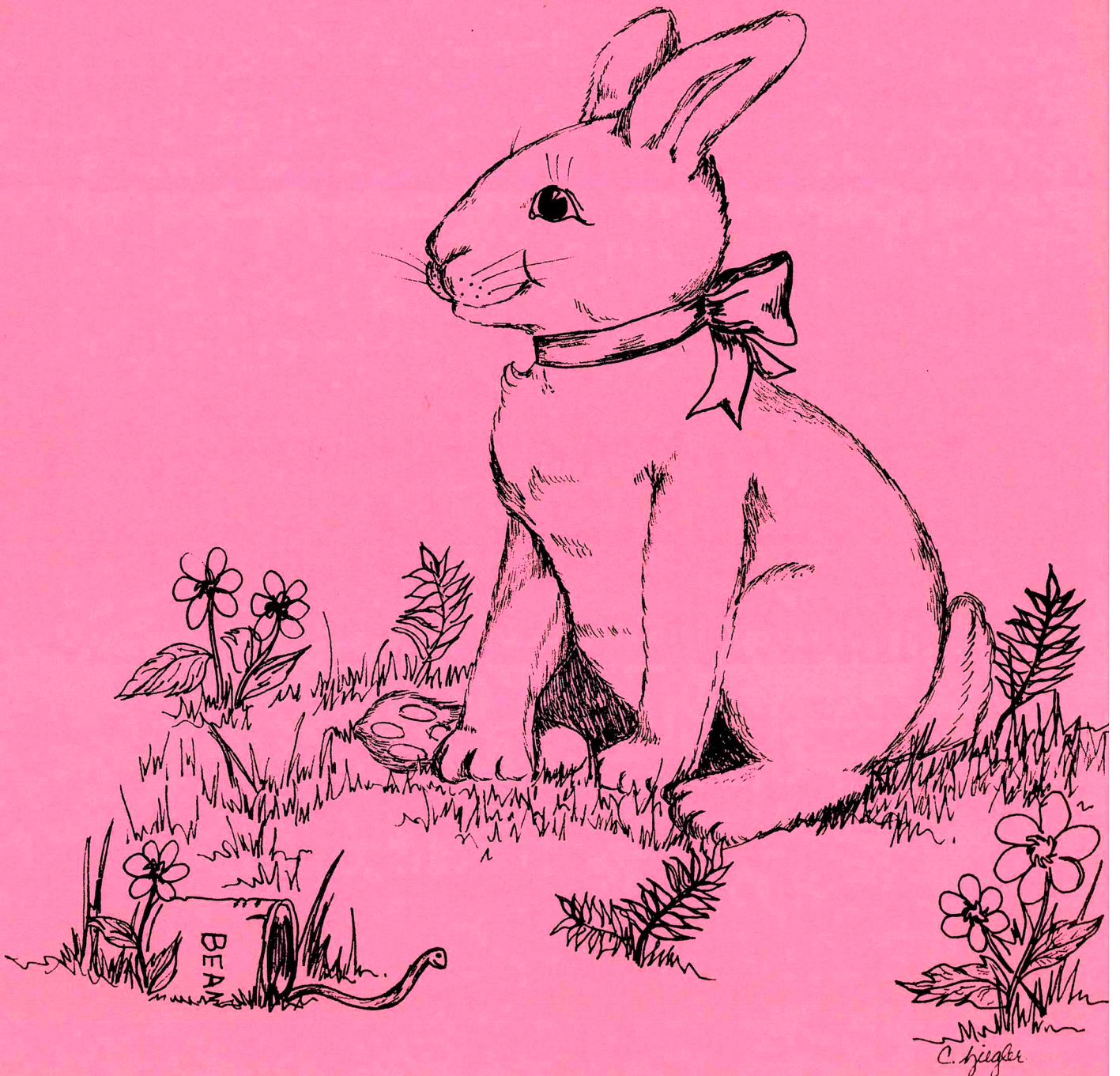


the
Observer

April 1981



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We apologize for not crediting Morris T. Phillips, formerly with the NSF, for his two photographs used in last issue's VLA dedication article.

* * * * *

The *OBSERVER* is a quarterly publication of the National Radio Astronomy Observatory. Articles and comments should be sent to P. O. Box 2, Green Bank, West Virginia 24944.

ON BARRED SPIRAL NEBULAE

Stephen Gottesman

At the University of Florida I teach a course in Modern Cosmology to non-science students. The subject matter has a very strong historical bias. Thus, when Wally Oref asked me to write about my current astronomical interests -- observations of barred spiral galaxies -- I thought it might be entertaining to write about some of the historical antecedents of current ideas and how our observations fit into this larger context.

Non-stellar, nebulous objects, a few of which are visible to the naked eye, have been recorded in the night time sky for several centuries. That several had a spiral form was first noted by the Earl of Rosse toward the middle of the last century. The drawings that he and his assistants produced are portraits of great beauty. However, the nature of these nebulae, whether stellar or gaseous, within the Milky Way or beyond was unclear and had been debated as far back as Sir William Herschel, the discoverer of the planet Uranus.

Naked eye observation ceased to be the normal mode of telescopic investigation when photographic techniques were applied in the 1880's and 90's to the study of these nebulae especially by Isaac Roberts in England and James Keeler in this country.

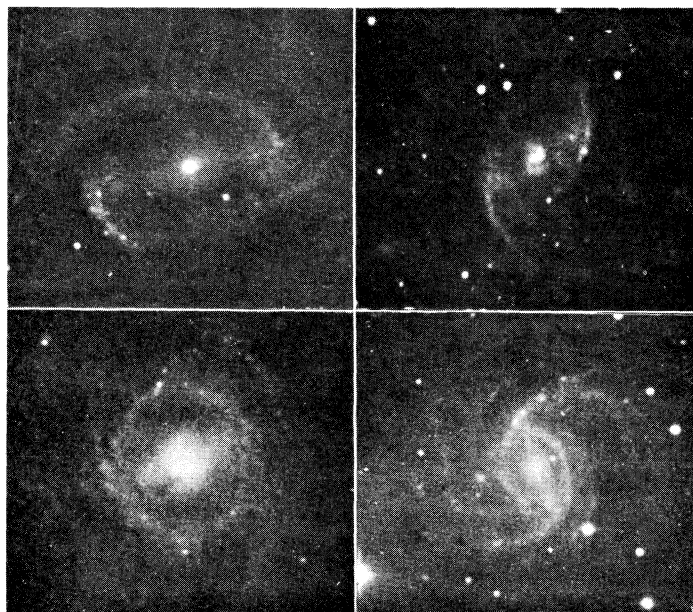
H. D. Curtis augmented Keeler's material and published in 1918, two important papers on the nature of the spiral nebulae. Curtis was particularly interested in what were called spindle-shaped nebulae. He argued that the photographic properties of spiral nebulae were entirely consistent with nebular matter distributed in a circular disk. If such objects were oriented randomly in space then the shape of the principal plane would vary from circular to highly elliptical as the viewing angle changed. Some would be seen edge-on as spindle shaped objects and one did not have to invoke a new class of nebulae.

Curtis was not the first to suggest this, but he presented the best evidence that this was indeed the case. Four years earlier in 1914, Slipher reported to the American Astronomical Society that his observations of the spectrum of at least one of these nebulae revealed that the outer parts were moving systematically with respect to the center. Once again, if one assumed that the diffuse nebular material was distributed in a fundamental plane then a rotating disk offered the simplest explanation for the observations. Thus diverse lines of research suggested that spiral galaxies possessed a well defined, rotating plane of material in which resided the spiral structure.

In his 1918 publication, Curtis also drew attention to a second form of spiral, "its main characteristic is a band of matter extending diametrically across the nucleus and inner parts of the spiral." He called these systems ϕ type spirals owing to their shape. Hubble, in his 1926 study of the properties of galaxies, called this new form a barred spiral. He found that they were less abundant than normal spirals but (with the exception of their bar) they appeared to be very similar in their overall properties to the ordinary systems.

The theoreticians lost no time in attempting to explain the most prominent feature of these nebulae, their spirality. Many attempted to explain the form of the spiral arms in terms of the orbits of stars or stellar aggregates in a rapidly rotating system. This is somewhat analogous to the spiral pattern of water drops seen in a spinning lawn sprinkler. Unfortunately, such theories were not satisfactory. Sir James Jeans, one of the leading theorists of the day, was led to a very pessimistic conclusion, "No satisfactory explanation has so far been advanced as to why the spiral arms should have these particular shapes ... it seems impossible to explain pure rotation ... in terms of known forces and we are led to the disconcerting, but almost inevitable conjecture, that motions in spiral nebulae must be governed by forces unknown to us." He was equally

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The first published photographs (1918) of ϕ -type spiral nebulae. Hubble (1926) proposed that they be called barred spiral galaxies. This name has been universally accepted.

gloomy about constructing realistic bars from rapidly rotating bodies.

Fortunately, Jeans' views, powerful as they must have been, did not arrest research in these problems. However, it was not until the 1950's and 1960's, (about 30 years later) that the first reasonably successful solution to the spiral arm problem was proposed; density waves. This model views spiral arms as an envelope. Stars orbiting in the disk of the galaxy move into the arm and congregate there momentarily before moving out. Thus the arm is a pattern the components of which are constantly changing. While not the only model, it is certainly one of the best working hypotheses that we have.

One of the difficulties associated with this model concerns the stability of a disk of rotating, gravitating stars. Such disks have a tendency to form bars. Thus, for this reason and others, there is a strong belief today that ordinary spirals possess a significant halo of material that stabilizes their disk.

However, the tendency of collapsing systems of particles to form bars rather than disks is extremely interesting. Modern analyses of galactic properties find (contrary to Hubble) that barred systems are slightly more prevalent than their ordinary cousins. If we add galaxies with less obvious oval distortions to the barred class, then the preponderance of barred galaxies may be very large indeed. To quote from a recent work by Sanders and Tubbs, "... this bar-forming tendency could possibly be a more fundamental characteristic than the tendency to form spirals ...".

We seem to have come full circle. Ordinary spiral nebulae were recognized some 80 years before barred spirals were first reported. Initially, it was thought that barred systems were a lesser spiral form and theoretical investigation concentrated on what appeared to be the more interesting and universal problem, the formation of spiral arms. It is only within the last 10-15 years that significant progress has been made in understanding the

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NGC 4565, an example of a spindle-shaped galaxy. Curtis (1918) provided strong photographic evidence that these were normal spirals seen edge-wise.

nature of barred systems. Current models predict that the gas distribution is very sensitive to the underlying stellar distribution. Mild oval distortions in the central stellar background can produce very large gaseous responses. These models also produce spiral arms at the ends of the rotating bars, and appear capable of explaining the spaghetti-like dust lanes that are often seen. Also the motions of the gas are expected to be effected significantly by the barred structure.

Owing to the wealth of predictions made by these theoretical investigations, it is exceedingly important that these models be confronted by good quality observations. Unfortunately, most of the barred spirals visible from the northern hemisphere are not very large, perhaps 6 or 7 minutes of arc in diameter (one-fourth the width of the moon). Consequently, most data has come from

optical observations. By their nature these are restricted to zones of high brightness, usually in the spiral arms or the central regions of the galaxies. Thus the data is restricted in its coverage and patchy in nature.

Observations of neutral hydrogen would be more ideal, for the gas is widely distributed within spiral galaxies. However, high resolutions are required, for bars that can be viewed from observatories in this country are typically 1-2 arc minutes in length. With the advent of a spectral line receiver at the VLA, radio astronomers can hope for the first time to contribute to the high resolution data that theorists require if their hypotheses are to be consistent with observations.

Data for this project were initially obtained with the three-element interferometer here at Green Bank several years ago and at the VLA last September. We hope to extend these observations when the VLA is again in its C configuration later this year.

* * * * *

THE GREAT STATE OF KANAWHA

Pat Crane

I recently discovered a fascinating book, Names on the Land by George R. Stewart, "the famous classic of place-naming in the United States" as the cover blurb calls it. The book is unfortunately no longer in print and I must return my copy before the West Virginia Library Commission becomes upset. Although I have not had the time to savor the book as it deserves, I have extracted the stories behind the names of the four states with NRAO facilities, starting with West Virginia.

* * *

During the Civil War the western mountain counties of Virginia held with the North and seceded from Virginia in 1861. The people then elected a convention to establish the new government. One of the first responsibilities of the convention was to choose a name. New Virginia was first suggested but the more extreme delegates rejected the name as well as the policy of Virginia. They fell back on the tradition of using the name of a chief river in turn named for an Indian tribe. The convention reported for "the state of Kanawha" after an amendment to substitute West Virginia failed.

The people then elected a second convention to write a constitution for Kanawha. These delegates, despite their charge, first considered changing the name under which they had been elected. Argument was hot; some favored Virginia because it suggested both the Virgin Mary and Virgin Queen Elizabeth. Others detested Virginia and wanted a new name. One delegate objected that there might be "too much Kanawha" with a county, two rivers, and a courthouse already so named. When the vote was finally taken, loyalty to the old name won and West Virginia had a clear majority (30 to 14) over all other choices.

The people approved the new constitution but since the convention may have exceeded its charge, the legal name may still be Kanawha.

* * *

As many know Virginia is named for the Virgin Queen Elizabeth, but there is more to the tale. In 1854, Sir Walter Raleigh sent two ships to explore lands in the New World that Queen Elizabeth had given him permission to settle. During their explorations of the Virginia and North Carolina coasts, the crews often asked the Indians how the places were called. In their report to Sir Walter and the Queen, they wrote that the whole country was called "Wingand-acoa" and its king, "Wingina". The spelling may have spurred the Queen's thoughts, and remembering her own virgin state and that the new lands were untouched and virgin, she and the English called the land Virginia, the proper Latin form for the name of a province, the "virginland".

* * *

The name Arizona came originally from the Papago Indians but followed a tortuous path before finally being used for the territory and state. In 1730, the Spanish governor of the province of Sonora established a royal mining concession near the site of present day Nogales, Mexico. The concession required a name and the governor chose Arizonac after a local spring of good water that the Papagoes called, approximately, ali shonak ("little spring" or "place of the little water"). Spanish is more attuned to soft endings, and Arizonac soon was clipped to Arizona. Arizona did not amount to much until 1735, when prospectors discovered, a short distance upstream, a surface deposit of huge nuggets of silver, the largest of which may have weighed two tons! The ore lasted for a century after which the Arizona Ranch became quiet once more.

In 1854, a one-time customs clerk named Charles Poston, founded the Arizona

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Mining and Trading Company in San Francisco. Poston had read widely, often in Spanish about the resources of the Southwest. One book in particular inspired his choice of names, this was a history of Sonora written by José Francisco Velasco and published in Mexico City in 1850, which recounted the story of the Arizona mines. Later, in 1856, Poston arrived at Mesilla in the territory of New Mexico, where there was considerable agitation to split New Mexico in half along an east-west line. The proposed southern section needed a name. Some of the schemers suggested Pimeria, others Cibola. Poston said they lacked romance and suggested Arizona.

Arizona was first declared a territory by the Confederate forces that invaded New Mexico in 1861, with the capitol at Mesilla and the boundary running from Texas to California along the 34th parallel. In 1862, the Confederates were driven out, and in 1863 the territory of Arizona was separated from New Mexico along the present north-south boundary.

The spring and ranch, nevertheless, are in Mexico.

* * *

New Mexico is one of the oldest place names in the United States. It was first applied to an area north of Mexico City in 1563. The area so called followed the Spanish explorers north, until in 1598, Don Juan de Oñante led an expedition north to establish the King's power over "all the realms and provinces of the New Mexico". The expedition forded the Rio del Norte (Rio Grande) at El Paso de Norte (El Paso) and followed Oñante north into the wilderness. Once, when his men were half-starved, they reached a pueblo called Teipana. The Indians gave them corn, and they called the pueblo Socorro, "succor". Oñante named his capitol, La Villa Real de la Sante Fe de San Francisco, "The Royal City of the Holy Faith of Saint

Francis", but it was shortened to Santa Fe.

The name New Mexico was unchallenged until statehood approached. In the nineteenth century Congress had asserted its power to overrule local preference for state names. Despite strong local preference for the ancient name, people objected that the words suggested part of Mexico. Lincoln, Montezuma, and Hamilton were advocated. Others suggested Acoma in order to displace Alabama at the head of the alphabetical list. But when the territorial representatives let it be known that any change of name might lead to rejection of statehood, New Mexico was accepted.

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HOW COME THEY CALLED IT THAT

Richard Fleming

Lucky Strike, Burma-shave, Drambuie, Dixie Cups, Noxzema, are all famous brand names. Why did they name it that? What was the inspiration for names such as these? What events and individuals were behind these familiar names? Let's look at one such brand name.

James A. Church ran a mustard and spice business in Brooklyn known as the Vulcan Spice Mill. Over the door of the mill swung a sign depicting the symbol of the mythological Vulcan, hammer-wielding god of fire and metalworking. In 1867, Mr. Church closed his spice factory to go into the baking soda business. Out of sentiment he took along the sign.

The new firm was named Church & Company. Soda was sold by the barrel in those days and along with each barrel went a supply of paper bags in which to package it. The bags were elaborately imprinted with names and pictures to advertise the individual merits of the company's various brands -- such as Lily (named for its outstanding purity); Eagle (it had the ability to make baked goods rise) and Tiger (which symbolized power).

Door to door salesmen played a big

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part in the success of a product at that time and Mr. Church engaged the services of a famous Colonel Powell, undoubtedly the most colorful salesman of that era. The Colonel, a 7 foot 4 inch giant (in his stocking feet), soared to 9 feet when he was dressed in his top hat and elevated shoes. This flamboyant man traveled about the countryside in a cart drawn by two huge, plumed horses draped in blankets emblazoned with glowing letters. Crowds collected wherever he went, and he made an imposing figure as he grandiosely swept into a customer's store and with great fanfare, tacked one of his baking soda signs to the ceiling. Then turning to the open-mouthed spectators, he expounded at great length the virtues of his product. Inside each package, he told them, they would find a copy of Mrs. Church's own recipe for Gold Cake (made only with Church & Company's baking soda, of course) and on his next trip through he would have a brand new recipe for Silver Cake.

But, in spite of the Colonel's efforts and Mrs. Church's recipes, sales lagged discouragingly behind competitors. One day Mr. Church sat at his desk, staring wistfully at the old Vulcan sign (a muscular arm and hammer) that now hung in his office. Suddenly the thought struck him that here was the perfect symbol for his baking soda. It took power to lift the hammer as it took power to leaven baked goods. Mr. Church immediately had a quantity of paperbags printed with the Arm & Hammer label and rushed them to all the stores in the area. His hunch proved right. The label was an outstanding success. Arm & Hammer Saleratus (as baking soda was then called) quickly became the fastest selling brand on the market. With its introduction in 1867, one of the world's oldest and most widely recognized package designs in the food industry was launched.

* * * * *

WHAT'S COOKING?

HOMEMADE GRANOLA

Dorothea Oref

Granola made with the amounts and ingredients listed below will make seven pounds of the mixture for about the same price you would pay for storebought Granola. However, homemade Granola contains more different natural ingredients and no refined sugars.

- 10 cups uncooked oatmeal
- 1 jar wheat germ
- 2 cups coconut
- 2 cups coarsely chopped nuts
(English walnut, pecan, black walnut, hickory)
- 1 cup sesame seeds
- ½ teaspoon salt
- 1 cup corn oil
- 2 cups honey
- 2 teaspoons vanilla

Mix dry ingredients thoroughly in a large bowl. Heat together oil, honey, and vanilla -- DO NOT BOIL. Pour liquid mixture over dry ingredients and mix well. Spread about ¼ of mixture evenly on an oiled shallow pan (a jelly roll pan is ideal for this). Bake at 325° for 15 minutes. Remove from oven and stir well. Bake for another 8-10 minutes and watch closely so the mixture does not over-brown. It's ready to remove from the oven when a golden brown. Place on a wire rack to cool and stir occasionally to prevent caking. When cool, store Granola in airtight containers. Repeat baking procedure for each panful.

Happy eating. You'll find that a bowl of Granola for breakfast will keep you until lunch. It also makes a good trail food and in-between-meal snack the kids.

You can add or omit ingredients according to your own preference. If you want to add fruit, add it after baking. Baking the fruit will harden it and dry it out.

WHAT'S COOKING?

(Continued)

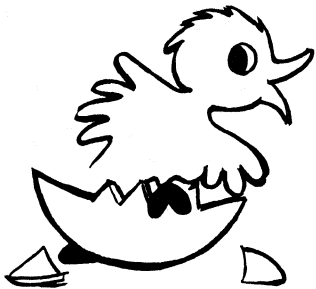
The January issue of the OBSERVER was contributed by the employees at the VLA. The cafeteria staff sent us some very interesting recipes and for reasons beyond our control some of them were left out of that publication. Now we have all the facts straight and listed below are the recipes that were omitted.

CHICKEN ENCHILADA CASSEROLE

Anita Chavez, Archie Lucero, Irene Hernandez,
Ellen Ary

- 1 whole chicken, boiled and boned and cut.
- save broth
- 2 cups chopped green chile
- 1 small can of mushrooms (if desired)
- 1 can cream of chicken soup -OR-
- 1 can cream of mushroom soup
- garlic and salt to taste.
- 2 doz. corn tortillas (fried soft)
- 1# cheese (grated)
- ½ cup chopped onions

Mix chicken, chile, mushrooms, cream of chicken or mushroom soup, 1 soup can full of broth. Simmer until mixture is hot. While chile mixture is simmering, fry corn tortillas and let drain. When ready to put together, place in layers First chile mixture, then corn tortillas, cheese, sprinkle onions lightly and keep on layering until all ingredients are used.



CINNAMON ROLLS

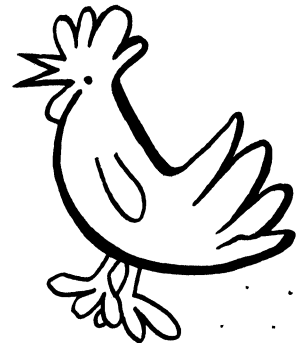
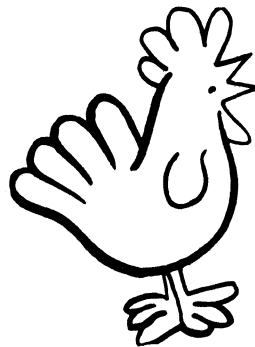
Ellen Ary

- 1 pkg. dry yeast
- ½ cup warm water
- 1 cup scalded milk
- 2 Tablespoons shortening
- ½ cup sugar
- 1 Tablespoon salt
- 1 egg
- 3½ to 4 cups sifted flour

Dissolve yeast in ½ cup water, add sugar, let stand. Scald milk and shortening, allow to cool to lukewarm and add to yeast. Add egg and mix. Add sifted salt and flour and knead until smooth. Let rise.

- butter (melted)
- brown sugar, granulated sugar
- cinnamon

mix brown sugar, sugar and cinnamon. Melt butter. Roll out dough and spread butter. Sprinkle dough with sugar and cinnamon mixture. Roll up the dough and cut in ½ inch thick pieces. Place in pan and brush with butter. Let rise and bake at 400° for 15 minutes.



VLA PROJECT RECREATION ASSOCIATION

Eva Jean Rigby

The newly elected Board of Directors for the VLA Project Recreation Association are:

Eva Jean Rigby	President
Emory Egler	Vice President
Sheila Reasner	Treasurer (2nd term)
Peggy Perley	Secretary
Paul Harden	Chairman (Fund Raising) (2nd term)
Jess Landers	Co-Chairman (Activities Committee)
Rick Hagen	Chairman (Activities Committee)

The Association at this time is involved in preparing for Jack Lancaster's Retirement Dinner. The Association will provide the band and entertainment. The dinner is scheduled for March 28, 1981.

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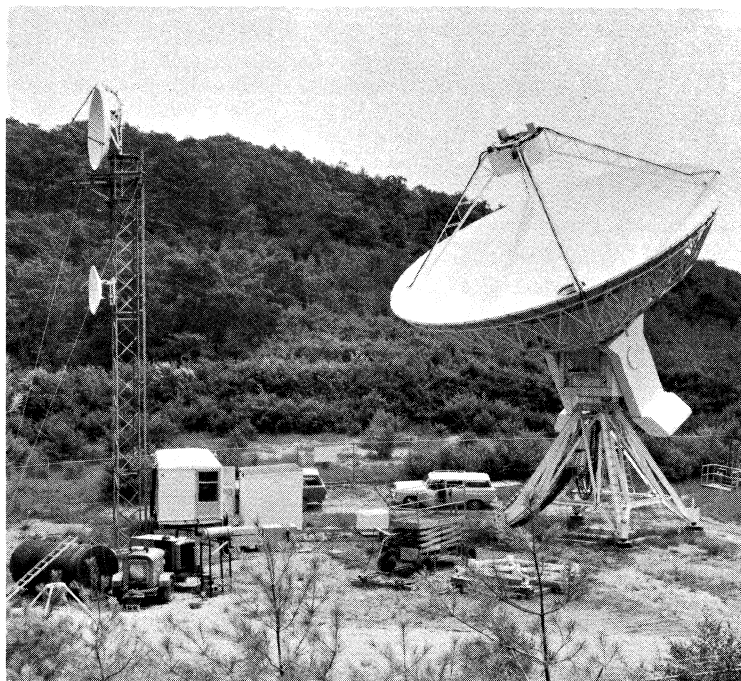
45-FOOT GOES ON COMMERCIAL POWER

Sidney Smith

The 45-foot radio telescope at the Huntersville site will soon get commercial electrical power after operating for many years from power supplied by a 50 KW diesel generator.

A little over 2 1/2 miles of power lines will be laid underground from a point between Huntersville and Devil's Backbone on route 39. Generally the powerline will follow the existing access road to the telescope site. The only places the powerline doesn't follow the dirt road is a short stretch near route 39, a shortcut at the "M" curve, and at the sharp turn near the site.

When commercial power was proposed for the 45-foot, little difficulty was expected in completing the project quickly and without construction problems. But we should have known better,



we've had a lot of experience to the contrary. It took the power company over a year to obtain the necessary right-of-ways. Some of this difficulty was attributed to the Forest Service's demand that any power line crossing Federal land must be underground. Our 45-foot site is on Federal land too, so we decided to put the entire line underground.

All right-of-ways were obtained by November 1980 and Monongahela Power had a contractor begin work in the middle of December 1980. Shortly after construction began, a severe cold front moved in and froze the ground 14 inches deep and stopped all work. Work will resume as soon as the ground thaws this spring and is expected to take three to five weeks, again, depending on the weather.



GREEN BANK RECREATION AREA

Dwayne Schiebel

The weather is changing for the better. As more warm, sunny days come our way, it might not be a bad idea to remind Green Bankers of the Hannah House recreational facilities. Let's begin our Recreation Area tour with the driving range.

While the golf driving range extends down almost to Deer Creek, the driving tees are within the main recreation area which includes the swimming pool, tennis, basketball, badminton and handball courts, beginners' ski slope/toboggan run, parking area and equipment shack.

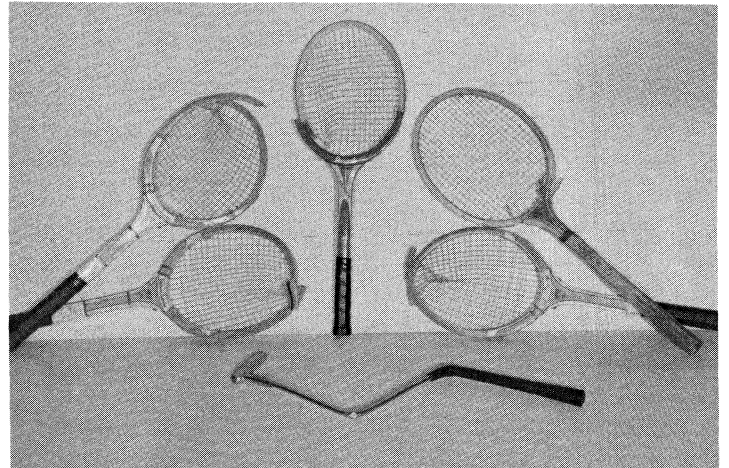
Across the road from the tennis courts and isolated by a relatively steep slope is the children's playground. It has swings, a merry-go-round, see-saws, sand box and monkey bars. Next to the playground is an 18 hole miniature golf course, picnic area and two horseshoe pitching courts. The picnic facilities include tables and a covered shelter with fireplace, electrical outlets, lights and running water.

Hannah Road ends at the old Hannah House which is the focal point for several recreational activities: ceramics, pottery, shell reloading and photography. A modern kiln, a potter's wheel and basic equipment are available for ceramics and pottery. Upstairs a well equipped reloading room makes reloading of pistol, rifle and shotgun shells relatively easy and inexpensive. In experienced people should contact a member of the Green Bank Rifle and Pistol Club for reloading instructions and help. The photography equipment has been loaned to NRAORA by Marc Damashek. Outside the Hannah House, a volleyball court dominates the front lawn. In the summer-time hardly an evening passes without a spirited game (and hardly a summer passes without a sprained or broken ankle).

The rifle and archery ranges are over the hill from the Hannah House and along the northeast border of the recreation area. The rifle range is reported to be among the best in West Virginia. The archery range however, is a modest trail target type.

Those who like nature in the pure can enjoy the plain quiet and loveliness of the area, watch grazing deer, hike along the many trails, and for those who want to wet a line, there's fishing in Deer Creek.

Yet, with all this recreation to choose from, there is a tiny minority (I hope not NRAORA members) who have to amuse themselves with vandalism. Our equipment shack has been broken into several times and several structures have been damaged by deliberate bumping and being overrun with a vehicle (the photo with this article shows some of their handiwork). If you or family members see any suspicious activity, please report it to the guards or the guard's supervisor.



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ICE JAM

On February 10, snow gave way to drizzling rain as temperatures began to rise. Midway through the next day as warm weather prevailed, the ice on Deer Creek began to break up and move downstream.

A short distance below the bridge on the road to Cass, the ice jammed, damming the water and forcing the creek to run over its banks. This photo, taken on February 12, 1981, shows the large, thick chunks that made up the ice jam. The thickness of the ice is surprising. Deer Creek has had low water since last summer.

AN END IN ITSELF

Lee J Rickard

One of the pleasant side effects of an astronomical education is a sense of relativity. Phenomena of great importance on one scale are often completely irrelevant to the happenings at a larger scale. Majestic Saturn, with its thousand rings and thousand mile-per-hour jet streams, is minor debris left from the formation of the Sun. The mighty Sun, a thermonuclear furnace whose smaller surface storms could swallow the Earth, is an undistinguished star in the backwaters of the Galaxy. Astronomers have raised this relativity of perspective to a maxim: "One man's life's work is another man's trivial effect to be neglected in the calculation."

Scale-skipping can be played with even the most somber topics. What, for example, is your pleasure in apocalyptic contemplation? Total nuclear war is a nice start, with the annihilation of much of the Earth's surface life. But, it's rather a small thing compared to the events in the Earth's past when, at the end of the Permian and Cretaceous eras, most of the lifeforms on Earth were destroyed, down to the deepest ocean habitats. And who gives a fig for the skin of a planet when compared to the destruction of an entire star in a supernova explosion? Of course, the loss of one star is peanuts when you think of millions of them being swallowed up by black holes in the centers of quasars. But what's a quasar anyway? Just a candle in the vastness of the universe, a memory of former greatness in a cosmos sliding inexorably to entropic ruin.

Pretty heady stuff, yes? Especially when you live in Washington, where a change in the majority party in the Senate is viewed as an end to civilization as we know it.

Armageddon is a fascinating subject, rich with revelations about human psychology. What do you do when the world is going to end? Redeem your savings

bonds? Buy a hang-glider? Shoot your neighbor? A person expresses a great deal about the nature of his dreams when he thinks his nightmares are about to come true. And, the end of the world comes more frequently than you'd expect. It's happened several times this century -- or at least was expected to happen, which is enough to prompt the apocalyptic frenzies that sociologists love to study. In 1910, for example, the Earth passed through the tail of Halley's comet. As cyanogen gas is a prominent constituent of comets, there was wide belief that this passage would result in the death of all life on Earth, through cyanide poisoning. Despite scientific lectures on the extreme diluteness of the comet tail, many people squandered the mortgage money on anti-comet gas masks.

Similarly, a surprising number of people in New York and New Jersey tuned in late to the Mercury Theater's radio broadcast of H. G. Wells' War of the Worlds, on Halloween, 1938. Mistaking the drama for real news bulletins, they panicked. Some fled for rural safety; some despaired and contemplated suicide; some armed themselves against the alien invaders. One farmer shot down a Martian war machine, which later turned out to be a water tower. Everybody bought anti-Martian gas masks.

Not everyone is brought to expect worldwide devastation by external threats. Some are driven to it internally, by religious beliefs, UFO fancies, etc. What strikes me as particularly curious about such people is that many of them are really eager to see the world conclude. The tendency to dwell on it is understandable, being an extension of our natural concern for personal mortality, which figures so prominently in our art and letters. But it hardly seems the thing to desire fervently -- so many books unread, jobs undone, retirement benefits uncollected. Yet apocalyptic cults are decidedly upbeat and hopeful, and seem genuinely disappointed when nothing hits the fan. Some people, apparently, would rather be right than resident.

Of course, when you anticipate the end of the world, there is some embarrassment

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involved in outliving your expectations (a characteristic it shares with Social Security). History has dealt harshly with millennial movements, those religious groups that occasionally appear with predictions of the Second Coming for Tuesday next, and are last seen sitting in dinghies hauled to the dry mountaintops. The term millennial, of course, derives from the medieval Christian sects who figured that the best time for a heavenly reckoning was when the digits all flipped on the solar odometer, at 1000 A.D. You can imagine their disgruntlement at the continuing darkness of the age.

But millennial sects have existed in Christianity since its inception. One of the earliest was founded by Montanus, in the latter half of the second century. More recently, one recalls the Anabaptists (deadline 1533), and the Millerites (deadline circa 1843). Nor are such movements confined to Christianity. Jews have been expecting their Messiah for thousands of years, and occasionally some decide that the time is ripe. The followers of Sabbatai Zevi hoped for heavenly redemption in 1666. Curiously, they were not only not discouraged by the persistence of mundane existence, but even kept faith when their Messiah subsequently converted to Islam!

This points up an interesting phenomenon. When confronted by the most obvious and thorough disproof of their beliefs -- such as the failure of the world to end -- people often not only persist in their convictions, but are moved to hold them more strongly. Thus, many Millerites continued to believe their prophet long after his predicted advent proved a bust. Similarly, Sabbataian Jews insisted Zevi's conversion to Islam was actually part of a hitherto unsuspected grand plan. This is a pattern of behavior that particularly fascinates sociologists, who hope to find in the extremity of the circumstances enough relief to trace the subtle contours of human nature.

One of the most detailed examinations of a millennial cult was made by Leon Festinger, Henry Riecken, and Stanley Schacter. As members of the Laboratory for

Research in Social Relations at the University of Minnesota, they studied a group of flying saucer enthusiasts who went public with a prediction of world cataclysm in the early 1950's. The group was never well received by the local newspapers or school authorities. But because the subject was flying saucers -- at a time when even the CIA wasn't sure what they were -- they attracted a respectable number of adherents. By the date of their anticipated ascension to a celestial haven (and subsequent traditional drowning of the remaining unworthies), the roster of firm believers was perhaps two dozen strong, and was liberally sprinkled with observers from the Laboratory for Research in Social Relations.

The observer's story is told at length in the book When Prophecy Fails. When the appointed hour passed without event, there was only momentary disappointment among the faithful. By the next day, they had interpreted their survival as a miraculous intervention, a divine delay in the program. Although a few dropped away, most not only held firm in their anticipation of a rescheduled advent, but actually increased their attempts to publicize it.

This behavior can be understood within the model of cognitive dissonance. People often hold inconsistent opinions, ideas, beliefs (generically, cognitions). My wife believes the Surgeon General's report, but she also expects to keep smoking. Such dissonance (inconsistency) produces discomfort, and corresponding pressures to reduce the dissonance -- by changing ideas, by seeking new evidence to support one side of the dissonance or by completely rejecting part of the dissonance. In this example, my wife has the option of quitting smoking, collecting pamphlets from the Tobacco Institute; or ignoring the Surgeon General as much as possible.

Usually, the rise of the dissonance is gradual, so that slow adjustments can relieve it. The Mercury Theater's audience was led to believe in Martians by stages, each barely acceptable and, once accepted, making the next step acceptable. One listener quoted by Hadley Cantril in his famous study of the panic, The Invasion from Mars, is explicit:

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"I kept translating the unbelievable parts into something I could believe until finally I reached the breaking point -- I mean my mind just couldn't twist things any more, and somehow I knew it couldn't be true literally, so I just stopped believing and knew it must be a play."

But when a true believer is confronted with overwhelming contrary evidence, he faces a clear, strong, and immediate dissonance. If his beliefs have already led him to take definite, irreversible acts (selling the house, insulting the boss, shooting the neighbor), then the mere rejection of his faith may not be the easy way out. The psychological pressure may instead favor reinterpreting the disconfirmation itself, as the best way to ease his dissonance. The conviction becomes stronger, because it's the only thing that can help him face the consequences of his original beliefs. The effect is particularly strong when shared with a group of similarly dissonant people.

All this seems rather pathological, but these patterns of behavior can be found in everyday situations. Scientists, for example, are often in the position of facing experimental evidence that contradicts a cherished theory. Some relieve the dissonance produced by believing both data and theory by the time-hallowed scientific method of scrapping the theory. But it is by no means uncommon to find the same behavior as in the millennial cults, the attempt to explain away the data in order to save the theory.

Nor is this surprising. Remember that the cherished theory itself acts to resolve a dissonance. It provides an explanation for some other set of perplexing facts. The decision to abandon it is one of weighing the dissonances. Is it better to explain many things at the risk of inferring one thing contrary to observations, or to chuck all for the sake of someone else's datum, which may prove to have been wrong or irrelevant? It is in recognition of the agony of such decisions that scientists are so highly paid.

One should not be misled, though, into believing that all such comparisons between scientists and adventists can be so nobly explained. There are many cases of personal theories advocated long after their objective support has dissipated. In some cases, it may even be said that the original justification was no more than aesthetic, supported by an initial lack of contrary observations. In recent memory, we find Sagan's advocacy of water-ice clouds on Venus, in which he persisted long after the model was contradicted by radio and polarimetric data; Schmidt-Kaler's insistence that stellar rings could be used to map out the structure of the galaxy, despite evidence that proved the rings to be chance arrangements in the sky, and not physical associations; Dingle's pathetic inability to understand everyone else's resolution of the twin paradox in Einstein's relativity theory.

Of course, not all such cases end badly. Persistence beyond all hope is sometimes a virtue in astronomy, where the community is often swinging back and forth between contradictory ideas. (It's our own way of passing the time until we actually know something about the subject.)

Furthermore, the eccentric champion is not necessarily an outcast from the community; he may even be viewed romantically. Clark Chapman, describing Sagan's Venus theories, argues: "By suggesting often outlandish alternatives and challenging traditionalists to disprove them, he has inspired doubts about many accepted theories. Sagan's role is essential for a healthy science because a bandwagon effect frequently leads to premature consensus among scientists before equally plausible alternatives have even been thought of, let alone rationally rejected." Thus we preserve Sagan in order to preserve the freedom of scientific inquiry -- a relationship akin to that between *Hustler Magazine* and the First Amendment.

The twin themes of apocalypse and dissonant science are often played together. Even as we breathe, Sir Fred Hoyle and N. C. Wickramasingh are energetically exercising the freedom of inquiry. Having

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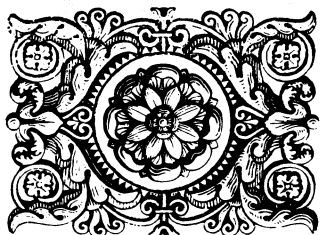
identified the surface material of interstellar dust particles as a collection of organic slushes called polysaccharides, through a technique known to infrared spectroscopists as "making a mistake", they have been ineluctably drawn to the conclusion that comets cause colds. More precisely, they assert that the nuclei of comets, being fresh-frozen interstellar starchsicles, harbor more influenza viruses than an equal weight of dirty Petri dishes. These viruses spray the Earth from each passing comet, causing epidemics. Hoyle urges the governments of the world to entertain a program of spaceborne disease prevention. The next return of Halley's comet threatens not death by poisoning, but possible fevers and sneezing.

Alas, the end of the world is not what it used to be. I am reminded of Karel Capek's character, the patriarch Adam, who destroyed the world in the hopes that he could get it right the next time. His disappointment with the quiet winking out of life is evident:

I'd hoped for cyclones, comets,
lava, floods,
And frankly, much more outcry
and lament.

I thought that it would be
God knows how fine,
And that the world must end in
splendid terror;
And this was merely like a lamp
snuffed out.

...Dead,
Dead is the world. Yes, it
was badly made
And I've abolished it.
A pity though,
That the end wasn't more
of a success.



GREEN BANK MUD DAUBERS

Pearl Clarkson and Mary Ralston

The Green Bank Mud Daubers spent a lot of hours this past summer and fall dabbling with ceramics. Ceramic classes funded by the NRAORA changed many of us from "I don't know what I'm doing" to "Gee, did I really make that?" No doubt about it, the grant from the Rec. Association started the action and for that we thank them.

Twenty members enrolled for the Monday night and Wednesday morning classes. Classes covered basic cleaning of greenware, covercoats, froth, dry brushing, antiquing, red coats, wax-resist, stains, crystal tones, dust-a-way, fired antique, sgraffito, E-Z strokes, brocade, polished covercoats, pearls and decaling. Our instructor was Arlene Rexrode from Janarbec Originals, who displayed a lot of patience teaching and instructing us. For her patience we are deeply grateful. Some of the ceramics we produced are shown in this photograph above. Unfortunately, this black and white of a color print doesn't do them justice.

When we displayed our finished products on a shelf in the Hannah House, they brought forth such comments as: I'll

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never make something like that." "Oh, isn't that beautiful." "Who did those gorgeous ornaments on the shelf?" "How will I ever get this piece of greenware to look like the one you did?" Surprisingly, most of the ceramics turned out great.

I might add also it took all twenty members working together and sharing firing the kiln, cleaning up, ordering greenware and many other chores to make the ceramics club a success. Most of the members of the ceramics club felt they completed an educational, successful, enjoyable and fun year. The officers of the club are grateful for the cooperation and enthusiasm of the members.

Come spring we look forward to the start of another wonderful year of ceramics.

* * * * *

MASERS

Roger Norrod

Over the past five years a great deal of time and money has been spent at Green Bank on the development of masers and receiver systems based on masers. For those who are not familiar with the term, maser is an acronym for microwave amplification by stimulated emission of radiation. Simply put, a maser is a device that amplifies microwave signals. Of course, there are a lot of devices that amplify microwaves, and most of them are not as complicated and less expensive than a maser. Despite the higher cost and complexity, a maser has one overriding property: it is a very low noise device. In fact, masers are the lowest noise amplifiers known. Therefore, they can help astronomers detect and study signals weaker than those possible with other types of amplifiers. This possibility, of course, makes radio astronomers light up like Christmas trees and so NRAO got involved with masers.

The maser currently in use at Green Bank was developed jointly by the Jet

Propulsion Laboratory and NRAO. JPL has been working on various types of masers for NASA since 1958 and began work on the reflected wave type currently used in 1972. Two basic drawbacks, besides cost, kept many prospective users, including NRAO, from adopting masers: 1) masers must operate at liquid helium temperatures and, 2) early masers were very narrow band, fixed frequency devices. Originally, liquid helium temperatures required large, bulky, unreliable helium liquefiers but developments at JPL in the sixties and improvements made at NRAO in the seventies have resulted in a compact, reliable, closed cycle helium liquefier which has helped make masers practical. As to the bandwidth, results at JPL on an X-band maser and the availability of a high power backward wave oscillator for the pump led to a joint effort by JPL and NRAO to develop a maser with broad instantaneous bandwidth, tunable over the 18 to 26 GHz frequency range.

Craig Moore spent much of 1976 at JPL in Pasadena, California learning and helping to build the first K band maser. This maser was delivered in 1977 and later installed on the 140-foot. Craig, working with Carl Chestnut, the machine shop, and others, began producing other units and making various improvements. Meanwhile, Howard Brown, Troy Henderson, and Dave Williams worked on building and improving additional closed cycle refrigerators. Satisfactory experience gained with the first maser on the 140-foot led to the construction of a maser system used with upconverters to cover the 5-25 GHz frequency range. Chuck Brockway and Tom Dunbrack integrated a maser built at Green Bank into this system and installed it on the 140-foot in the summer of 1980. The original JPL maser remains on the telescope as a backup until completion of a second channel 5-25 GHz receiver now under construction.

A maser system was shipped in February to the VLA for integration into the array. This maser is configured somewhat differently than others built at

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Green Bank. Normally, the maser consists of four amplifier stages connected in series, but the VLA maser is instead connected as two, two-stage units and can provide two receiver channels simultaneously. The maser will be installed on one of the array telescopes that isn't moved during reconfigurations. It will be connected as a pre-amplifier in front of the K-band receiver used now. The current K-band receiver uses a cooled mixer operating over the 22-24 GHz range and has a receiver temperature in the 250°K range. With the maser attached, the receiver temperature should be less than 20°K. The maser equipped antenna will be used primarily for VLBI work but is also expected to improve the overall array baseline somewhat.

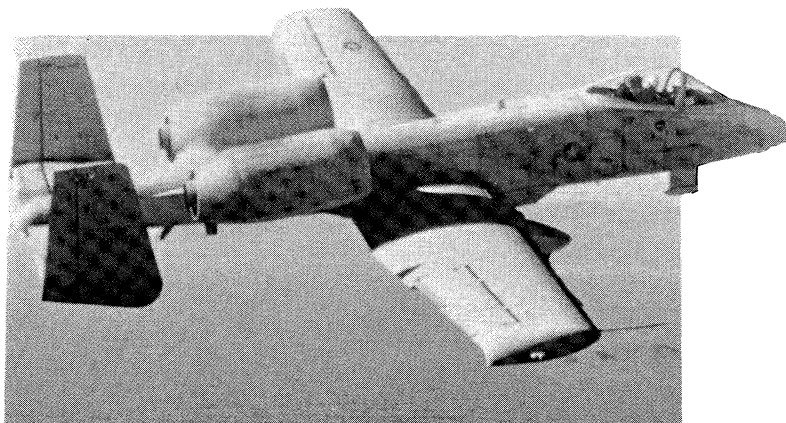
One indication of the masers' success is interest expressed by other observatories. CSIRO of Australia and the NRC of Canada are currently fabricating K-band masers based on the JPL/NRAO designs. Many other observatories have expressed interest but unfortunately cost is still an obstacle for many. Here at Green Bank, work is being done on a maser for the 40-50 GHz range and other receivers based on the K-band maser are being planned.

* * * * *

IS IT A BIRD.....

Richard Fleming

Is it a bird? Is it a plane? No, it's Superman! Actually you were right the second time. It is a plane, an A-10 Thunderbolt II to be exact. That is the name of the jet aircraft you see over Green Bank two or three times a week. The Air Force is buying (6.2 million dollars per copy) the A-10 from Fairchild Industries in Hagerstown, Maryland. There are three Air Force test pilots assigned to the Fairchild plant and they perform flight acceptance testing before the aircraft



A-10 close air support aircraft.

is entered into the Air Force inventory.

The A-10 is primarily designed as a defensive weapon against the tank. It is powered by twin fan jets which produce relatively quiet and smokeless thrust. It is highly maneuverable, operates efficiently at low altitudes and has short take off and landing capabilities.

The aircraft can carry a tremendous amount of ordinance and is heavily armor plated. In addition to free-fall bombs and missiles, there is an internally mounted 7 barrel, 30 mm Gattling gun that can fire 4200 rounds per minute.

The aircraft (always two together) operate in a specific geographic area designated by the FAA as the Evers MOA (military operating area). This area is an 18 x 36 mile rectangle with Green Bank located in the southwest corner. The majority of the test flights operations are conducted in the area northeast of Hightown Virginia.

* * * * *



*Beautiful arch in Medinas one mile southeast of Huntersville, West Virginia.
(Photo by Paul H. Price, circa 1929)*

DEVIL'S BACKBONE

Wally Oref

On route 39 between Minnehaha Springs and Huntersville and about 2000 feet down the road southeast of the 45-foot telescope access road is a unique geological structure known locally as Devil's Backbone. Devil's Backbone is an anticline -- originally horizontal rock formations that have been bowed up in an arch.

The strata that were deformed to create Devil's Backbone were deposited in a shallow inland sea some 400 million years ago during a period of time known as the Early Silurian. Subsequent consolidation over eons transformed the sediments into sandstones, shales, and limestones. The principle strata that one sees at Devil's Backbone are the White Medina (also called the Tuscarora) and

the Red Medina Sandstones, the red being the lower of the two. About one hundred fifty million years later during the violent upheaval of ancient Appalachia that formed our present Appalachian Mountains, these formations were bent into the graceful arch we see today.

Anticlines, like Devil's Backbone, but much larger, have always interested geologists and oil and gas men, because they can be traps for migrating oil and gas. Historically, much of the early oil and gas in West Virginia was found in easily recognized anticlines. West Virginia's first State Geologist, I. C. White, developed the anticline theory of oil and gas accumulation.

* * * * *

NRAO SERVICE AWARDS BANQUET

10 YEAR AWARD

From left to right: Ed Fomalont, Richard Fleming, Jane Chestnut, Neil McLaughlin, Mervel E. Runion

20 YEAR AWARD

From left to right: Glen Grandon, Richard Hiner, Troy Henderson, Pearl Clarkson, Carl Davis, W. Delbert Cassel, Tom Carpenter, Edmund Gardner

The 14th Annual NRAO Service Awards Banquet was held in the Green Bank Cafeteria on March 6, 1981.

Employees were honored who had completed ten and twenty years of service as of December 31, 1980. Employees included those qualifying from both Charlottesville and Green Bank. Campbell Wade and Emory Egler from New Mexico received their twenty year award and Bill del Giudice from New Mexico received his ten year award.

Ten Years

Edward B. Fomalont
Eva J. Chestnut
Richard L. Fleming
Charles R. Pace
Neil A. McLaughlin
Mervel E. Runion
Craig R. Moore

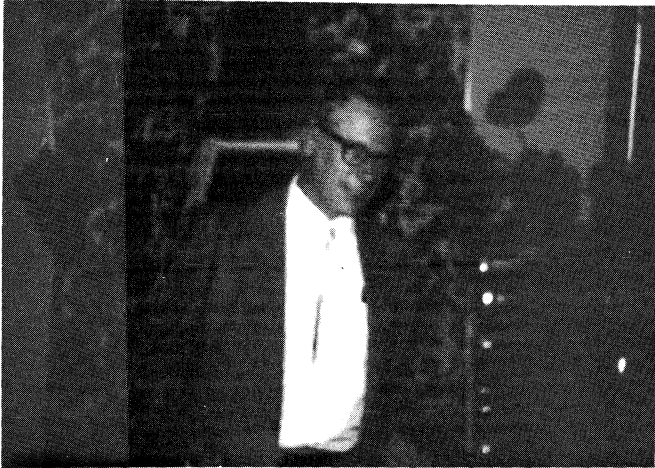
Twenty Years

Richard B. Hiner
Troy V. Henderson
Clifford G. Mayes
Glen E. Grandon
Pearl R. Clarkson
Thomas H. Carpenter
W. Delbert Cassell
Dana B. Cassell
Carl C. Davis
Edmund C. Gardner

This brings to 177 the number of employees who have completed ten or more years of service. Of this number, 32 have completed 20 years. 138 of the 177 are still employed by the NRAO.

* * * * *

VLA AWARDS DINNER



Cam Wade



Emory Egler



Bill del Giudice

Photos by Don Swann

On March 11, 1981, Cam Wade, Emory Egler, and Bill del Giudice were honored for their many years of service to NRAO at a special dinner at The Luna Mansion (see article on page 22). Cam and Emory received 20 year awards and Bill, a 10 year award.

Presentations were made by: Ron Ekers to Cam Wade, Jack Lancaster and Forrest Wells to Emory Egler and Les Temple to Bill del Giudice.

The honored guests were accompanied by their wives, Mary Ann Wade, Jo Egler, and Betty del Giudice. Other guests attending the dinner and presentations were Ron and Jay Ekers, Peter and Lynette Napier, Jack and Phyllis Lancaster, Les and Charlene Temple, Forrest Wells, Don Swann and Eva Jean Rigby.

* * * * *



THE LUNA MANSION

In 1692, Domingo de Luna came to New Mexico on a land grant from the King of Spain. A few years later, Don Pedro Otero came to Valencia County under similar circumstances. These two families grew, acquired fortunes in land and livestock, and became extremely powerful in politics and prominent in territorial society. The family heads became friends and business associates. The marriages of Solomon Luna to Adelaida Otero and Manuel A. Otero to Eloisa Luna in the late 1800's united these two families into what became known as the Luna-Otero Dynasty.

In 1880, the Santa Fe Railroad wanted right of way through the Luna property. In return for this favor, and because the proposed railroad tracks went squarely through the existing Luna hacienda, the railroad agreed to build a new home to the specifications of Don Antonio Jose and his family. Legend has it that numerous trips through the south by the Luna family inspired the architectural design of the mansion. Whether

or not this is true, the building is unique in that, while it is southern colonial in style, its basic construction material is adobe.

Because Don Antonio died in 1881, the first family to occupy the mansion was his oldest son, Tranquilino. After Don Tranquilino's death in Washington while serving in the legislature, younger brother Solomon took the reins of the family. Although Solomon was probably the most famous of the Lunas, he was not very prolific. With no children in his family, control passed to his nephew, Eduardo Otero, in the early 1900's. It was during this time, specifically in the 1920's that the mansion truly became the outstanding building that now exists. During this period the solarium was constructed, the front portico was added, and the ironwork, which once surrounded about five times as much property as it now does, was erected. Responsible for these and other improvements was a talented and creative woman, Josefita Manderfield Otero, wife of Don Eduardo. Josefita, or Pepe as she is affectionately remembered, was a daughter of William R. Manderfield, founder of the Santa Fe New Mexican. This fine lady ruled the mansion with a gentle and loving hand and spent her days caring for her magnificent gardens and applying paint to canvas. There are those in this area who still remember and speak highly of her.

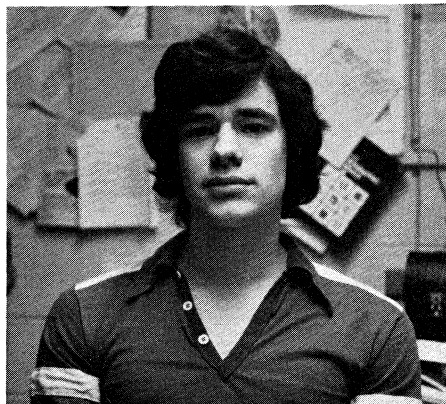
The Luna-Otero Mansion is an important monument to a time now past. The heirs of these families are scattered far and wide in new and different walks of life. The economic viability of the mansion as a headquarters for a livestock dynasty is forever gone. Such monuments as this building usually have one of three fates. They can be torn down and forgotten, to be replaced by new construction. They can be converted into museums by philanthropists. Or a new concern can inhabit the old structure and put it to a new use. By reopening the Luna-Otero Mansion as a fine restaurant we have sought to preserve and display an important part of New Mexico history.

PERSONNEL UPDATE

NEW EMPLOYEES



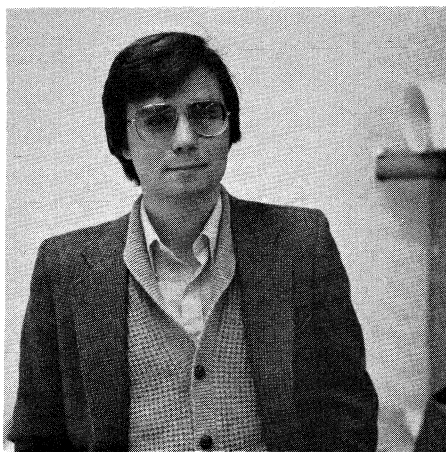
Pamela L. Fulcher
Technical Trainee
Computer Division - CV



James R. Lyons
Research Assistant (Co-op)
Electronics - Green Bank



Jackie B. Thomas
Receptionist/Telephone Operator
Business Office - CV



W. Thomas Vestrand
Research Associate
Basic Research - CV

OTHER NEW EMPLOYEES - PHOTOS NOT AVAILABLE

Raymond L. Gonzalez
Lynda O'Connor
Jacqueline von Gorkom

Technical Specialist
Secretary
Research Associate

Array Operations - NM
Tucson Operations
Basic Research - NM

REHIRES

Catherine F. Burgess
Michael T. Routt

Executive Secretary
Technical Specialist

Electronics - CV
Electronics - Tucson

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PERSONNEL UPDATE (Continued)

LEAVE OF ABSENCE

Kenneth Kellermann
Barry Turner

TERMINATIONS

Pamela C. Black	Robert M. Mitchell
James C. Brannan	Robert J. Peralta
Annie L. Chavez	Paul J. Riehle
Rosalie A. Ewald	Eric D. Russell
Kevin P. Gallaher	Linda Sowinski
Cynthia Henderson	Patrick A. Temple
Jerrold I. Kaplan	Richard Timney
Leta McMaster	Gary W. Towner
	Terry S. White

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IF YOU HAVE ANY NEWS, GIVE US A CALL



Every day at 7:30 a.m. two buses leave Socorro for the VLA site. Forty-six miles of the trip is over route 60 to the VLA cutoff. From the cutoff it's another four miles to the site. Magdalena is the only stop in the one hour trip. The return trip to Socorro leaves the site at 4:30 p.m.

Some 100 people ride the VLA buses regularly and at one time or another all site employees have ridden the buses driven by Nat Pargas, Emillio Vallez or Dave Archuleta. These three men drive the buses and Frank Bacon, the auto/diesel mechanic, maintains the buses.

Once the ride becomes routine, what do the people do to relieve the boredom and monotony? Some talk, some read, some play cards, and some catnap. In a later issue we hope to get an article from the VLA site commuters.

While searching through the old *OBSERVER* files recently, we found a list of "current" grocery prices. Since it was a 1972 *OBSERVER* that we found this information in, it occurred to us that it might be of interest to compare this list to today's prices. With the help of Joan Martin in Charlottesville, Max Thomas in Tucson, Toby Mann in Green Bank, and Eva Jean Rigby from Socorro, here is that list compared with the same items (or rough equivalent) found in their local markets.

PRODUCT	Average prices in Charleston, WV in 1972	Marlinton, WV FOODLAND	Socorro, NM SAVEWAY	Tucson, AZ A. J. BAYLESS	C'ville, VA IGA
Peanut Butter - Jif 12 oz.	.50	1.60	1.55	2.19(18 oz.)	1.49
Mayonnaise - Kraft 16 oz.	.45	1.14	.98	.97	1.09
Mustard - French's 12 oz.	.33	.78	.85	.45 (9 oz.)	.75
Vinegar - Heinz 32 oz.	.41	.70(Lucky Leaf)	.75	.73	.73
Milk - 1 gallon, vitamin D	1.17	2.22	2.34	1.93	1.99
Margarine - Blue Bonnet, 1 lb.	.38	.83	.87	.63	.93
Cheese - American 12 oz.	.73	1.59	1.99	2.49	2.19
Eggs - 1 dozen, Grade A Large	.51	.91	.75	.91	.79
Spaghetti - Mueller's 48 oz.	.72	2.30	2.19	2.21	2.39
Kellogg's Corn Flakes 18 oz.	.37	.85	1.22	1.15	1.23
Tang - 18 oz.	.87	1.96	1.69	1.93	1.79
Round Steak - Top, per lb.	1.64	2.99	2.65	2.79	3.29
Chicken, legs - per lb.	.77	1.09	1.29	1.35	.89
Pork Chops, Center - per lb.	1.40	1.89	2.39	2.19	2.19
Dishwashing Liquid - Ivory, 22 oz.	.56	1.30	1.39	1.25	1.35
Tide Powder - 49 oz.	.86	2.11	2.12	2.05	2.09
Oranges - each	.09	.15	.13	.15	.16
Bananas - per lb.	.17	.49	.39	.39	.40
Lettuce, per head	.28	.50	.35	.19	.49
Potatoes, per lb.	.12	.30	.59	.24	.32
Instant Coffee - Maxim, 8 oz.	2.04	5.09	5.46	4.79 Tasters Choice	5.49
Ketchup - Heinz, 26 oz.	.48	1.34(32 oz.)	1.29	1.29	.97
Tomato Sauce - Hunt's, 15 oz.	.25	.58	.62	.43	.57
Cooking Oil - Crisco, 24 oz.	.57	1.42	1.46	1.24	1.34
Flour, 5 lb. - Robin Hood	.61	1.39	1.39	1.09(Pillsb.)	1.19
Sugar, 5 lb. - Domino	.70	2.39	2.99	2.15	2.19
Bread - 1 lb. 4 oz.	.33	.59	.86	.59	.79
Coca Cola - 128 oz.	1.10	3.35	2.29	2.78	2.70
Bologna - 3/4 lb.	.87	1.25	1.85	1.69	1.39
Ground Beef - per lb.	.81	2.13	1.79	1.39	1.69
Steak - T Bone, per lb.	1.84	2.99	3.75	3.39	2.89
Wieners - 1 lb., all meat	.68	1.33	2.15	1.59	1.59
Bacon - 1 lb.	.75	1.19	1.55	1.69	1.79
TOTALS	23.36	50.74	53.93	50.30	51.14