Natural Radio

News, Comments and Letters About Natural Radio

February 2011

This morning, I went to the first hamfest of the 2011 season with my son Jeff. January hamfests have a little different character than summer ones since most people, myself included, don't really like the idea of hauling all of their stuff into a building usually through a very icy parking lot and then hauling the bulk of it back to the car and then the basement or garage. So this one is mostly dealers selling books, connectors and the like and thus there are not very many interesting finds.

Jeff sells custom boards and kits and components based on the Arduino platform and generated a lot of interest. Fortunately, the stuff is small and light so there was only one trip in and one trip out and a cart was not necessary.

The Arduino is an open-source electronics prototyping platform based on flexible, easy-to-use hardware and software. I wasn't much help to him since I haven't experimented with the board or software yet, so I guess I'll get a board and download the programming environment and try to learn enough that I can at least answer basic questions. I don't know of any Natural radio applications off hand, but with its analog inputs, an Arduino might be useful for monitoring SIDs or counting lightning strikes or some other data loggin or display application. I'm sure I can come up with a few ideas once I get a board in my hands.

Since my ignorance wasn't of much help to him, I took the opportunity to finally take the exam for the Amateur Extra license. I passed, but I see that I need to do a bit of reading to update myself on some of the new operating modes and other innovations.

I had hoped to have some more information this month on the receiving system I am working on using the Emu 0202 USB sound adaptor with Spectrum Lab. A little more experimenting confirmed that I need to construct an antenna away from the house and that is going to have to wait until the weather warms up a bit. Due to the number of mature trees the antenna will probably need to be a loop, and probably in the front yard as the power lines are in the back. Making it unobtrusive should be interesting.

***Neon Bulb Trivia* –** I often enjoy the nostalgia of reading about the obsolete electronics of my youth and recently purchased a copy of the 1963 General Electric Glow Lamp Manual on Ebay. At that time neon bulbs were used as oscillators, voltage regulators, voltage detectors and even as components of computer logic circuitry. Now I really have no plans to build a neon bulb based computer, but I was interested in finding out more about their application as a protection device on the front end of Natural Radio receivers. Unfortunately, this application was not even mentioned in the GE manual.

Neon bulbs work in this application by providing a low impedance path to ground for static build-up or voltage spikes induced by lightning once the breakdown voltage of the bulb is exceeded. I looked through the book to see if I could find any particular devices that might offer more protection than another. I found that some neon bulbs were susceptible to the "dark effect" where the firing voltage of the bulb would increase by many volts if the bulb was kept in the dark for an extended period of time. GE minimized this problem by doping the electrodes with a little radioactive material to counteract this effect.

A standard NE-2 bulb doesn't have this but the NE-2V does. The current replacement for the NE-2V is the A2B bulb manufactured by Eiko and others. It's available from a variety of sources for less than a buck. How much more protection it will offer is anyone's guess, but it's probably the better choice for front end protection. The firing voltage is around 60 volts.

Another Reason To Avoid Lightning – Early in January during a news briefing at the American Astronomical Society meeting in Seattle, Michael Briggs, a member of Fermi's Gamma-ray Burst Monitor (GBM) team at the University of Alabama in Huntsville (UAH), presented the first direct evidence that thunderstorms make antimatter particle beams.

Terrestrial gamma-ray flashes (TGF) were first discovered in 1994 by the Compton Gamma-Ray Observatory, a NASA spacecraft. A subsequent study from Stanford University in 1996 linked a TGF to an individual lightning strike occurring within a few ms. of the TGF. The newer RHESSI satellite has observed TGFs with much higher energies than those recorded by Compton, but the mechanism was still unknown.

In 1998, the Fermi spacecraft was launched. Fermi's GBM was designed to observe high-energy events in the universe and constantly monitors the entire celestial sky above and the Earth below looking for gamma rays, the highest energy form of light. The GBM team has identified 130 TGFs since Fermi's launch in 2008.

The GBM has detected gamma rays with energies of 511,000 electron volts. This signature indicates an electron has met its antimatter counterpart, a positron, and provides direct information about the source of the gamma rays.

What's interesting is that while most of the TGFs were detected when Fermi was orbiting directly over a thunderstorm, there were four cases Fermi was far away from any thunderstorm activity. In addition, sferics detected at the same time by a global monitoring network indicated the only lightning at the time was hundreds or more miles away.

During one TGF, which occurred on Dec. 14, 2009, Fermi was positioned over Egypt. But the active storm was in Namibia, some 2,800 miles to the south. The distant storm was below the horizon and not visible to Fermi, so any gamma rays it produced would not be visible to the satellites detectors.

Nevertheless, the TGF produced high-speed electrons and positrons, which were injected into the ionosphere and ducted along Earth's magnetic field to strike the spacecraft. The stream continued past Fermi, reached the mirror point, where its motion was reversed, and then hit the spacecraft a second time just 23 milliseconds later. Each time, positrons in the beam collided with electrons in the spacecraft. The particles annihilated each other, emitting gamma rays detected by Fermi's GBM.

So it appears that these particles follow a field line, just like a whistler and bounce back in a similar manner. It will be interesting to see if there is any relationship between the two.

Considering the amount of positrons in the beam Fermi detected, the thunderstorm was briefly creating more radiation—in the form of positrons and gamma rays—than what hits Earth's atmosphere from all other cosmic sources combined,

Dr. Steven Cummer at Duke University added that nobody knows why some thunderstorms produce gamma rays while most do not.

"We really don't understand a lot of the details about how lighting works," he said. "But discovering the creation of positrons gives us a very, very important clue as to what's happening."