

Sudden Ionospheric Disturbances (SIDs) are rapid changes in the Earth's Ionosphere caused by X-ray flares erupting on the Sun. These release massive amounts of X-ray and UV radiation and, nine minutes later, this wall of energy slams into the top of our atmosphere, modifying the way it reflects signals from low-frequency (15 to 30kHz) radio stations. The result is a distinctive 'sharks fin' change in the received signal strength which reveals that a flare event has occurred.

A SID detector is easy to build, being nothing more than a simple loop aerial connected to the microphone socket of a computer. If this sounds confusing, remember that all a microphone does is convert changes in air pressure (sound waves) to tiny electrical signals that are amplified by the sound card in your computer. In contrast, an aerial converts changes in electromagnetic fields to tiny electrical signals, and at these low frequencies your sound card can act as a perfectly good receiver.

Unfortunately, the microphone performance of computers is very variable. There is also a very small risk of damaging the computer from static electricity. An alternative is to use a low-cost external USB sound card and details of four of these, varying from £1 to £20, are included on this month's cover disk, along with further information on how to observe and record SID events.

### **Wind that loop**

The loop dimensions are not critical but it should be at least one metre square. That's quite a size, but it can be hung on the wall of your observatory or in the loft, away from sources of radio interference such as computer monitors and plasma television screens. Larger is always better, even if this means fewer turns of wire, so go for the biggest area you can.

Use Bell Wire for the loop itself. This consists of two PVC-coated wires, usually with a stripe marking one of the cores. Buy a 100-metre reel from a local electrical wholesaler or a supplier such as National Lighting, choosing a product with solid copper wire rather than copper-coated aluminium.

Decide on a size for your loop and make a wooden cross to help you wind it. You can then remove the frame if wanted and simply drape the loop in its final location, or perhaps enclose it in plastic mini trunking for a tidier finish. The loop is directional and the best results will probably be with the winding aligned in a North-South direction.

Finally, you will need an audio cable with a standard 3.5 mm plug on one end to connect the loop to the microphone socket of the sound card. The easiest solution here is to use a ready-made cable and cut off the unwanted connector.

### **Let's see those radio stations**

Plug in the USB sound card to your computer and wait for any driver installation to complete – this really can take several minutes! Then adjust the configuration settings under Sound in the

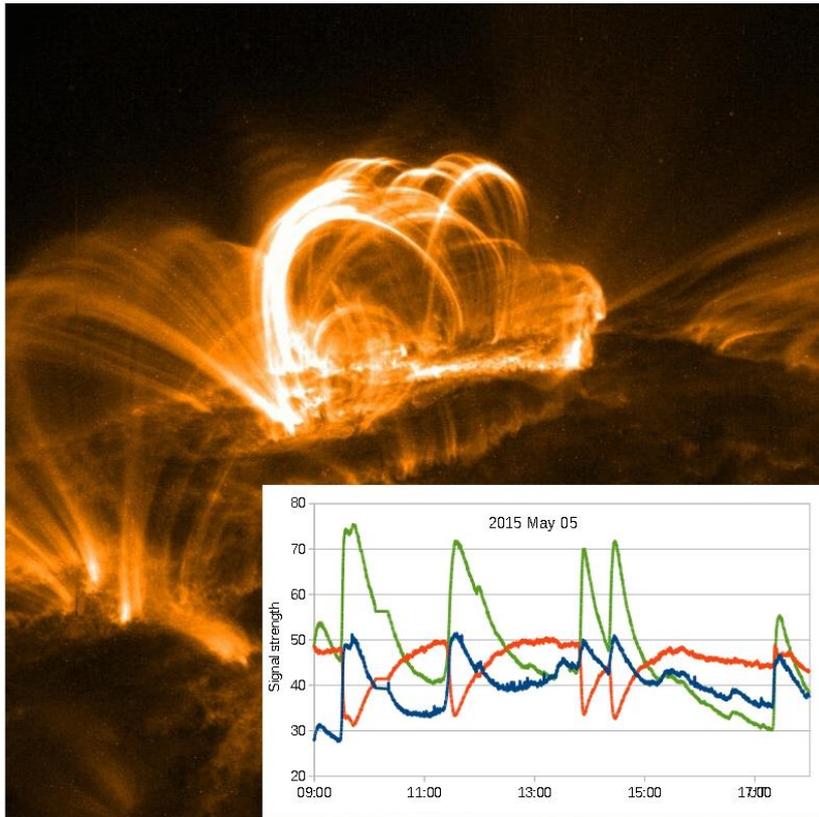
computer's Control Panel. For the final set up, move the sound card to the aerial and use a USB extension cable to connect it to the computer.

The software for displaying and recording the signals is Spectrum Lab, as used for monitoring meteors in our 'How to ...' article last year. This will run under Windows XP, 7 and 8. Download and install the latest version and then use the FILE and LOAD SETTINGS FROM options to load the RAG\_SIDv1 configuration file.

Select the external USB sound card as the source using Spectrum Lab's OPTIONS and AUDIO SETTINGS tabs. You should now see several VLF stations appear in the Waterfall window. Then use the VIEW, WATCH LIST and PLOTTER options to display the Plotter chart which reveals the sudden changes in signal levels caused by X-ray flares, a sure sign that it's time to get your solar telescope out!

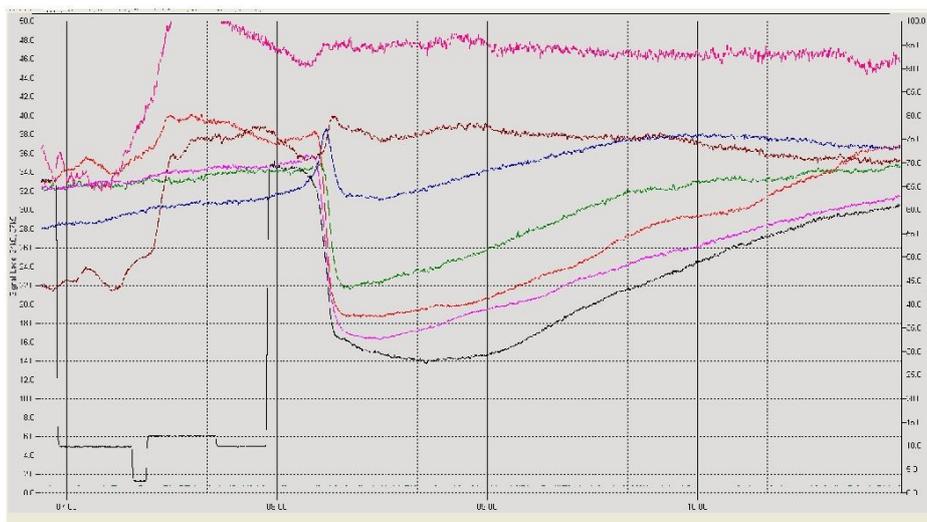
639 words

## MAIN PICTURE



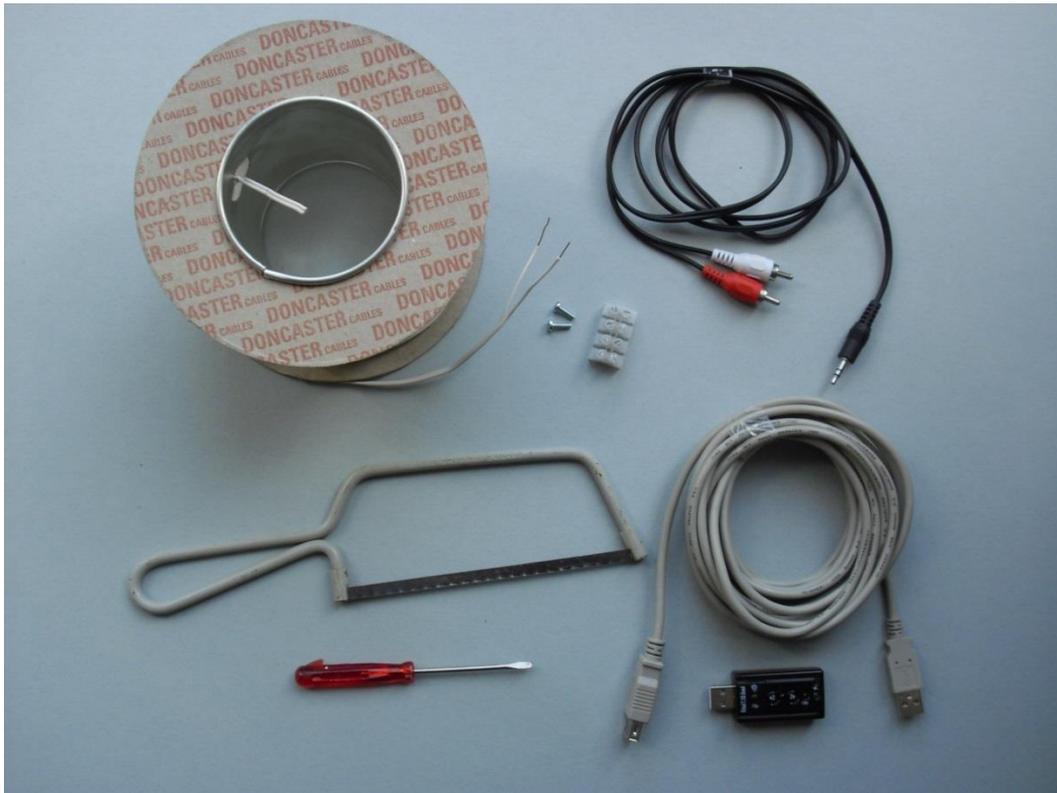
Background image: [http://www.nasa.gov/images/content/162169main\\_Trace\\_solar\\_flare\\_lg.jpg](http://www.nasa.gov/images/content/162169main_Trace_solar_flare_lg.jpg)

## SECONDARY IMAGE



Suggested caption: See the effects of solar X-ray flares on radio signals

## TOOLS AND MATERIALS



### TOOLS

Small screwdriver and hacksaw

### CABLES

A 100-metre reel of Bell Wire, a Mono or Stereo audio lead with a 3.5mm jack at one end, and a 5 metre USB2 extension lead. Longer length 'active' USB leads are also available.

### HARDWARE

4 metres of 12 x 32mm (or similar) timber for the frame

A USB sound card such as the USB2.0 Audio Sound Card Adapter from PlusBee. See this month's cover disk for more information.

### SOFTWARE

Spectrum Lab, available from [www.qsl.net/dl4yhf/spectra1.html](http://www.qsl.net/dl4yhf/spectra1.html), and the RAG\_SIDv1 configuration file available from [www.skyatnightmagazine.com.cd/config.zip](http://www.skyatnightmagazine.com.cd/config.zip)

89 words

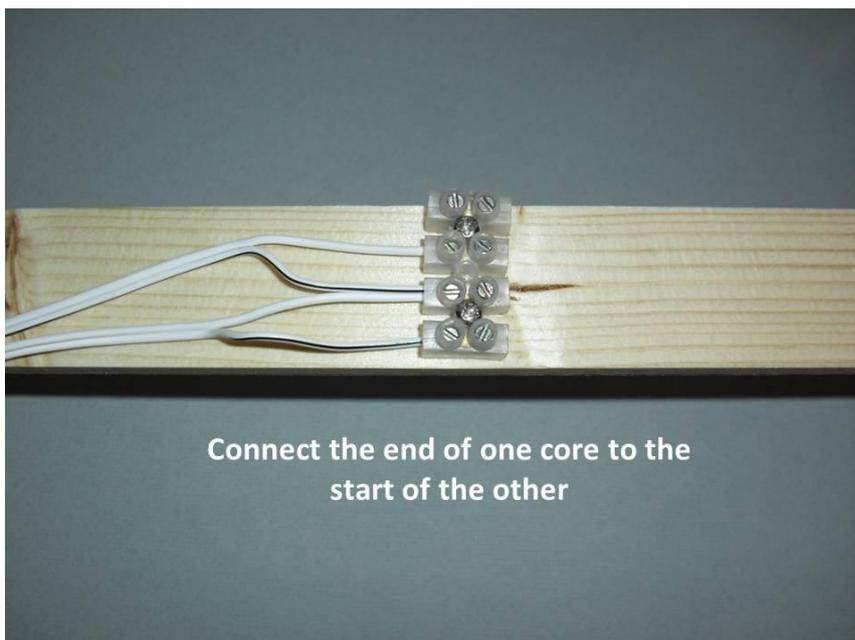
## STEP 1

Cut notches at each of the temporary frame to hold the wires in place. Avoid twisting the wire and keep the windings taught, but don't overstretch the cable! Then use tie wraps or insulating tape at 100mm spacing to bundle the wires together. 43 words



## STEP 2

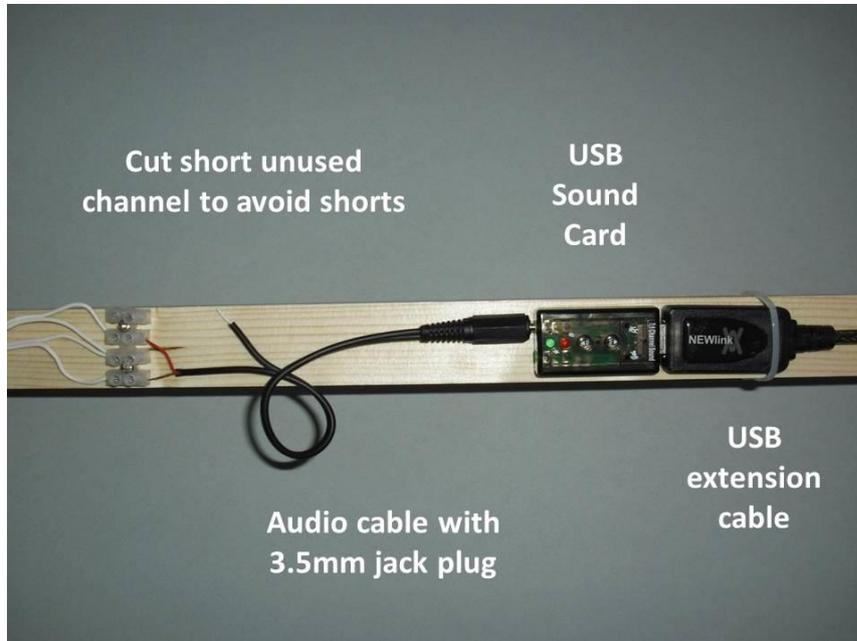
Screw a 4-way terminal block to one leg of the frame and connect the bell wire cores so as to create a single, continuous loop. Make sure you connect the wires as shown or you will lose half your signal! 40 words



### Step 3

Remove 10cm of insulation from the audio lead and connect the centre wire to one end of the loop and the braid to the other end. Add the USB sound card once you have set it up on the computer.

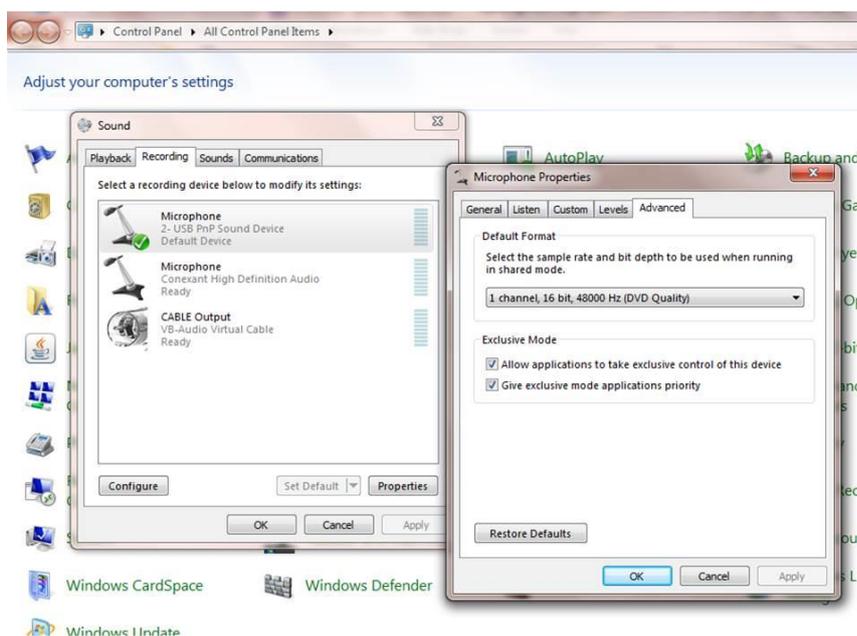
40 words



### Step 4

It's better to do the initial installation of the USB sound card with it plugged directly into the computer. Then check its microphone (Recording) settings - the Sample Rate should be 48000Hz or higher, the Level should be set to maximum, and AGC switched on.

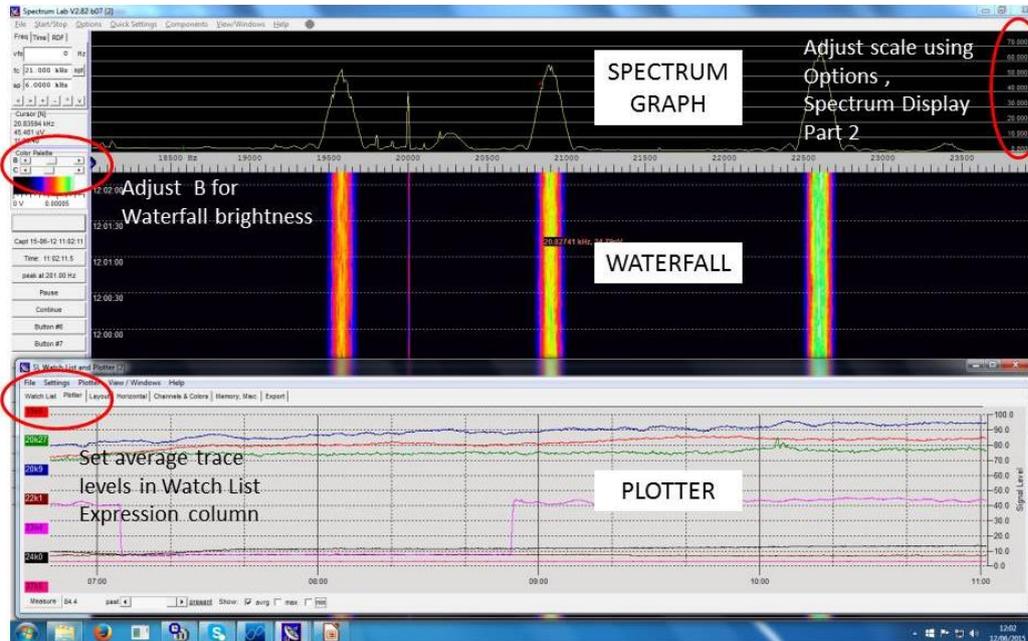
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## Step 5

As each aerial and sound card will be different you will need to adjust the scales for each window to match your installation. The Plotter window is the one used for day-to-day observing and you can adjust each signal to fall about two thirds up the chart by modifying its Watch List entry.

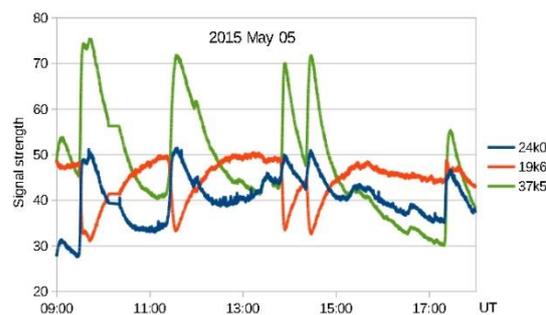
53 words



## Step 6

For detailed analysis it is better to use a spreadsheet to import the daily text files that are saved in the Spectrum system folder. The article on this month's cover disk explains how to measure and report SID observations to the BAA's Radio Astronomy Group.

45 words



Start (UT)	Max (UT)	End (UT)	Imp	Comment
09:29	09:34	11:19	3	
11:21	11:34	12:55	3	
13:48	13:54	????		End lost in next flare
14:21	14:27	14:54	2	
16:32	16:37	16:54	1	