MAGIC

2013-08-28 update

A newsletter for non-scientists (and scientists) interested in MAGIC

MAGIC is a field program funded and operated by the Atmospheric Radiation Measurement (ARM) Climate Research Facility of the U.S. Department of Energy. The ARM MAGIC webpage is http://www.arm.gov/sites/amf/mag.
All previous updates and other MAGIC information can be found at http://www.bnl.gov/envsci/ARM/MAGIC/.

The *Spirit* is scheduled to arrive at the Port of Los Angeles tomorrow morning, completing MAGIC Leg17B. Mike Jensen, with whom I work here at Brookhaven National Laboratory, and Yuan Gao, a scientist from Rutgers, rode the *Spirit* to Honolulu and back on this last leg. I'm anxious to hear how they fared on the return trip. I talked to Mike briefly while he was in Honolulu and he said all was well, and he sent me a message and said he had a great time on his day off in Hawaii.

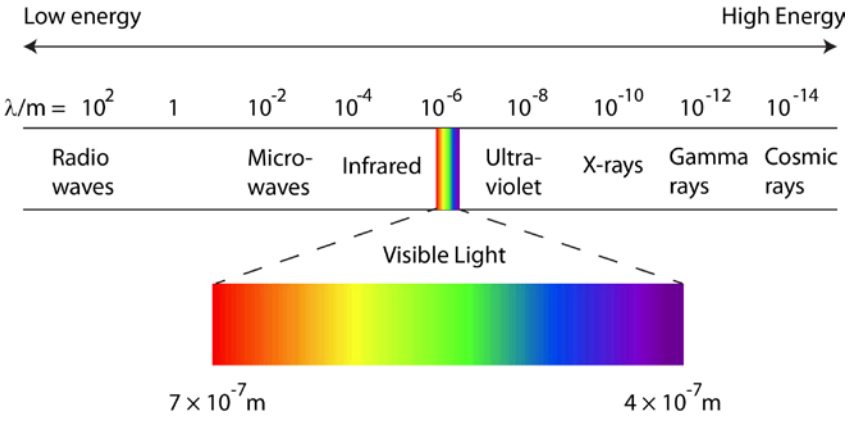
MAGIC is winding down, with only two round trips left before the vans with the instrumentation and the radars are coming off. They will go to Finland this fall for a field program starting in January of next year. I'm working on a plan to keep a small set of instruments on the ship so that they can provide some basic but important data on a continuous basis. The requirements are that these instruments are either spares or aren't needed for the Finland deployment, that they be robust and reliable, and that they be able to operate autonomously (i.e., without a tech on board). Someone could meet the ship in port and download the data every two weeks, or even every month. There are several instruments that match these criteria. The mast meteorological system, which provides key measurements of temperature, pressure, relative humidity, precipitation, and wind speed and direction, is one such instrument. It has run reliably since being installed, and as it was designed specifically for this ship it won't be required in Finland (there are ground-based meteorological sensors that will do the job there). Another instrument is the portable radiation package, which consists of several instruments that measure solar radiation (which in this context means "light of various wavelengths" and not radioactivity). Other instruments are the total sky imager, which takes a picture of the sky every thirty seconds and thus tells cloud amount, a ceilometer, which tells the height of the clouds, a microwave radiometer, which tells how much water is in the clouds, and a sun photometer operated in "cloud mode," which provides information on how much light is transmitted through the clouds and on the size of the cloud drops.

Microwave radiometer
(known as “the mailbox”)

Total sky imager (TSI)

Image from TSI
(the band blocks the sun)

While I was working on this plan, I was thinking about the electromagnetic spectrum and how we are making use of it. Electromagnetic radiation, which I discussed in the MAGIC update of July 20, 2012 (I’m sure all of you recall that one!), refers to radio waves, microwaves, infra-red light, visible light, ultra-violet light, x-rays, and cosmic rays. All of these are aspects of the same physical phenomenon but differ in wavelength. The electromagnetic spectrum refers to the entire range of wavelengths. Humans see in only the visible range, and different wavelengths of visible light appear to our eyes as different colors. I think of the entire electromagnetic spectrum as comprised of different colors, most of which our eyes can’t detect. Just as there is more information in color than in black and white, we can obtain more information about clouds and the atmosphere by using this “extended” color range of the electromagnetic spectrum. As scientists, we want to make best use of the resources we have, and in this case these resources are the different “colors” of electromagnetic radiation. The microwave radiometer measures microwaves emitted from water in the atmosphere. The ceilometer sends out and receives a beam of infra-red light. The sun photometer looks at the light coming from clouds through a set of filters in the visible and infra-red ranges, and the total sky imager takes pictures of the visible light from the sky. Good use of resources!



Electromagnetic spectrum

In the figure of the electromagnetic spectrum shown above I have labeled the wavelength of red light as 7×10^{-7} m (seven tenths of a millionth of a meter) and that of violet light as 4×10^{-7} m. Any scientist knows that red light has a longer wavelength than violet light (7 is greater than 4). One can find many images similar to the one above by doing a google search on images for "electromagnetic spectrum," and the one above was based on one obtained in this manner (which I have since modified). However, some of these images, including my original one, have the wavelength of red light *less* than that of violet light, something any knowledgeable person *should* have spotted immediately. I had used my original figure in several presentations and it wasn't until I was going through one of these presentations with my summer students, Danielle and Michelle, that I noticed that the figure was wrong. As the saying goes, you can't believe everything you read, and certainly just because it's on the internet doesn't mean it's true. I'll be more careful in the future.

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Please address any questions or comments to elewis@bnl.gov.