The SPECTROGRAM

Newsletter for the Society of Telescopy, Astronomy, and Radio

June, 2002

June's Meeting

The next meeting of S*T*A*R will be Thursday, June 6th , at 8:00 PM. The meeting will be held at the King of Kings Lutheran Church, 250 Harmony Street, Middletown.

Our speaker will be Dr. Tad Pryor of Rutgers University, who will speak to us about "Studying Globular Clusters with the Hubble Space Telescope". You can learn more about Dr. Pryor and his research by visiting:

http://www.physics.rutgers.edu/~pryor/

In this Issue

Election of Officers in June

Hi, Everyone!

As you all know, the elections for S*T*A*R officers will be held at the next meeting (June) after the speaker is finished. As always, nominations for any position can be made the night of the election. Or if anyone is interested in a position, you can email me directly in advance to be placed on the ballot. We currently have offers from Andy Zangle to stay on as Vice President, from Chris Olszewski to repeat as Secretary, from Paul Nadolny to stay on as Treasurer, and from Michael Lindner to continue as Member at Large. Happily, Greg Cantrell has agreed to stand for election to the Presidency, so we are ready with a full slate of officer nominations. In addition, Rob Teeter has offered to accept the responsibility of rounding up speakers for our meetings.

Thanks to Andy, Paul, Chris, Michael, Greg and Rob for their offers to serve! See you all at the meeting!

Gordon Waite
President, S*T*A*R Astronomy

From the Editor

Thank you to Ernie Rossi, Michael Lindner, and David Segelstein for your contributions to this month's newsletter.

Several folks have contributed to making this year's Spectrogram a great series, including Chris Olszewski, Steve Fedor, Edward Collett, Joe Cascella, Fred Block, George Reiner, Sam Michael, Gordon Waite, Steve Walters, and, of course, Ernie Rossi, Michael Lindner, and David Segelstein. Thanks to you all!

Observing From New Mexico

by Ernie Rossi

About (6) months before our trip which took place on April 15 to April 20 Steve Fedor told me his sister is a travel agent and could get us plane fair and hotel reservations for Roswell, New Mexico for a few days. Steve and I figured while we are in New Mexico why not spend some additional time at New Mexico Skies Inn. This is an Astronomy Inn just outside Cloudcroft located on 35 acres at an elevation of 7,350 feet. New Mexico Skies Inn is owned and operated by Mike and Lynn Rice and caterer to amateur astronomers. Steve and I left Newark at approximately 7:30 AM on American airlines with a 50 minute stopover in Chicago, and than landed in El Paso Texas around 2:30 PM Mountain time. Looking down from the plane coming in for a landing the landscape looked so alien. All you could see for miles was sand and brush and some small mountains that had carved ridges from the time all this land was underwater millions of years ago. We rented a Pontiac Sunbird and drove along route 54 which was pretty desolate and boring with desert on both sides until we arrived at Alamogordo about 90 minutes later. We stopped off at a Walmart to buy food so we would have something to eat while we stayed at NM skies since there were no stores, or restaurants in the area. From Alamogordo we drove west on Rte 82 through part of Lincoln National Forest to the town of Cloudcroft which is located at an elevation of 8,700 feet. The town of Cloudcroft looks like it belongs back in the old west. When I first drove into the town a short distance off route 82, I just hit the brake and couldn't believe the site, like a town from an old western movie. We continued for another 16 miles until we turned off the road heading up to Joy Mountain where we came to several new red roof buildings which was New Mexico skies. We met Mike and Lynn Rice, and Lynn gave us a tour of the place and took us to the cabin we were going to stay in. The cabin had two bedrooms, living room, kitchen, bathroom, outside porch, satellite TV, and everything was in immaculate condition. We were shown the library which also had three computer terminals and a bar where Mike and Lynn would make there guest drinks such as coffee, tea, cappuccino, or whatever was available during the evenings. We were taken out to the observing area which was about 100 yards away and shown the different telescopes and their setups. They have 4 clamshell domes which houses 12, 14, and 16 inch Schmidt Cassegrains and a 7 inch Astro Physics refractor telescopes. All the telescopes are outfitted with various CCD cameras connected to their own computer screens. The 14 & 16 inch scopes can be used remotely and the observers usually do this from the library computer center. Besides telescopes set for CCD imaging 3 Dobsonian telescopes with apertures 15, 25 & 30 inches are used visually and all have digital setting circles. There are four other telescopes that are used for either CCD or visual observations. During the evening red lights marked the trails and areas to each building. The reason we picked this month was that April has the least precipitation of the year with less than .5 inches. July has the most with over 5 inches of rain. Cloudcroft gets snow 8-9 months a year because its so high up and even during April the days were

in the sixties, the evenings in the mid thirties. They claim that Cloudcroft has 260 clear nights a year but that is really not correct. There are some clouds almost everyday and clear skies are not correct. The correct claim should be partly cloudy to clear skies, with occasionally mostly cloudy skies. Our first observing session was April 15 where we had rented the 15 inch Astro systems Dobsonian telescope which was equipped with Sky Commander digital setting circles and Pegasus mirror with a 4.0 focal ratio. The sky conditions was completely overcast until around 11:30 when the sky mostly cleared except for some lingering clouds along the eastern southern horizon. No light pollution could be seen, but according to some observers that were there from earlier in the week the transparency was not at its best, only fair.

My magnitude estimates ranged from 6.2-6.4, not quite as good as Cherry Springs or the Catskills at their best, but far better than anywhere in New Jersey. One of the things I wanted to witness was looking up at 7 plus magnitude skies. What I did like was that we had absolutely no moisture or dew in the air, you don't need dew heaters here. You can observe all night and everything remains perfectly dry. The air throughout the night stayed pretty steady except for occasional wind gust of 15-20 mph. By the time we called it quits at 3 am the temperature was down to 35 degrees. Performance of the telescope was good when it came to the Pegasus mirror and digital setting circles, but the declination was very hard moving and took some muscle not like an Obsession, not all eyepieces came to focus like my Naglar 31 MM N 5 on the inward travel, and looking at objects near the horizon with medium weight eyepieces the telescope would drop. One great thing I did like about the scope is that I could observe without a ladder. I also brought my own eyepieces with me since the ones supplied were not top of the line.

Observing: We only used two magnifications 90 power using a 17 MM N 4, and coupled it with a TV 2" 2X Barlow for 180 power. We looked at well over 50 objects from 11:30 until 3 am, about 30 of them were Galaxies. There were two objects I couldn't wait to see was NGC 5139 the greatest Globular of them all Omega Centauri, and NGC 5128 Galaxy Centaurus A. I had never seen these two objects because they lie right down on our horizon from 40 degrees north but at this latitude 32 degrees they were 9 to 10 degree above the horizon not in a perfect spot but at least I would be able to see them. The galaxies I observed were NGC 2683, 4565, 5033, 4402, 4406, 4374, 4387, 4388, 3384, 3389, 5128, M 81, 82, 51, 84, 85, 86, 87, 88, 104, 105, 64, 65, 66, 95, 96 and many others that I didn't identify but looked at while observing these other galaxies. Globular Clusters; M53, NGC 5053 usually tough to see in NJ, but no problem here even with a 15", M 3, M 5, M 4, M 13, M 80, NGC 5139 Omega Centauri, and open cluster M 44.

Impressive Objects: All the objects showed some to lots of detail. NGC 5128 Centaurus A galaxy showed a dark rift in the middle just like it's photograph and very easy to see making it look like a nebula. M 51 was straight overhead and looked like a picture with the arms and bridge very easy to see. The 25" was next to us and we looked through that scope to compare M 51 to the 15", and it looked even more impressive and very dense with the sweep and whorl of it's arms sweeping around and around. M84 & M86 at 90X displayed a total of 8 galaxies in the same field. I always wanted to see Omega Centauri and I finally got my wish. It was just over the mountain ranges about 1 degree in the South close to where some lingering clouds were. It looked like a huge bright ball of densely packed stars, so different looking than M13. Even at the low altitude and with haze around it, wow was it

impressive. M13 as usual was just a mass of stars, bright pinpoints almost sparkling, can't wait to check it out with the larger scopes over the next few days. M5 and M4 were another two wonderful globulars each with bright different patterns. NGC 4565 a needle of a galaxy that extended the entire eyepiece field at 180X. On this night we stopped observing at around 3 am since we were tired and the sky became party cloudy and we heard the following night was to be clear and have excellent transparency.

April 16, 2002, Steve and I got up around 9 am and made some breakfast and decided to see some of the sites. So we drove out to the Sacramento Mountains for Apache point observatory, and the Solar observatory which are near each other located about 9800 feet. The distance from New Mexico skies is about 40 miles and is located at the peak of the mountain, what a view and deep blue skies. We first went to see the Solar tower telescope which rises up 136 feet, and the John W. Evan's solar facility where they monitor the sun every clear day. Steve and I lucked out on this trip since the viewing inside the telescope domes wasn't open to the public. As I was taking pictures a technician was going by with a nitrogen tank heading inside the Sloan Digital survey observatory and I told him who I was and asked him if I could see the inside, and at that moment an astronomer came by and they said OK. Just the month before I went to a lecture from one of the Princeton astronomers who is involved with the operation of this telescope. This is really a giant CCD camera using 100" mirror connected to an array of CCD camera's which can now survey the sky in a very wide field compared to a regular telescope using one CCD camera. One of the astronomers also took us inside one of the smaller domes which houses a 20" Cassegrain telescope which does photometry, and we were shown how easily the telescope moves about electronically. We didn't get to go into the 3.5 meter Mayhill telescope nearby we needed to get back to New Mexico skies for some rest and dinner. We started observing at 9 PM using the 25" f/4 Dob, and stayed up viewing until 4 am just before it started to get light. The sky was completely clear the entire night not a cloud in the sky, low humidity, and the temperature was about 40 degrees by 4 am. The sky reach close to 6.5 magnitude and I was hoping to see 7+ magnitude and was very disappointed. Three weeks later at my place in the Catskills at one of my star parties the sky was noticeably darker, galaxies showed more structure, M13 was direct naked eye not averted vision as in New Mexico skies. Steve and I couldn't understand why, was there dust in the air, it couldn't have been the humidity there wasn't any. I looked at Copland Septet, seven galaxies 15.6 magnitude and fainter, I was able to see about 3 or them just at the edge of visibility. Leo A cluster about 7 galaxies in the high 14 to low 15 magnitude objects. We observed over 100 plus galaxies ranging from 8-16 magnitude. Some galaxies we looked at the previous night with the 15", we wanted to see what they looked like in the 25". We also covered about every galaxy in the Messier list. Galaxy NCG4656 looked very funny until I realized the two galaxies were imbeded/merged together.

We also looked at many globular clusters again, some new. With the 25" scope, globulars like M13, 4, 92, 22, 3, looked amazing with bright patterns of stars sparkling over your entire field of view. We also looked at many other just to name a few that were a little dimmer, M9, 10, 12, 14, NGC 6144, 5053 etc.

I also looked at many of my favorite nebula like M8, 16, 17, 20, 42, NGC 6992 (veil) all where spectacular. I used the 2" o 3 filter while viewing these objects. I also looked at many other objects like M 97 (owl) NGC 3242 (Ghost of Jupiter), M 57 (the ring) NGC 6826 (blinking planetary), 6542 (cats

eye), 6888 (crescent nebula), as well as many others. We also looked at more than a dozen open clusters, all toll at least 200 plus objects. I wanted to take a look again at Omega Centauri but the Astro systems mount wouldn't allow the telescope to get quite low enough. I was told that the 30" would be able to get low enough to get a look at it again on our last night. We were scheduled on our last day to use the 30" Tectron which was an f/5 and had a focal length of 150 inches and had a 12 foot ladder needed to view at the zenith. However, on our last day we were completely, or mostly clouded over and all we could do was stay in the library talking to Mike and Lynn Rice and some of the other guest while drinking coffee or cappuccino. I asked Mike Rice about the seeing conditions of the previous night and he said it was about average. One of the other guests who was there for a week said the previous Saturday he thought the transparency was a little better. Well, I didn't get to see my 7.0 sky and still wonder if I will ever see one. What I did learn from this trip was that we have some very dark skies in parts of the Northeast when we get those special clear nights. What the West and southwest offers is many more clear nights, many more dark area's to observe from, far less humidity, and 8-10 degrees lower latitude to view some of the finest deep sky objects that are so low when viewing from the northern latitudes.

The nest day we said good bye to everyone and headed to our next destination Roswell, than to Albuquerque before heading back home. This was one wonderful and exciting trip and I will always remember it as one of my best. If you have any questions please email me at EROSSI40@aol.com.

Testing Telescopes: Interference Tests Part II

By Michael Lindner

In the previous column I described Newton's interference test. While it can be very useful, it is limited to testing a curve against another curve, which matches or nearly matches it. If the glass surfaces become separated too far, the interference fringes don't show up.

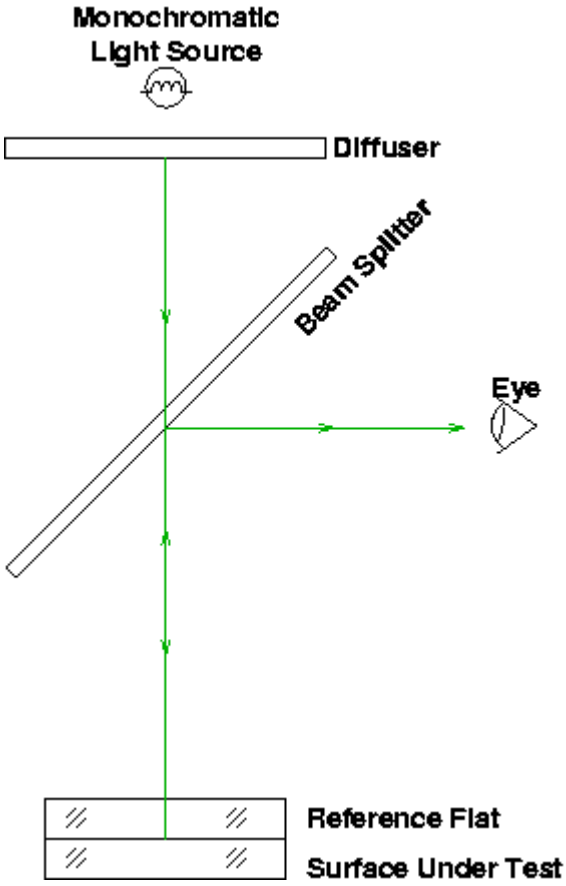

Figure 1. Newton Interferometer

So, over the years many different interference tests have been devised. In this article I'll barely have room to name a few, let alone describe every one. Daniel Malacara, in *Optical Shope Testing* devotes over 400 pages to describing various interference tests.

Note that in some of these tests a diffuse monochromatic light source is called for. Amateurs can use either one or more neon bulbs, or a compact fluorescent light blub with a green plastic filter as a monochromatic source. For a point source, as in the Fizeau interferometer, a condensing lens can be used, or a laser diode can be the source. Even though LEDs are considered monochromatic, their emission spectra is too wide for an interferometer.

The simplest improvement to the Newton interference test is the Fizeau interferometer. A collimating lens is added to provide parallel light paths to the test surfaces. Because the light is striking perpendicular to the test surfaces, they don't have to be as close together, and the tolerances and requirements for good contact in order for the test to work are relaxed.

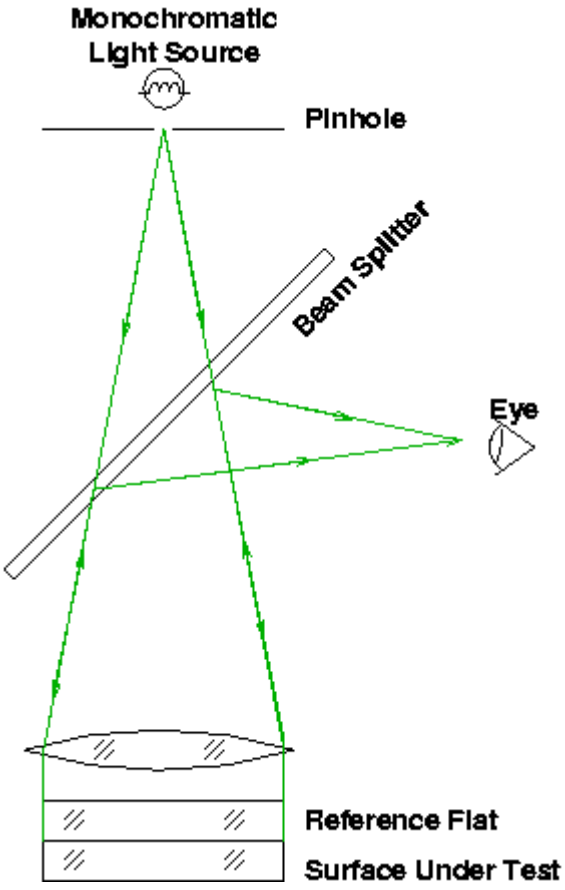

Figure 2. Fizeau Interferometer

In fact, since the beam from the pinhole is diverging, we can test concave surfaces without a collimating lens, as shown below in figure 3. The reference surface must have curves on both sides that are concentric (have the same center of curvature) with each other and with the surface under test.

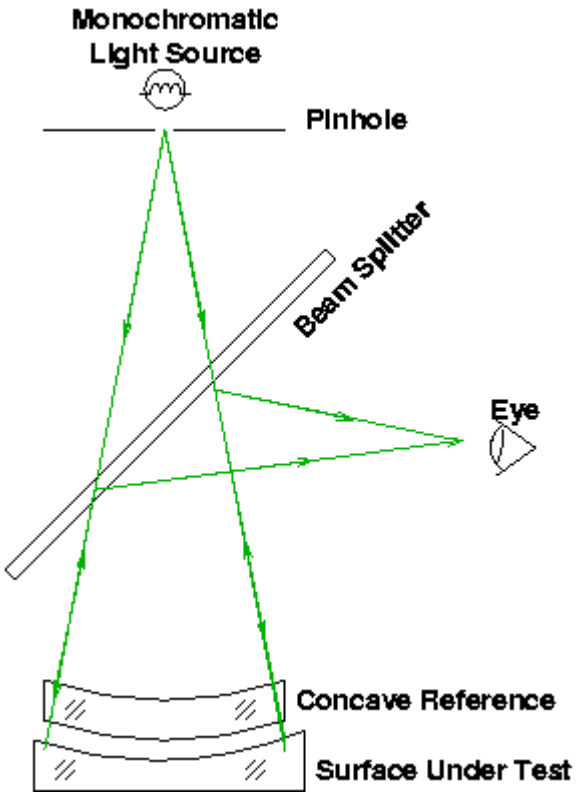

Figure 3. Measuring a concave Surface

Other setups can be used to test the homogeneity of glass (important for determining the quality of glass for making lenses), for measuring the angles of corner cubes and prisms to great accuracy, and for measuring convex surfaces.

Another variation is the Haidinger Interferometer, which measures the parallelism of the front and back surfaces of a single piece of glass. This is important in determining wedge in windows, prisms, and some lenses. This interferometer is shown in figure 4.

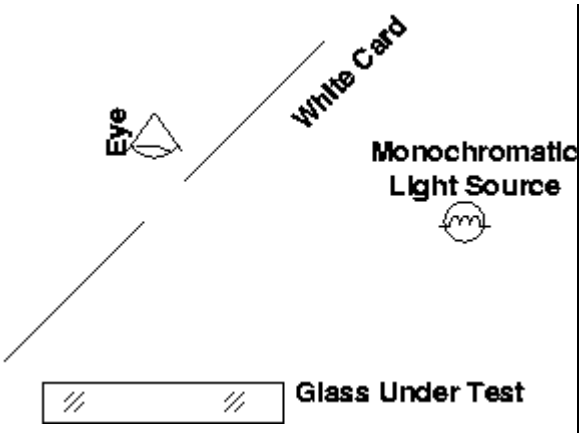

Figure 4. Haidinger Interferometer

Next, we get into the not-so-simple interferometers. The Twyman-Green interferometer is a variant of the Michaelson interferometer, used in the famous experiment to show that the Earth wasn't traveling through ``the ether.'' It is used primarily to test prism, microscope objectives, and camera lenses.

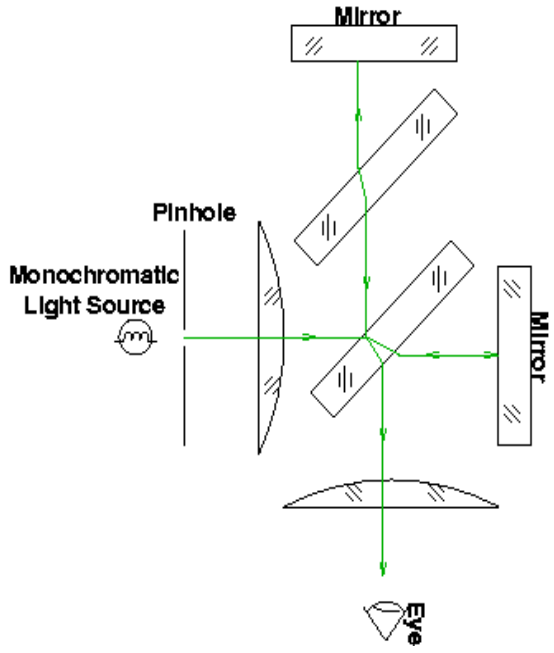

Figure 5. Twyman-Green Interferometer

There are many variations of this test, and space does not permit even naming them all. One interesting one, worth mentioning, was invented by Rogers, which uses a hologram to compensate for defects in the interferometer itself. A hologram is made by exposing film in the interferometer. Next the surface to be tested is introduced, and a second hologram is made on the same photographic plate as the first. The fringe patterns of the two holograms form a moiré pattern showing the true surface being tested, and the errors due to the interferometer itself cancel out.

The scatter plate interferometer is interesting and relatively easy to make. A scatter plate can be made by photographing a speckle pattern, or by replicating a lightly fine ground surface. The soot plate used in the Lyot test described in an earlier article is a scatter plate, although in the test I'm about to describe two identical ones are needed.

Edmund Scientific used to sell scatter plates, but they don't anymore. However, an enterprising amateur can make one using one of the methods described above.

Figure 6 shows Burch's interferometer. The reference beam and the scattered light offer the two paths from the source to the eye, causing the interference pattern to occur. The two scatter plates must be identical.

A variation using a single scatter plate was invented by Shoemaker and Murty, and is even more sensitive to even-order aberrations, but it cannot detect odd order aberrations.

Birefringent Interferometers rely on the properties of birefringent crystals, such as quartz or calcite. If properly placed, these crystals split an incoming beam into two parallel beams. Normally, the two resulting beams are polarized perpendicularly to each other, and do not interfere. However, is polarized light is passed through a birefringent material, the beams produced will interfere, and can be used to form a lateral shearing interferometer.

It is not necessary to use a birefringent crystal in some lateral shearing interferometers. In fact, an ordinary diagonal mirror can be used to turn a Foucault tester into a lateral shearing interferometer.

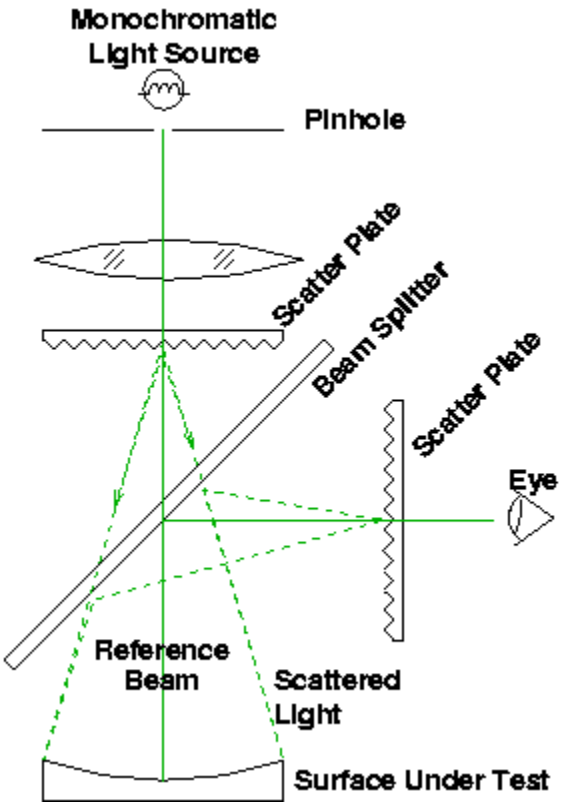

Figure 6. Burch's Interferometer

The diagonal is placed with its surface adjacent and perpendicular to the viewing slit. The result is that light entering the slit has two possible paths; direct of reflected off the mirror. Since the path lengths are slightly different, we have an interferometer.

The image through the slit looks like two mirrors superimposed, and the intersecting portion has interference fringes.

As usual, there are dozens of different designs for lateral shearing interferometers, but I describe this one because it can be made easily at home. Another interesting design, invented by Ronchi, uses a diffraction grating to provide multiple paths.

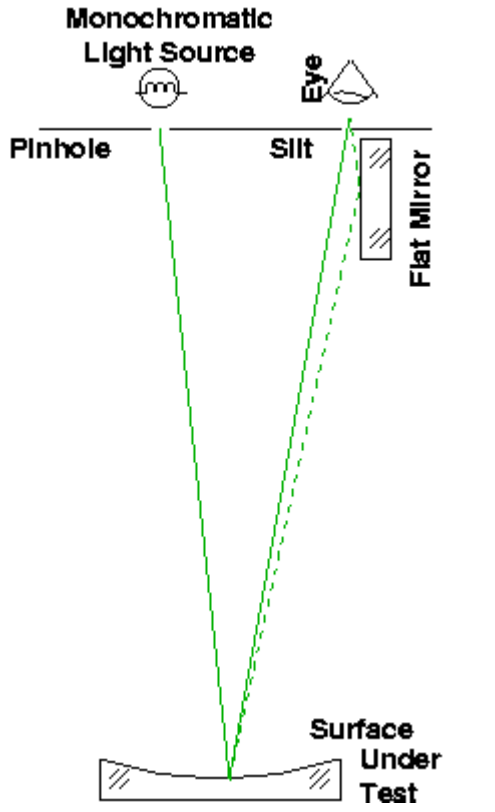

Figure 7. Lateral Shearing Interferometer

Radial, rotational, and reversal shearing interferometers form the second light path by disturbing the original light path radially, rotationally, or by reversing it, as the names imply. Most of these involve many reflections/refractions from prisms, plates, and lenses, and are not suitable for the amateur, so I'm not going to go into details.

Likewise, there are multiple bean interferometers, holographic interferometers, multiple pass interferometers, and fringe scanning interferometers. The reader interested in learning more about these or about any of the other tests mentioned in this series of articles should read the book referenced at the beginning of this article. Beware, it's a pricey tome, and the math is not for the feint of heart.

Reminiscences
by David Segelstein

Lying on my back in the grass, feeling as if the earth's surface stood sideways and I was, upright, looking out into the universe, I spent long hours trying to really ***see*** the heavens. You know, trying to really see the stars existing in a three-dimensional space, trying to really comprehend the depth, the distances, the actual existence of those stars. Occasional glimpses of that reality were like visions into the heart of God. My little four-inch reflector standing on its spindly, barely-equatorial mount on the driveway, waiting for me to want to look more closely, but not offering nearly the excitement of those moments of clarity understanding the expanse of the universe. Add the moon. See it as a three-dimensional ball in space instead of a flat disc on the flat map of the sky. Hard to do, just as it was hard to really see the universe, but in those moments when it did have that presence, it became the mysterious object that it is, circling the earth for whatever unknown reason, with unknowable forces keeping it there. You can't actually see gravity, and you're never really sure it's there or true. Anyway, it's not relevant. It has nothing to do with wonder or with the soul. The mystery of the sky is not revealed by optical aids, but by allowing our minds to pierce the veil of common experience, and see the facts of existence and depth.

That little reflector, I was able only to find Saturn, Jupiter, the Moon, and any star that was naked-eye visible. That for years. I was barely a teenager, and what did I know of seeking help. I thought it was just me, my telescope, and the unknown. Unable to find the galaxies and nebulae that I imagined were there, I was content to look – really look – at those planets. Was it the weirdness of adolescence, the odd discomfort of growing beyond childhood, that found refuge in the solitary pursuit of cosmic experience? I know that it was not the same experience that I have now in using my telescope, now that I know more.

Life in amateur astronomy. Mine has traveled many paths and passed through many stations. The first Dobsonian I remember was a humongous affair built into a massive sonotube. Being the then-common f/6 or so, it required a huge ladder to use. Unwieldy hardly describes it. A hand-ground & figured mirror whose optical refinement was not the issue, was mounted in some undisclosed manner at the bottom of that huge cylinder. Andromeda, oh my, I'd never seen it like that. Dark lanes, and expanse well beyond the field of view of that eyepiece. Teetering on top of that ladder, I waited as my friend Milton aimed the "scope" by looking along that sonotube wall. No, it wasn't a "scope," it was a "contraption." Wondrous, hardly usable, that scope made me feel honored to be present.

Russ, the guy who ran the planetarium at the small college 50 miles from my house, sort of also ran the astronomy club local to that little town. He was a plain old guy who was just living his life being easy to be with, and helpful, which was in his nature and not an effort on his part. We spent hours in the farm land of the Midwest, exploring, being reminded of all the little smudges and oddities, not in the least being bothered by the street lamp 200 yards away, which had no business being there because there was no street, but maybe was installed by a farmer who thought it was appropriate for some reason private to him. Russ gently led me by the hand through what he knew and loved about the sky, passing on whatever knowledge and experience I wanted to take from it. It was the quietest and gentlest of learning. It just grew to be more a part of me as I spent more time out in that field. The kind of time spent with quiet friends, you hardly know it as it changes you. You just find yourself different, affected.

How have I ended up in the most dense of states, trying against the odds to keep looking up at the sky? Life's paths follow twists and turns, but it hardly matters because we keep doing what keeps us human regardless of our circumstance. You can hear the genius of Mozart even through a crackling, weakly- receiving radio, even only catching occasional phrases of the music. We manage to see the poignant facts of the universe even from this worst of light-polluted, crowded, wet, inhospitable locations. It comes through. It can't help it. It's there. We just need to look at it.

Upcoming Events

Star parties are an important part of the amateur astronomy experience. Listed below are several events offering dark skies and astronomical fellowship.

June 5 – 9, The **4th annual Laurel Highlands Star Cruise** will be hosted by the Amateur Astronomers Association of Pittsburgh. Visit http://lhstarcruise.org/ for information.

June 7 – 9, The **Jersey Starquest** will be hosted by the Amateur Astronomers Association of Princeton. anthony_monticello@hotmail.com is the contact for more information.

June 7 – 9, The **13th annual Mason-Dixon Star Party** will be hosted by the York County Astronomical Society. For more information, visit http://home1.gte.net/dmdewey/mdsp.html.

August 1 – 6, The Oil Region Astronomical Society's **ASTOBLAST** will be held near Franklin, Pa. Visit http://www.oras.org/ for information.

August 2 – 11, The Rockland Astronomy Club's **Summer Star Party 2002** will be held at Shady Pines Campground near Pittsfield, MA. Visit http://www.rocklandastronomy.com/members/ssp2002/index.htm for more information.

August 9 – 10, The **67th annual Stellafane** will be held outside Springfield, Vt at Breezy Hill. http://www.stellafane.com/

September 6 – 7, The **Blackwater Falls Astronomy Weekend** will be held at Blackwater Falls State Park, WV. For information, visit http://www.kvas.org/AstronomyWeekend%202002.htm

September 6 – 8, The **2002 Black Forest Star Party** will be held at Cherry Springs State Park in Potter County, PA. For more information visit http://www.bfsp.org/starparty/

October 4 – 6, Stella Della Valley XVI will be held by Bucks-Mont Astronomical Society. Visit http://bmaa.freeyellow.com/Sdv.html for more information.

October 12, The **12th annual NOVAC Star Gaze** will be held at Franklin Park, 45 miles west of Washington, DC. Information at http://novac.com/gaze.

October 28 – November 4, The **8th annual Mid-Atlantic Star Party** will be held at a central North Carolina site that boasts mag 6.5 skies and southern sky objects that cannot be viewed from New Jersey. For more information, visit http://www.masp.org/maspindex.htm.

May 4 May 12 May 19 May 26

Observing -- Solution

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