CONSTELLATION

The Official Publication of the Bucks-Mont Astronomical Association, Inc

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President's View

Good News!

Your Executive Committee has just instituted the BMAA Outstanding Services Award. At the end of each year, the Committee will recognize those members who have contributed to the club in an outstanding way. The award will be a free membership in the club for the following year.

Observatory

Our purchase of the 14" F/7 Newtonian reflector from Willingboro Astronomical Society is moving forward. We will be making a 'good faith' down payment of $300 on March 8, when we join them for a star party. The star party is open to all members of both clubs and will be held in Cecil NJ (less than a 1.5-hour drive).

Stella-Della-Valley

We have identified nine positions that together will comprise the SDV committee this year. Names must be associated with all these positions by the next Executive Committee meeting (March 19) or SDV will be canned. It is important to note that all members of the Executive Committee favor holding SDV this, and every, year. It would be a tragic loss to the club and the local amateur astronomical community if SDV did not happen. With enough people, each one is left with a quite manageable task. And remember - we've been doing this for many years, so there's very little to actually figure out. Everyone is qualified. The positions are as follows:

Chair (1)	somebody's got to drive the SDV bus
Publicity (2)	contact various media to make sure everyone knows about SDV
Food (2)	order and pick up food
Program (1)	find and retain Saturday afternoon speakers
Vendors (1)	send out door prize solicitations, swap meet invites, thank yous
Registration (1)	maintain database as registrations come in
Brochure (1)	update the brochure, organize the teaser and mailings

I sincerely hope we can pull together and make this happen. Clear Skies...

Antoine Pharamond
President, BMAA

'NASA Space Place' column inside on page seven

Wednesday, March 5 at 8:00p - BMAA General Meeting at Peace Valley

Wednesday, March 19 at 8:00p - BMAA Business Meeting at Peace Valley

The next BMAA General Meeting is scheduled for Wednesday, April 2 at 8:00p

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BMAA MESSAGELINE - 215/579-9973

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The *CONSTELLATION* is the official publication of the Bucks-Mont Astronomical Association, Inc, a 501(c)3 non-profit organization incorporated in the Commonwealth of Pennsylvania and exists for the exchange of ideas, news, information and publicity among the BMAA membership, as well as the amateur astronomy community at large. The views expressed are not necessarily those of BMAA, but of the contributors and are edited to fit within the format and confines of the publication. Unsolicited articles relevant to astronomy are welcomed and may be submitted to the Editor.

Submission deadline for articles is the 15th of the month prior to publication.

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Bucks-Mont Astronomical Association, Inc

2003 Calendar of Events

StarWatch Chairman: George Reagan, 215/741-3701 *StarWatch@bma2.org*
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For directions, visit the BMAA website **http://www.bma2.org** or contact George Reagan**.**
Please call the information line at 215/579-9973 before you leave for any event.

Observing Tips

More atmospherics....rainbows

- by Bernie Kosher

The weather has been very uncooperative for amateur observers, clouds, turbulence and this white, cold garbage that falls from the sky.

However, these conditions can give us displays of atmospheric phenomena both beautiful and bizarre.

Last month we looked at the 22-degree solar halo, caused by refraction at the flat faces of ice crystals. This time we'll discuss the rainbow.

I imagine we've all seen one, but have we really looked with an eye towards more than the superficial appearance? I found in my reading on the subject, and in listening to a talk by Bob Summerfield at a Willingboro Astronomical meeting that there was much I did not know, and had not looked for.

So how does a rainbow form? The first things to know are basic to the physics of the rainbow.

A term used often in the literature should be explained. The 'antisolar' point is that part of the sky or ground 180 degrees from the sun. Since that is true, it follows that the shadow of your head is the antisolar point for you.

To start, the sun must, of course, be in the clear, and there must be raindrops. But where in the sky will we find the sun and the raindrops? (Note: for the time we are considering only sun/raindrop rainbows, not the ones visible in water sprays.... more on that later)

A rainbow is formed by the white light rays from the sun entering a falling water droplet, being refracted, and of course dispersed, at the air/water interface. The light ray is then reflected at the back of the droplet, and again refracted at the water/air interface with a further dispersion. The overall change in the light path is about 138 degrees.

As is obvious, this means the sun must be at your back! And the rain must be in front of you. The refracted angle you see amounts to 42 degrees (that is 180 minus 138). Therefore the rainbow you see has a radius of 42 degrees.

Well, you reason, then it follows that the sun must be less than 42 degrees high in the sky to see a rainbow at all. That is correct. With the sun at any angle greater than this no rainbow can be seen. As the sun sinks lower, the rainbow will appear higher and higher until the light from the sun is blocked by the Earth and no rainbow is possible once again.

The secondary rainbow sometimes seen is caused by the light rays striking the drop at a somewhat different angle and being refracted twice as before, but being reflected twice internally. this also would mean the color pattern of the rainbow, which is a prismatic effect, is reversed. The primary rainbow has the blue on the inside of the arc, while the secondary has the blue on the outside.

The secondary bow has a radius of 51 degrees.

The size of the drops has an effect on the color intensity distribution, and on the general intensity of the rainbow itself. Clouds obstructing the sun can cause odd plays of light and shadow. Sometimes, arcs or entire thin, defined bows appear near the primary bow. These are called 'supernumary bows.'

" But whoa!" you ejaculate. "If the droplets refract and reflect these rays back to you at a 42 radius, why is the whole sky in that direction not awash with a display of magnificent rainbows?"

"Aha!", I reply in disdain, " I read the book and understand, at least in a vague sort of way."

Since the rays of the sun are essentially parallel on striking the droplet, the rays striking the edge are refracted more strongly than those nearer the center. I digress a bit here. Raindrops are essentially spheres, not streaks as shown in drawings or as the eye perceives them. After the reflection and second refraction the rays have tended to bunch at the 42-degree angle. This effect of bunching has a name but I forget what it is. Oh dear.

Actually, there is a bit more to it than this, but I'll leave that up to those who wish to read further on the subject.

In the opening part of this talk I referred to the angle as 42 degrees. Actually, the angle is different for various colors due to the refraction, but amounts to the stated angle for practical purposes.

Since the light is concentrated at this angle of 42 degrees, it follows that the light came form somewhere, and that some other part of the sky must be darkened. This is indeed true. If you look at the outer edge of the rainbow, especially if a secondary is present, the light will be found to be noticeably lessened there.

"Well, hey, BK! Another point occurs to me! Since the antisolar point for me is slightly different than it is for you, it follows that the rainbow which I see is NOT THE ONE YOU SEE!"

Very good. And absolutely correct. Although you may be standing beside someone, the rainbow you see is not the one that person sees. And the reflection of a rainbow in a shiny surface is NOT THE SAME ONE YOU SEE IN THE SKY. You cannot see the reflection of a rainbow as there is none. Really.

To draw out that line of reasoning it also follows that the antisolar point can also be caused by sunlight reflecting off a pool of water. In that case the antisolar point is at a different point in the sky, and the associated rainbow will be a different one than the one you see directly.

Rainbows can, of course, be formed by moonlight, or for that matter by any light source at sufficient distance to have it's light rays sensibly parallel. Naturally, the light source must be intense enough for the eye to perceive the light.

Rainbows formed by your garden hose set to spray a fine mist are formed by the same process. The sun must be behind your back. The rainbow will have a radius of 42 degrees. For a real stunt, try to frame this in a camera, say as standard 35mm with a 50mm lens. No matter how far back you move, the rainbow will not fit in the camera viewfinder. This is because it is an angular measure, not a linear one. As you move back you are seeing a different rainbow!

Earlier I mentioned that an entire circular rainbow cannot be seen from the ground, as the sun must be lower than 42 degrees, and if lower than the horizon the light will be blocked. The entire arc can, however, be seen from the air. It is possible to see the entire rainbow circle if the sun is at an angle such as to send light to a fine mist at a lower level than your altitude. The subsolar point is now beneath you but accessible.

Rainbows formed by the sun shining on waterfalls can produce near circles if the sun is very low and you are looking upward, especially at a torrential flow rate like Niagara Falls with it's associated mist.

'White' rainbows are formed by superfine particles in mists, as in a heavy ground fog. Here the particles are so tiny the rays are not strongly refracted.

'Red' rainbows form when the sun is very low to the horizon, and are due to shorter wavelengths being absorbed in the air. This is the same as the reddening of the light at sunset.

There is much more to learn on the subject. Last month I recommended two books; i.e., "The Nature of Light and Color in the Open Air" and "Rainbows Haloes and Glories". These two books, and I am sure many others, will provide much interesting reading and an occasional "Ah, I see!" from the reader.

BK

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- BMAA member Bernie Kosher, bkhere@optonline.net, provides this monthly 'Tips' column. [-ed]

STUPID EYE TRICKS

- by Alan Pasicznyk

This winter has really been a dog. It is mid-February as I am writing this and the weatherman was talking about wind chill temperatures in the negative numbers, and about snow storm #1, snow storm #2, and even snow storm #3!!! It makes me wonder if those darn low-pressure systems are strung out all the way to Japan! So the question if you're an amateur astronomer is: What to do?

If you've ever watched "Late Night with David Letterman", then you may have seen "Stupid Pet Tricks" in which household pets perform strange and unusual tricks. Below are listed a number of eyeball "tricks" that you can perform to while away the time until clear and user-friendly skies prevail, and maybe even learn something about the most important piece of optics you will ever own, your own eyes.

THE TWISTING EYE - I listed this one first because it is one of my favorites and the most unexpected of eyeball functions. First, go to the bathroom mirror and using both eyes, look at your right eye, noting its position. Then tilt your head slightly to the side and then back. Your eye will twist! It is trying to give your brain a "level" view, so that when you tilt your head to the side your eye is kept level. If you have trouble seeing this because your iris (colored part of the eye) is too bland, hopefully you will have a little bit of bloodshot veins on the white of your eye (from reading this article) to use as a reference to see it twist.

THE UNRULY IRIS - While you are still in the bathroom and looking at your right eye, cover your left eye with your hand and note that the pupil (black circle) of your right eye gets larger. The Iris of the eye dilates, allowing more light and signal to the brain to compensate for the signal loss of the left eye. Uncover the left eye, and the pupil becomes smaller. Lots of fun! What does this mean for Astronomical observing of dim deep sky objects that require a dilated pupil to get the most light into the eyeball?

THE BLIND SPOT - First find a small, dim, light emitting diode such as on a VCR or cell phone charger. Put it about ten feet in front of you in a slightly darkened room. Put your hand over your left eye and look directly at the small light with your right eye. Now slowly look farther and farther to the left of the light. When your eye has moved about fifteen degrees or so away from the light it will disappear, because that is where the optical nerve connects to the back of your eye, which is insensitive to light. In everyday life your brain fills in the void as though something is there. Amazing!

AVERTED EYEBALL - So OK, If you've been doing Astronomy for any respectable amount of time you know about this one which is that the part of your vision which is least sensitive to low light levels is where your eye is looking directly looking at. What you may not know, however, is that the most sensitive part of your eye to low levels of light may be directly above or below your direct vision, and not to the right or left which may contain your blind spot.

OPTICAL FREQUENCY - Your eyes sample and your brain processes optical signals about ten times a second. For some reason this is less in the periphery part of your vision. To observe this, find a computer CRT screen, (not flat screen) and cover your left eye while looking just to the left of the screen itself with your right eye. Make sure that the screen itself is fully illuminated, not just with text. You should see the screen slightly flicker in your periphery vision. Low ambient light levels enhance this effect.

THE AFTER IMAGE - The most obvious effect of this is when someone takes a picture of you with a flashbulb camera, and you can still see the after image of the bulb after the picture is taken. At night if you quickly look from left to right past your TV set you will see a slanted after image of the TV picture, because it takes time for the electron beam in the tube to scan in the entire picture. This also works for certain distant gas fired street lamps and radio tower flashing xenon bulbs. Actually each flash of the radio tower white light is a series of short flashes. What this means in Astronomical terms is that if you have been watching TV all night, and immediately go outside into a totally dark sky, you may notice seeing a rectangular after image temporarily burned into your retina wherever you look. What does this tell you about watching TV and then trying to observe deep sky objects?

WHAT COLOR IS IT? - When I was living with my parents, I would always get into an argument with my Mom about a pair pants that I had. "I just washed your green pants," she would say. "You mean my brown pants" I replied, etc. etc... There are tests for color blindness, but here is a trick that you can try: First find a sheet of colored construction paper. Light colors work best, especially pink or light blue, but almost any color will do. Place your hand over your left eye and stare at the colored sheet of paper with your right eye for at least a half-minute, preferably more. It helps if the paper is well lit. Remove your hand and the paper and look around the room at any brightly colored objects while alternately blinking your left and right eyes. Each eye will see a slightly different shade of color! Which is right? Don't ask me! In about a minute both eyes will look about the same, and the fun is over.

EVERYTHING DISAPPEARS - For some weird reason, this one seems to work best in church while you are listening to a sermon. Simply stare at the person giving the sermon with both eyes, being very careful not to move your eyes or head in the slightest. It helps if you are at least fifty feet from that person; if less concentrate on his/her nose. It also helps if you don't blink. Relax and fully concentrate on the speaker's head/nose. After about a minute everything else in the room will seem to disappear except the speaker's head or nose! Do not be disappointed at failure on your first try. Make sure that no one else around you is moving to distract you.

Also, if you keep your eyes open without blinking for too long, tears may run down your cheeks, but don't worry. The speaker and anyone else around you will think that you have been deeply moved by the sermon. What this exercise shows is that in order to really see detail while observing, it is necessary to move the eye around in miniscule jerks. Actually you do this all the time without realizing it. I once read that the eye can build up "exposures" of up to nearly six seconds when using averted vision, as long as the eye movement is small. This was stated in an abstract from an ALCON convention.

MOVE ONE EYE - Yes, you too can look like Columbo (Peter Falk). All you have to do is look cross-eyed then slowly to the right and back again to cross-eyed. Amaze your friends, but don't do it at midnight on Halloween or you'll stay that way. (Just kidding).

THE RULING EYE - With both eyes open, extend your forearm and use your finger to cover up a distant object. Now close your right eye while still looking at that object. If your finger suddenly seems to jump to the right of the object, then your right eye is dominant. If your finger stays over the object while closing your right eye, then you are left eye dominant. Chances are that you will be more comfortable observing with your dominant eye, all other factors such as Astigmatism etc. being equal. I wonder if most left-eyed dominant people are left-handed?

THE NUCLEAR EYE - Go into a darkened bedroom and lie down on your back while looking up at the ceiling. Allow your eyes to become dark-adapted. Now very quickly move your eyes from left to right. If you see a slight light blue "flash" this effect is called "Phosphene". If you see this effect in the dark while working in an area of high nuclear radiation without actually looking at the radioactive source, then you have received more than the lethal dose of radiation. This is not to be confused with Cherenkov radiation which is a glow around the water in nuclear reactors. The human eye can actually see very high doses of radioactivity, but by then it is too late. Sorry about that.

THE UNCLEAR EYE - Have you ever seen Holiday cards with drawings of lit candles? Most of the time the flames on the candles have halos. This effect is purely illusory! to prove it, go into a dark dining room with a lit stick candle on the table. Using only one eye look directly at the flame. Now slowly move your finger in front of only the flame and the halo disappears. For fun have some children try the same thing. Chances are that they won't even see the halo at all. The reason is that older eyeballs are not as clear as younger ones. Don't forget to extinguish the candle.

FLIES IN THE EYES - If you are over forty years old then there is a chance that you may have "floaters" in your eyes; stuff that flakes off the back of your retina into the eyeball itself. Quite normal with age, although some people get more some less and some not at all. To see these little buggers you need to go outside on a perfectly clear bright day and look into the bright blue sky. Move your eyes around, and anything that moves with them with a sort of jet lag is a floater.

DETAIL IN THE EYE - Amazingly, the part of your vision which is able to see detail is only about one degree wide! This area is called the "Fovea Centralis". Several times I have looked for and found the planet Venus in the daytime sky. And after finding it, if I do not "mark" it's location by using a distant tree branch as a pointer, it becomes very difficult in finding it again, because unlike the stars at night it is a low contrast object which is very small, and my Fovea Centralis has to be pointed directly at it to see it. A paradox: the eye can make out detail only as small as about one arc minute. But the stars subtend much less than an arc second in the sky. The solution: although stars are too "small" to be seen, they are too bright to be ignored!

OPTICAL AXES - You can do this only if you wear glasses. Slightly push your frames cock-eyed and note that your depth perception gets all screwed up and that you feel like you will get a headache. What this means is that if you buy a new pair of glasses, don't just pay and rush out of the building. Take your time and put them on and WALK AROUND to make sure that the optical axis of the lenses matches that of the spacing between your eyes. If the glasses make you feel dizzy while walking, don't even think of using them to drive.

THE UPSIDE DOWN EYEBALL - Go into a dark room. Sit down and close both eyes. While keeping your eyes closed, look to the left, and GENTLY touch the far right hand side of your right eyelid. You will "see" a light blue "image" appear to the left. If you now move your finger slightly up, the image will go down and vice versa. Because the image formed on your retina is upside down, your brain flips this image so that up is up, and down is down.

OTHER EYE-DEAS - One of the best ways to get dirt or acrylic lint (ouch) out of your eye if an eyecup is not available is by gently using a clean Q-tip. Also, if you wear eyeglasses and go to a starwatch, take a spare pair of glasses and leave them in your glove compartment. When you do astronomy you are constantly taking off and putting on your glasses, and if you sit or step on them (like I recently did) you may need a spare pair in order to drive home. Lastly, when driving at night, do not look directly into the headlights of an approaching automobile, but instead concentrate just a little to the right on the lines on the road. I read this last suggestion in an old copy of the trucker magazine "Commercial Car Journal".

So there you have it, have fun and be sure to take care of your eyes with safety glasses and UV resistant sunglasses when needed. What you do with the rest of your body parts is your own business!

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- BMAA member Alan Pasicznyk provides occasional articles, and manages SDV volunteer staffing. [-ed]

NASA Space Place

Seven Strangers?

- by Dr. Tony Phillips

At the dawn of the space age some 40 years ago, we always knew who was orbiting Earth or flying to the Moon. Neil Armstrong, Yuri Gagarin, John Glenn. They were household names--everywhere.

Lately it's different. Space flight has become more routine. Another flight of the shuttle. Another visit to the space station. Who's onboard this time? Unless you're a NASA employee or a serious space enthusiast, you might not know.

Dave Brown, Rick Husband, Laurel Clark, Kalpana Chawla, Michael Anderson, William McCool, and Ilan Ramon.

Now we know. Those are the names of the seven astronauts who were tragically lost on Saturday, Feb 1st, when the space shuttle Columbia (STS-107) broke apart over Texas.

Before the accident, perhaps, they were strangers to you. But if that's so, why did you have a knot in your gut when you heard the news? What were those tears all about? Why do you feel so deep-down sad for seven strangers?

Astronauts have an unaccountable hold on us. They are explorers. Curious, humorous, serious, daring, careful. Where they go, they go in peace. Every kid wants to be one. Astronauts are the essence of humanity.

They are not strangers. They are us.
While still in orbit Dave Brown asked, jokingly, "do we really have to come back?"

No. But we wish you had.

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Please see the NASA Home Page www.nasa.gov for more information on the Columbia Investigation.

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