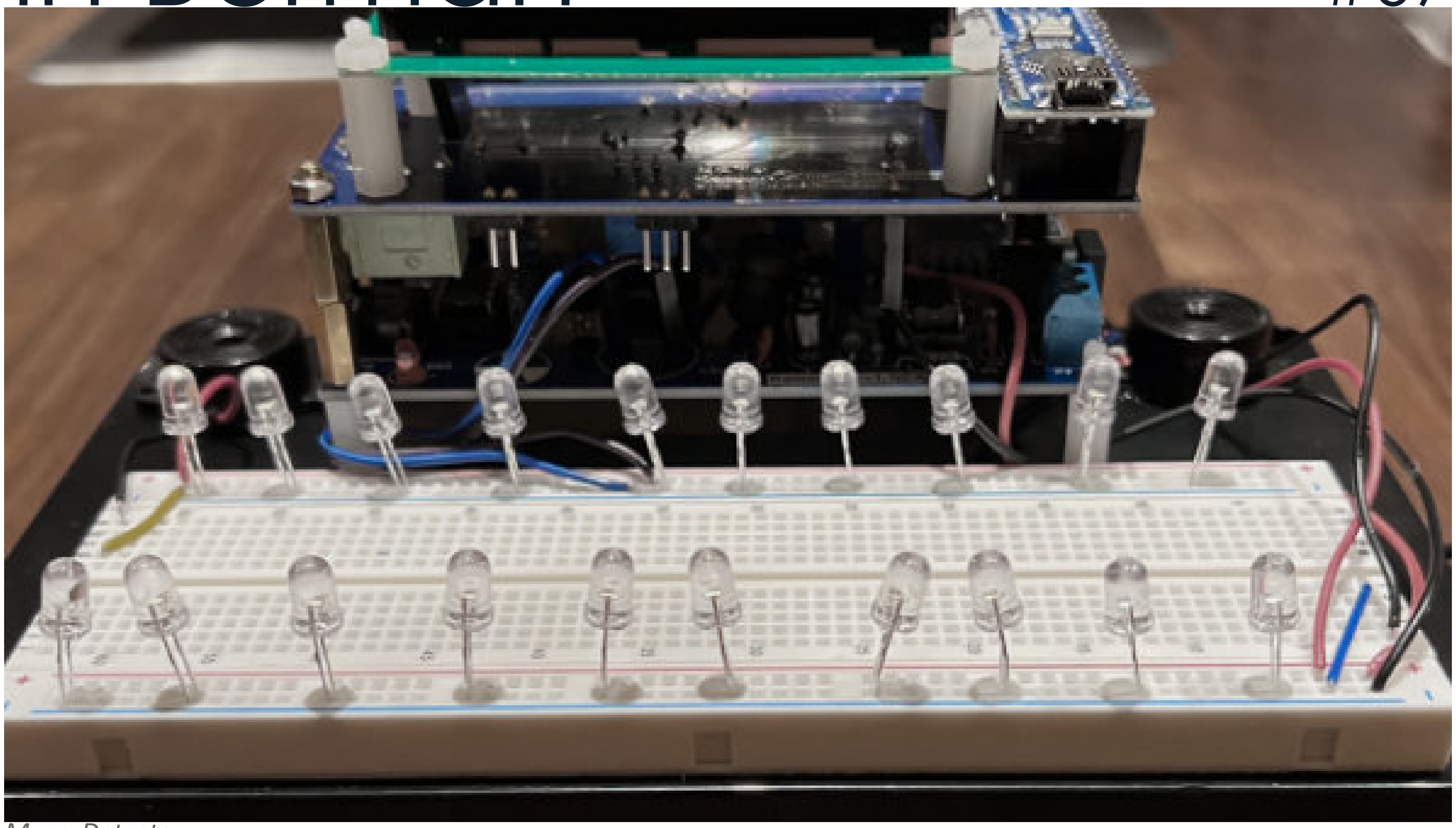
# Periastra : Participant Information

# John Berman #07



*Muon Detector*

## About muons

**Where do Cosmic Muons come from?**

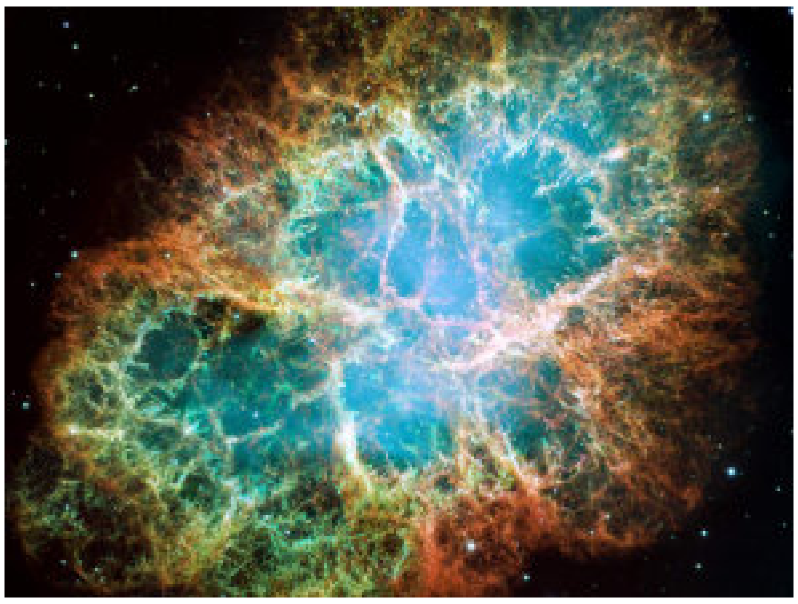
1. From outside the solar system e.g. Supernovae - exploding massive stars - are one source of cosmic rays.

2. From within the solar system e.g. Solar cosmic radiation, high energy particles (predominantly protons) emitted from the sun.

Muons are generated in the Earth's upper atmosphere by cosmic rays (particles) colliding with atomic nuclei of molecules in the air. The muon only has a lifetime of 2 millionths of a second so, given that they will travel over 10,20, 30 km, how are there any left to detect at the surface?. How are we able to detect them?

*Time dilation*

A muon moves at about 99.999% the speed of light, every 660 meters outside of its reference frame will appear as though it's just 3 meters in length. A journey of 100 km down to the surface would appear to be a journey of 450 meters in the muon's reference time frame, taking up just 1.5 microseconds of time according to the muon's clock.



*Cosmic ray source: Crab nebula: Messier 1*

*Cosmic rays cascading and fragmenting onto the Earth*

# About the muon detector

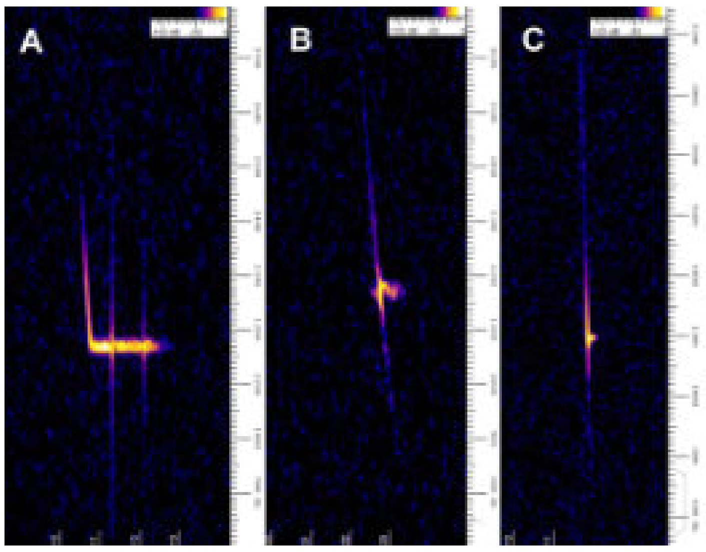
About the detector

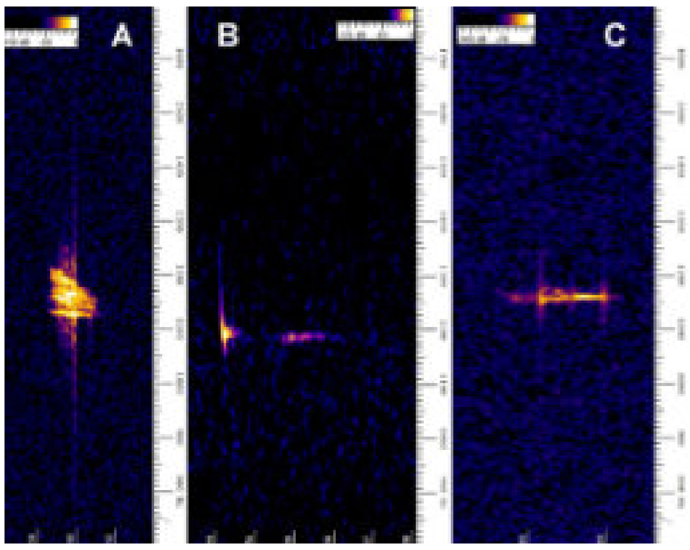
There are several ways to detect them, some of which are quite expensive

I have opted for a Geiger Müller (GM) tube, they are low cost and require relatively simple electronics A GM tube will detect alpha particles, beta particles, gamma rays and Cosmic Muons If we have one or more detectors then we can stack them, an event registered on all GM tubes simultaneously will be a muon and not background.

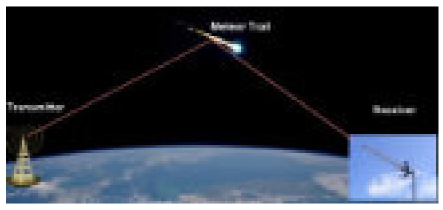
These two detectors are currently working independently as I need to build the interface electronics. Each time an event is registered the blue light flashes, once the interface is built, I can then determine simultaneous events which will be Muons - Currently the detectors are registering alpha particles, beta particles, gamma rays and Cosmic Muons

## Movie of meteor detection




*Spectrograms of radar-wave reflections by meteors*



*Whilst we may all have seen meteors from the showers (if it's not cloudy). Radio Astronomers can see and hear the meteors using relatively simple equipment.*

In this instance the Receiver is based in London and we are using the GRAVES(French radar-based space surveillance system) transmitter near Dijon, France.

We pickup up reflections from ionisation in the upper atmosphere. Such ionisation is created as a meteor ablates in the atmosphere.

The Video in this exhibition is an edited version of the 2020 Perseids Meteor Shower and it shows meteors being detected and their trace being displayed on the screen along with an audio tone. Above are some examples of what you may see when you watch the video

*On the left above:* Time is indicated on the x-axis (seconds) and frequency on the y-axis (Hz). Three head echoes are shown. (A) represents a complete reception of a meteor reflection with head echo and meteor trail. (B) and (C) display head echoes with only small fractions of meteor trails.

*On the right above:* Spectrograms of radar wave reflections by meteors. Time is indicated on the x-axis (seconds) and frequency on the y-axis (Hz). Three differently fragmented meteor trails are shown. (A) presents a short fraction out of a multiple meteor trail. (B) lacks the middle part of its meteor trail. (C) displays a meteor trail with a strange trend of signal strength.

https://radiometeordetection.org


**Perseid Meteor Shower from 2020**

The Perseids are a prolific meteor shower associated with the comet Swift–Tuttle. The meteors are called the Perseids because the point from which they appear to hail (called the radiant) lies in the constellation Perseus.

The Shower runs annually between the 16th July and 23rd Aug with the peak of the shower being 12th \ 13th of August.

# AstroArt

All of the images you will see were taken using a Skywatcher 250 Reflecting Telescope and a Modified Cannon 450 Camera, they were from Kenley (3 miles south of Croydon)

The picture below is representative of the setup

The Cannon Camera (less the lens) is connected to the telescope and then pointed to the object ion question after which multiple long exposures shots are taken (typically 300 seconds) these are then combined to produce the final image. Post processing involves Cropping and adjust Levels and Curves only – the colours see are part of the original image.

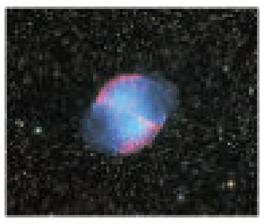
Stars do not have spikes, they are an artefact of the Newtonian telescope

**Light moves quickly**

Light travels 300,000 km/sec (186,000 miles/sec). So in 1 Light year light has travelled 9.46 trillion kilometres (5.88 trillion miles)

(A traveller, moving at the speed of light, would circum-navigate the equator approximately 7.5 times in one second.)

## Examples of astro-photography in the exhibition



**1 - The Dumbbell Nebula**

The Dumbbell is a planetary nebula (nebulosity surrounding a white dwarf). Distance from Earth - About 1360 light-years

**2 – The Bubble Nebula**

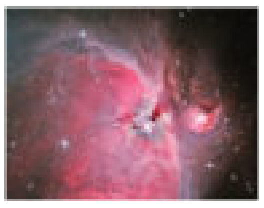
The Bubble Nebula, is created by the stellar wind from a massive hot young central star. Distance from Earth - About 11,090 light-years

**3 – The Pleiades or Seven Sisters**

The cluster is dominated by hot blue and luminous stars that have formed within the last 100 million years. Distance from Earth - About 444 light-years

**4 – The Great Globular Cluster in Hercules**

The cluster is composed of several hundred thousand stars, the globular cluster is one of over one hundred that orbit the centre of the Milky Way. Distance from Earth - About 22,220 light-years



**5 – The Orion Nebula**

The Orion Nebula is a diffuse nebula situated in the Milky Way, being south of Orion's Belt in the constellation of Orion. Distance from Earth - About 1,344 light-years

**…and 5 more.**