel 2 Analog TV transmissions from stations in Mexico and Canada. The video signal carrier frequency is 55.250 MHz. Not all stations transmit precisely on frequency due to differences in engineering tolerances at the transmitters. As a result, we see different stations a few Hertz apart at our receiver. We tune slightly above or below 55.250 MHz in order to center the best signals in our monitor. When using Upper Sideband on our receiver, 55.2493 MHz often gives the best results, but we adjust this frequently based on ionospheric conditions and signal paths.
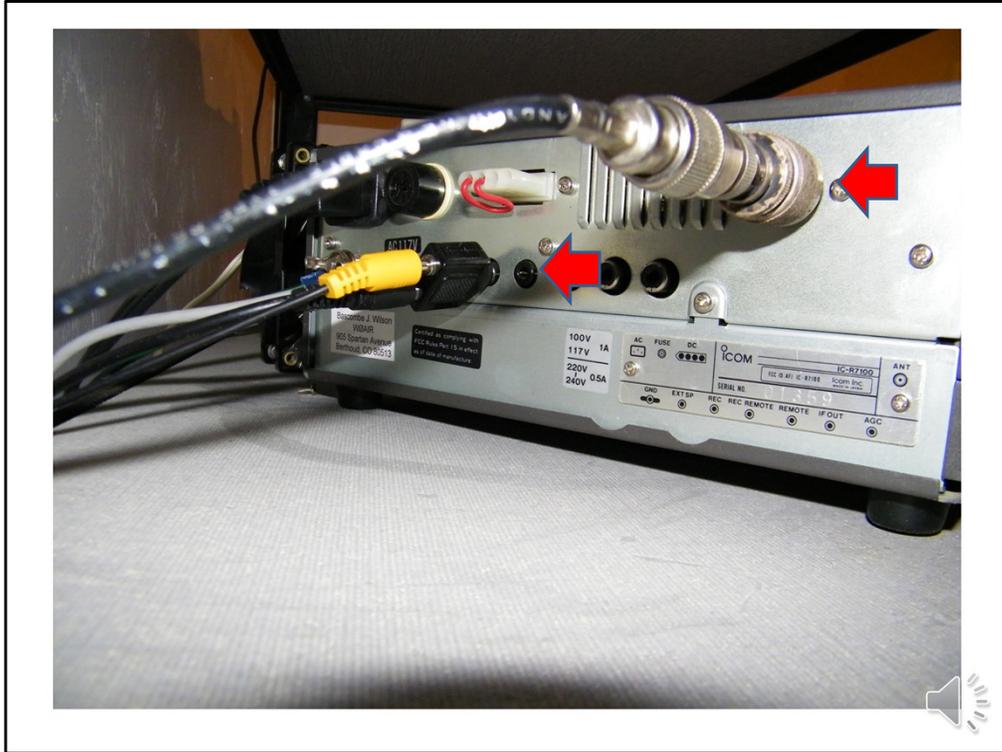
Plug the RG8U cable from the antenna **+PRESS** into the back of the receiver.

+PRESS Now take the audio output from the receiver and…

+PRESS …plug it into the computer's soundcard.

We use a Dell Precision 690 computer, running Windows 7 operating system. This setup was chosen because it gives better graphics performance.
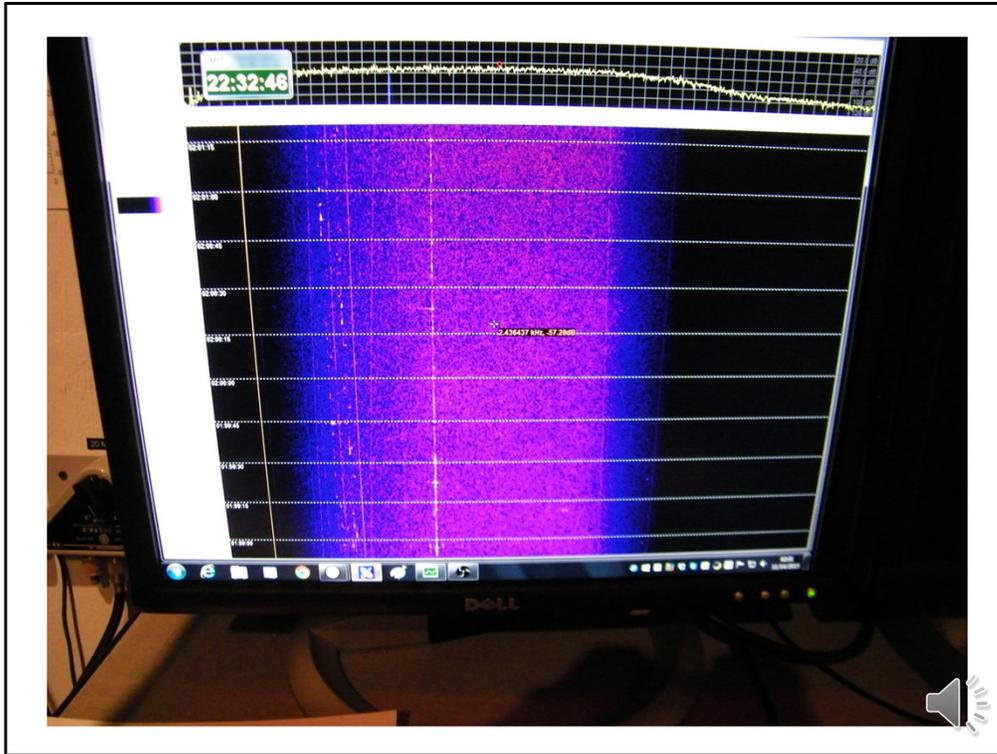
We use the program SpectrumLab to process the analog meteor signals and display the output as a waterfall display. SpectrumLab has a variety of Fast Fourier Transform (FFT) options that allow us to tailor computer output to the specifics of meteor observations. There are a very large number of parameters that can be adjusted, such as audio sampling rate, upper and lower frequencies of the spectrum sample, integration speed or signal averaging. All these parameters can be set from the program's control panel and change the appearance of the waterfall and recorded files. We've selected settings that highlight the kinds of reflections meteors and meteor trails give.

The SpectrumLab software is configured so that it runs 24x7 and displays a waterfall of the signals coming through the receiver's bandpass, which is about 2.5kHz. We do not have the program configured to be triggered by events, such as a strong meteor, although it is possible to do that with the software.

Watch Our Live Meteor Streaming

http://obsproject.com/forum/resources/directx-dependency-fixer-dxfix.87

http://www.livemeteors.com/little-thompson.html

I loaded the Open Broadcast Software program so that the main window of the SpectrumLab software can be broadcast over the internet. The initial installation of the OBS software had an issue with the Direct X software already loaded on our computer. A patch was installed that loaded 4 additional Direct X components, **+PRESS** found at this URL https://obsproject.com/forum/resources/directx-dependency-fixer-dxfix.87/).

I configured the software to display the main SpectrumLab waterfall window and used an IP Address provided by the livemeteors.com hosting provider. In a web browser, **+PRESS** enter this URL http://www.livemeteors.com/little-thompson.html and it will bring up a webpage that is connected to our live stream of meteor data.

Having this internet broadcast capability will allow the Berthoud HS STEM students to write application software that would go beyond the capabilities of SpectrumLab, to time the delta between reflections from a meteor coming from different transmitters, as a way to determine direction of meteors, and to accurately measure Doppler frequency shifts for velocity measurements.

That is all you need to do to get your Meteor Reflections Monitoring Telescope operational. It is very simple and easy to do.