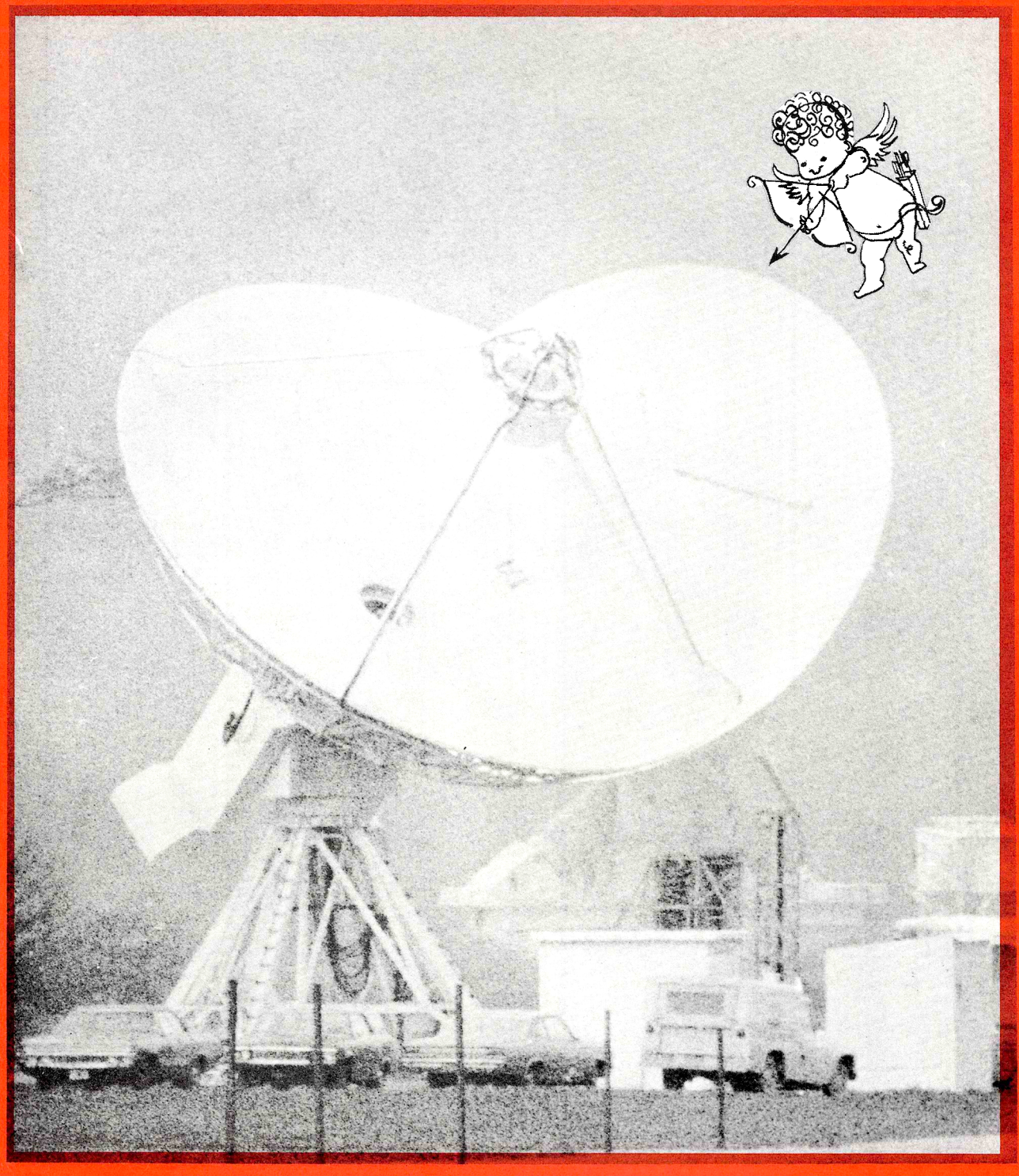
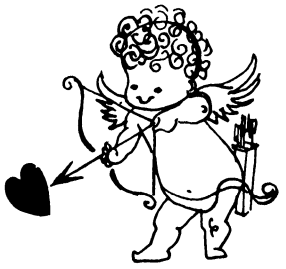
The OBSERVER

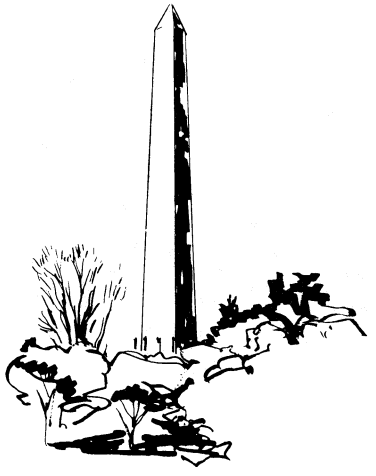
Vol. 15, No. 1 February 1974 Page 1



Cupid's confusion
Caused this illusion.

HAPPY VALENTINE'S DAY





Editor: - Wally Oref

Editorial Board; - Ed Fomalont
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Assistant Editor: - Vicki Taylor

Consultant: - Dave Hogg

Assistant to the Editor: - Berdeen O'Brien

Typist: - Vicki Taylor

Photography and Printing: - Brown Cassell
Gene Crist
Tony Miano
Ron Monk
Peggy Weems

Contributors to this Issue: - Rick Fisher
Richard Fleming
Eric Greisen
Ray Hallman
William Howard
Ross Jeffries
David Kellermann
Wally Oref
Alan Parrish
Monroe Petty
Seth Shostak
Mary Ann Starr
Bob Vance
Sebastian von Hoerner
Dave Williams

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A special thanks to all of those who helped assemble the OBSERVER.

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THE UNDERDOGS OF EXTRAGALACTIC ASTRONOMY

Rick Fisher

I have never tried it, but I suspect that if you asked an astronomer what the average size of a galaxy is he would give you a number which would describe something not smaller than our own galaxy or our neighbor, the Andromeda Nebula. It is well recognized that these two objects are relative giants, but there has been very little direct evidence that there is a substantial population of galaxies containing less than a few percent of the total number of stars in the Milky Way. I think it is possible to say now that recent observations of about 800 fairly nearby galaxies with the 300-foot telescope will change this picture significantly.

Very small galaxies have been known to exist almost as long as we have known that Andromeda was an external galaxy, about 60 years. Since these objects were always associated with much larger galaxies, they were considered to be trash left over from formation of the parent. Very few, if any, small galaxies were known to exist by themselves. In 1959 Dr. Sidney van den Bergh of the University of Toronto published a list of over 200 objects which he thought were dwarf galaxies not directly associated with other objects. Being a very experienced observer of galaxy photographs, he believed that he could tell the intrinsic brightness of a galaxy from its shape and apparent density. Unlike the very bright galaxies which he could also classify in terms of inherent brightness, he had no reasonable measure of the distance to the dwarfs so there was no way of conclusively separating faint, nearby galaxies from bright, distant ones. In the mid-1950's a great deal of effort was put into determining the distances to very bright galaxies, but the faint ones were beyond instrumental techniques of the time. In the years since 1959 one other investigator, Dr. Paul Hodge of the University of Washington has, with no mean effort, piled up enough evidence on a few of the dwarfs to show that indeed they are fairly nearby, but again the techniques at his disposal did not lend themselves to surveys of large numbers of galaxies.

So things stood in the summer of 1972 when I got a call from Brent Tully, an optical type galaxy expert and old crony from graduate school, asking what the chances were of observing hydrogen in dwarf galaxies. After we cleared the fundamental questions like, "What's a dwarf galaxy?", we did a few telescope sensitivity calculations and decided it was worth a try. In November we had 18 hours on the 300-foot which we used to observe about 50 of the van den Bergh dwarfs. We detected well over half of them which meant that in less than a day we had increased the total number of galaxies ever observed in the 21 cm hydrogen line by about 15%. The success of our program was due almost entirely to the fact that we had the use of one of the largest 21 cm telescopes in the world and, without a doubt, the best receiver in existence for hydrogen line work. Except for the Bonn 100 meter dish which is just now coming on line, the nearest competitor takes about 3 hours to reach the same sensitivity that the 300-foot attains in 10 minutes. The limited tracking ability of the 300-foot is not of major consequence for surveys of large numbers of objects at high speed.

As you might expect, we asked for additional time to observe the rest of van den Bergh's list. In the meantime Brent was traveling around the world after finishing his thesis, so we had correspondence scattered from Hong Kong to Rome. One package of data made three trips across the Pacific. At one point the sequence of arrival of letters got so fouled up that later when we met in Maryland we spent an entire morning sorting it all out. One box of cards is still floating around in the mail system six months later. At any rate, when Brent settled in Marseille, France, he went through the Palomar Photographic Sky Survey and picked up every galaxy he felt had a reasonable chance of detection on the 300-foot and were probably within a specified distance of the earth. The result was a list of 1250 objects which, if we could observe hydrogen in them, had the potential of defining the population of various sizes of galaxies in our local universe. Over 800 observations later, it looks like some of our goals are being realized.

As an example of the information we get from our observations, take the galaxy pictured on the next page. The photograph was taken by Brent at Haute-Provence Observatory

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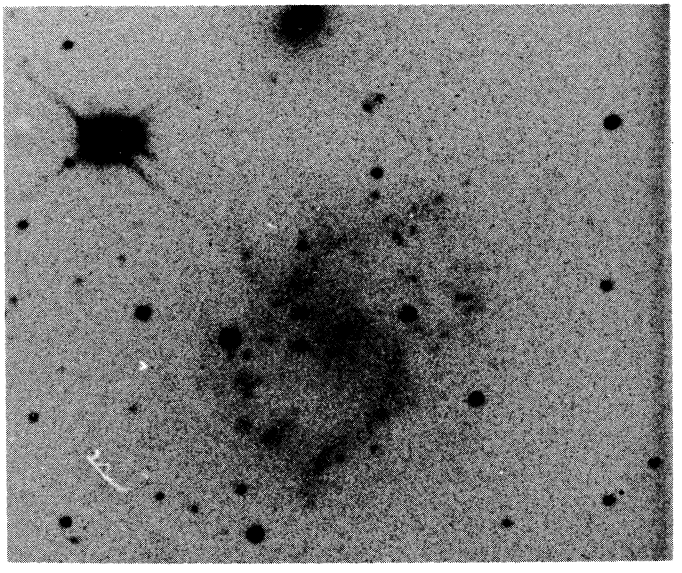
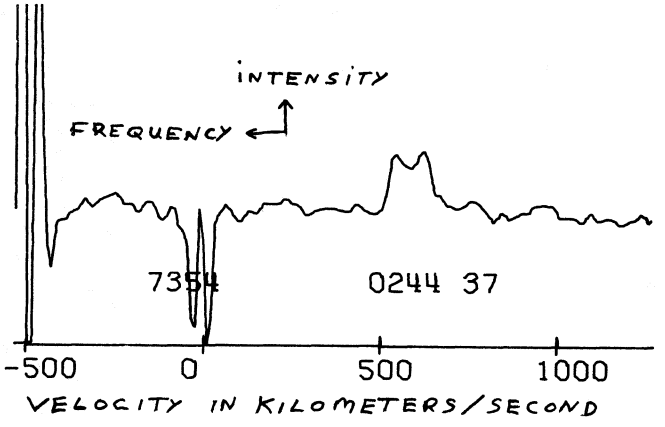
at Saint Michel, France. It has been considered such a run-of-the-mill object that its only designation is by its position in the sky, 0244+37, or the number in our list, C129. The hydrogen line spectrum obtained on the 300-foot is shown below the photograph. A spectrum is simply a plot of observed intensity versus frequency which, in this case, is decreasing to the right.





Since the observed frequency of radiation from an object is decreased if it is moving away from us, we can translate frequency into velocity as is done on the horizontal scale of the spectrum; the lower the frequency the higher the velocity of recession. Also, to a first approximation the velocity of recession of an extragalactic object is proportional to its distance from our own galaxy which begins to help us solve the problem of separating bright distant galaxies from nearby faint ones.

The feature in our spectrum near zero velocity comes from the hydrogen in our own galaxy while the square looking profile at 588 km/sec comes from the galaxy C129. Unless this object has an unusually high peculiar velocity, we already know its distance is roughly 9 megaparsecs or 30 million light years. From its velocity and position in the sky we can also associate it with a group of galaxies around the bright galaxy NGC 1023 for which we have a somewhat independent distance of about 7 megaparsecs, and by inference we can say that C129 must be about the same distance and our argument is strengthened. Now that we think we know the distance, it is a simple step to derive the linear size of the object, about 15,000 light years across or about one sixth of our own Milky Way, and its inherent brightness, about 3% of our own galaxy. It is just faint enough to be called a dwarf galaxy. If all of our conclusions are correct, C129 is one of the smallest known galaxies with a very neat spiral structure or grand design in extragalactic astronomers' jargon. Most small galaxies are much more irregular in shape.

Another bit of information we get from our spectrum is an estimate of the rotational velocity of the galaxy. You notice that all of the hydrogen in the galaxy is not moving away from us at the same velocity. Some has a velocity of 530 km/sec and some is receding at 650 km/sec which can be interpreted as a differential velocity of rotation of 120 km/sec times a correction for the tilt of the galaxy. Since the velocity of rotation is proportional to the square root of the total mass of the galaxy, we can derive a mass of about 3% of our own galaxy in good agreement with its inherent brightness.

Even more information about this galaxy can be gleaned from our spectrum. The area under the line profile emitted by C129 is proportional to the amount of neutral or unionized hydrogen in the galaxy. With the appropriate scale factors we get a value which says that the ratio of neutral hydrogen

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to star light in this galaxy is three to five times the same ratio derived for the Milky Way. A high ratio of hydrogen to star light is very characteristic of dwarf irregular galaxies as we have found from our observations which adds still another bit of evidence in support of the idea that C129 is small and nearby.

By this time I may have led you to believe that all of the parameters of C129 are well determined, but what I have not said is that the assumptions which go into the conversion of the observed values -- velocity, line width, and profile area into distance, mass, and hydrogen content -- are often not more accurate than a factor of two. When one combines the observations of hundreds of galaxies, however, a more convincing and accurate picture of the local universe emerges. For instance, Brent claims to be finding possibly twice as many groups of galaxies in our local universe than heretofor known with less velocity information. Also, some of the dwarf galaxies are apparently even fainter than van den Bergh had estimated which leads back to my original statement that we may be changing the picture of the local universe population. I might even speculate by saying that the gap in intrinsic brightness between the faintest galaxy and the brightest star is likely to be bridged by large numbers of intergalactic pigmies as observational techniques improve.

Why do we even care about galaxies which contain a rather insignificant amount of matter in the universe? There are several reasons. First, any theory of galaxy formation and structure is going to have to account for the properties of dwarfs. Second, the large number of small galaxies makes them good tracers of the statistical details of our universe. Finally, even the underdog deserves a little recognition.

We still have a way to go before we finish our observations, but as you can see, some of our final conclusions are beginning to take shape. We have just begun extending the survey to lower declinations on the 140-foot which cannot be reached with the 300-foot. Between the two telescopes we can cover nine tenths of the sky from Green Bank - a good fraction of the local universe.

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A JOURNEY TO THE NEW FRONTIER

Alan Parrish

You leave Green Bank in the middle of the morning, for Dulles airport. Henry is driving and, as usual, he has some amusing stories to tell. Five and a half hours later, you are back: five white dots in a familiar pattern appear in a valley five miles below.

A change of planes in Dallas, and on to Albuquerque. If you have a long wait at the baggage claim turntable, conclude that the airlines are about as on the ball as usual. "We'll send it down on the next bus." "Thanks."

The compact you reserved probably turns out to be a Chev luxury coupe with about as much room in the cab as a mini but it has an engine suitable for a five ton truck. At sea level, that is - at 6000 feet, it is pretty lethargic. You drive out of the airport, find the interstate highway, and head south. There is a loud station on the long-wave end of the car radio that plays some rock heavy enough to keep you awake as you travel down the long, straight road. A quarter moon etches the distant mountains sharply against the ten-gallon sky. After an hour and a quarter you reach the Socorro exit, and it is not hard to find route 60 west. Magdalena, the sign says, 25 miles. You pick up several hundred feet more altitude on a long grade, and lights appear on the horizon. It must be bigger than Arbovale--there are more murky-vapor streetlights.

The Western Motel is uptown (that is, east of the Phillips 66 station), and at six dollars a night the uninformed would guess it to be a rathole. A comfortable, clean room done in genuine knotty pine makes it some mighty high class rathole. However, those who want color TV, wall-to-wall carpeting, and a sanitized-for-your-protection strip on the john will have to stay in Socorro.

Breakfast? Go downtown to the Magdalena Cafe, where Rose holds forth over an enormous black gas stove. Periodically she bustles about taking orders in several varieties of Spanglish while refilling coffee cups from a well stained quart measuring cup made of some high melting-point plastic. The hot coffee will be appreciated as some time must

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pass before the sun and the stove have the place up to Federal Temperature Standard. (Do not fail to try the $3.75 steak on your return in the evening!)

The strong morning sunlight reveals that the town is but a shadow of its former self. The Magdalena Hotel, a substantial brick building of three stories, may become the next NRAO co-op and graduate student commune, but today it is empty and boarded up. It's closing must have been recent; Old Man Time has not yet done in the glass in the windows, nor the bulbs in the porch light sockets. The same cannot be said for many of the small adobe houses nearby! Further inspection reveals that the town must have been in its prime in the twenties and thirties. Many of its public buildings are courtesy of the WPA.

The NRAO inhabits the front room, the back room, and the back-back room of an old storefront across from the post office. Inside, the exposed bare bulbs on drop cords have been replaced by some fancy fluorescent lights, and the GSA has supplied some of the usual tin desks, yet the flavor of the place still reflects its past. (There are no drapes in the front window yet.)

Your first trip to the site is likely to be in a dusty, tool-laden four-by-four carryall with Forrest Wells at the helm. After a few more of these trips one is likely to conclude that the best earth-based approximation of infinity is the 23 miles between the office and the site when covered in a government vehicle at fifty mph! At the top of the hill the Plains of San Augustin stretch before you - tens of miles of grass tufted grey soil lie between the eastern and western mountains. Out in the middle of the Plains, a few turnoffs onto smaller and smaller roads will bring you approximately to the Center.

You have arrived. You too can leave ten thousand footprints in the moondust.

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Use an electric corn popper for warming rolls or crisping potato chips, crackers, dry cereals. They must cool again before they regain their crunch.

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BIRTHDAY POLL RESULTS

Ray Hallman

Twenty-six were against and nine were for having the day off for birthdays. The returns received during the first four days of the poll were all against the idea, which indicates that people against the idea were more energetic in expressing their feelings than were people that were for this idea. This pollster thought this idea was good and was quite surprised to see the overwhelming results against birthday holidays. I thought I would be the only one for this now apparently ridiculous idea! But finally a few others expressed favorable returns.

A few of the comments received:

"Offer employees the option of either having his/her birthday or his/her wedding anniversary off."

"On condition: If I get my birthday off, the rest of the Observatory should be allowed a day off for my birthday--and thus contribute to energy conservation."

"I don't like holidays at all!"

"How about a day of our choice on an individual basis."

The last comment was received often. It is difficult for this writer to distinguish this from an ordinary vacation day unless the meaning comprises the fact that not all employees are permitted to take vacation at any time.

The number of returns received represents only a small sample of all employees. (35 valid returns, plus 1 disqualified for marking both boxes, and 10 disqualified for being xerox copies.) The poll results appear to indicate a general discontent with the prospect of having a holiday off for your birthday, and hence will not be further pursued. Watch the OBSERVER for future polls on questions of general interest. Thanks to those taking the time to file a return.

Ray, you had an excellent return. The highest number of responses I've ever gotten from employees was two. The second highest was a magnificent 0.---Ed.

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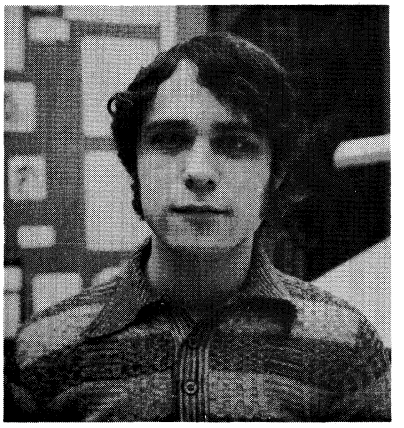
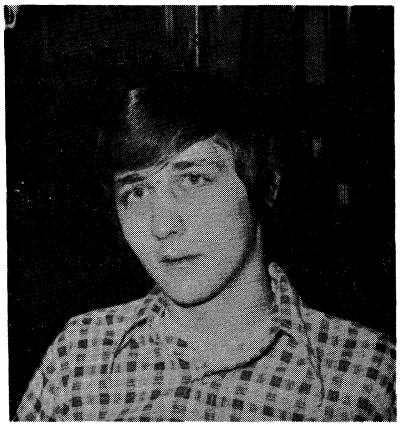
NEW EMPLOYEES

Hiroshi Ohta
Vis. Research Associate
Electronics Div. - CV

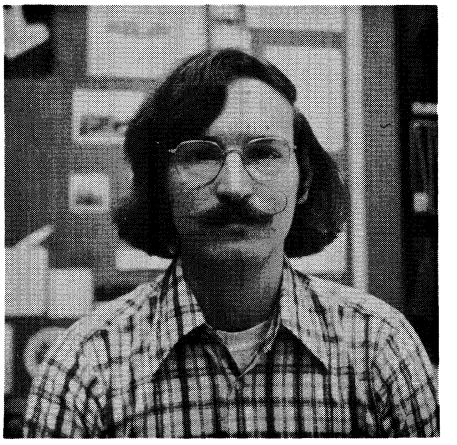


Lee J. Garvin
(Co-op)
Scient. Services - CV



John D. Liebenrood
(Co-op)
Scient. Services - GB

Samuel S. Rouse
Draftsman II
Electronics Div. - CV



Thomas M. Bania
Research Assistant
Scient. Services - CV

TERMINATIONS

Eugene E. Wetmore	Tucson Operations
R. Jane Gordon	Administrative Services - GB
C. Scott Donovan	Fiscal Division - GB

TRANSFERS

Jackie G. Cochran	Electronics Division - Tucson

*****

WHAT IS MUSIC ALL ABOUT?

Sebastian von Hoerner

Before going to the I.A.U. meetings in Poland, we spent a wonderful vacation in Ossiach, Austria, where I attended an international meeting on "Physical and Neurophysical Foundations of Music," August 14 - 18, held in an old monastery right at a beautiful lake. Maybe I should not write it where astronomers can read it, but I must say it was the most fascinating meeting I have seen in years. There were experts from 11 countries and many different fields: musicians, composers and conductors; physicists, physicians and psychologists; and scientists of brain research, cybernetics and information theory. This meeting was embedded in a larger frame, a music festival "Carinthian Summer" (Carinthia = old name of Kärnten = south-eastern part of Austria). Every evening we had a most wonderful concert, mostly in the old monastery church. We really got our fill!

I even got a chance of repeating by myself many of the experiments I had learned of. After Ossiach, we spent a week in Heidelberg. Hermann, our eldest son, has completed his masters degree and continues his studies, but he has also a little firm "Electronics Development," together with a colleague and two employees. They just had their summer vacation, and there was all the equipment I needed: frequency generators, amplifiers, loudspeakers, and a good set of earphones. Thus, Hermann put it all on a big empty table and gave me the keys, and I happily worked away for the whole week.

The meeting contained a wealth of interesting things. But since I did not take any notes (regarding it as vacation rather than work), I can mention in the following only those few topics which happened to stick in my mind better than the others, making it a rather biased sample.

I. Hearing, in General. Many of the lectures dealt with the construction and functioning of the ear and its nerves (theory of hearing), but all this would fill up a whole book, and I will repeat only some more experimental topics.

(1) The range of hearing goes from a lower limit of 30 to 50 Hz, up to an upper limit of 8,000 to 20,000 Hz (decreasing with age). But our musical range is much more narrow: this is the range where you have a clear sensation of pitch, where you easily can recognize or invent melodies. I tried this in Hermann's lab, with two (alternating) generators, trying to tune the second generator as well as possible to a fourth above the first one, with eyes closed; and thereafter reading the scales and doing the arithmetic on an HP calculator. Deviations in pitch are measured in "cents" (1 cent = 1/100 of a half-tone; 1 octave = 12000 cent, and 1 fourth = 500 cent). My guesses were not bad, with an rms deviation of 27 cent, and an average of 6 cent low. But this was true only for a range from 120 Hz up to 3,000 Hz. At still deeper tones, I got gradually worse; but above 3,200 Hz, I even realized a sharp cutoff, feeling very uncertain about pitch, and making ridiculous mistakes. If both tones are above 3,200 Hz, I still can say which one is higher, but not how much higher. (My hearing range, however, extends from 40 Hz up to 12,000 Hz.)

(2) Two Tones. The ear is a nonlinear device (like our mixers are). If you hear simultaneously two tones close together in pitch, say 600 and 605 Hz, you hear a "beat", a strong amplitude modulation 5 times a second. If they are a half-tone apart, or a tone, it sounds very dissonant or "rough"; but it sounds nice or harmonic again if the difference gets a minor third or more. Close to a fifth, or even more so close to an octave, you hear again weak beats, even using two very good generators (without higher harmonics): the ears produce the higher harmonics of the two tones, and these beat against each other. Very interesting also are the difference tones the ear makes up: listening simultaneously to 600 and 750 Hz, for example (a major third), you clearly hear a deep tone of 150 Hz (two octaves below 600 Hz), just like the IF of our mixers. This fact even is sometimes used by composers of organ music, to produce or amplify the deepest tones on smaller organs where the largest pipes are missing or too weak. Also other combination tones may be heard, not only the difference, $f_2 - f_1$, but for example the combination $2f_1 - f_2$, and so on. During the lectures, all this was nicely demonstrated, with two-channel tape recorders and separate speakers, so the mixing could not occur in

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the equipment but must be done by the ear. In Hermann's lab, I could easily repeat the experiments with two generators and two speakers.

(3) Reflections. Another interesting demonstration was concerned with the interference between direct and delayed signals. If a white noise (like the hiss and rumble of streaming pressurized air) is played on one speaker, and on another speaker the same noise is played but delayed by a small amount, say 1/500 of a second, you hear a weak tone with a pitch of 500 Hz; and if you vary the delay, the pitch moves up and down. I think there was no explanation given, but my own is that two random noises add up to a noise which is stronger by a factor $\sqrt{2}$, whereas the 500 Hz waves in our example add up in phase, by a factor 2, thus sticking out above the other frequencies by a factor $\sqrt{2}$. The delay for the second speaker was produced by electronic means, but it works also if you use only one speaker, plus a reflecting board at changing distance.

Reflections and their interference play a role in music halls, and they produce differences in tone quality even between one seat and its neighbor. Some scientists had mounted an omnidirectional microphone on the outer end of a rotating swivel only one yard long, in a good music hall, recording on tape, while on stage a small organ played a stationary full cord. When this tape was played back to us, the effect was amazingly strong, and you clearly heard it going "ooiing-ooiing" for every rotation of the swivel. Another demonstration showed that it makes quite a difference whether a radio announcer has his manuscript on a padded table or on a reflecting one. Actually, however, all these differences do not matter so much, since our hearing system, after only a short time of listening, starts to eliminate whatever disturbs it. (Just as a scientist might by disregarding all experiments which don't agree with his theory.)

II. Binaural Hearing (different things for each ear). Some fascinating effects show up if you have one frequency generator connected to one ear, and a second generator to the other ear, using good earphones (no leakage, no distortions).

(1) There is no dissonance or roughness anymore for two tones nearby in pitch; if they are a semitone or a tone apart, you just hear both tones separately, without feeling bothered.

(2) The most amazing thing is that you still hear a beat if both tones are very close together in pitch. Since both ears receive now different tones, each ear only one of them, the "mixing" cannot be done any more mechanically in the ears; it must be done (electrically, so-to-say) further up in the brain, where the nerves from both ears meet, by a complicated process not yet fully understood. I made many careful experiments in Hermann's lab, until I finally was satisfied that it really is not just a mechanical leakage from one ear to the other, either by the outside air, or through the head (bone conduction), or the Eustacian tubes (connecting both ears to the throat). By the way, this binaural beat is an amazing sensation; it is clearly not amplitude modulation any more, but it is hard to tell what actually is beating. It is a weak beat only, but still clearly audible. You can even count how many beats per second and it turns out again to be the difference between the two frequencies. A still weaker beat is heard again for a mistuned octave (and still weaker for the fifth). The range for hearing the binaural beat is rather limited, in my case from 140 Hz up to 1100 Hz. This upper limit, of about 1000 Hz, is very similar for all people, and it agrees nicely with other experiments showing that the nerves of the ear carry frequency and phase information for lower tones, while phase is lost above 1000 Hz (remember: phase information is also needed for producing fringes or beats in our interferometers).

This finding agrees well with another experimental result: our ability of hearing the direction of a sound is achieved by using mostly the phase differences for low-pitched sounds, while only amplitude differences are used for higher pitches.

Some experts claimed that one also could hear the difference tone in binaural hearing, but this I could not verify, hard as I tried.

III. Music and Age.

(1) Almost all small children, age 4 or less, have absolute pitch, the ability to remember tones of given frequency. If a melody is played or sung to them several times on one day, always in the same key,

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they will sing this melody the next day in exactly the same key, mostly with deviations less than half a semitone. Absolute pitch later is lost (if no musical training is given) mostly between age 4 and 9. Older children may repeat melody and rhythm more exactly than a small child, but they will do it in any other key, at random. This is very similar to another change: if shown a picture, a small child will next day tell all the little details (here was a green tree, and some grass, and there was a bent-over man with gray hair, holding a spade with both hands, and so on); whereas older children, above 9, will remember the abstract idea of it (an old gardener at work).

In an experiment, 1100 professional musicians were tested for absolute pitch, and were also asked at which age their musical training had started. There is a very strong negative correlation: of all those where training had started at age 2 - 4, about 95 percent had absolute pitch; if it started between 7 and 9 years, the fraction dropped to 40 percent, and it was only 5 percent if musical training started at age 12 or older.

(2) Several lecturers claimed that small children actually are a lot more musical than parents or teachers think. Music education should start much earlier and should be more intensive. But it should never be a drill; it should be singing and harmonizing and playing instruments; it always should be playing, while the more abstract things should come later. Learning about keys and scales and notes, and finger practice, should not start before the first grades of school.

IV. Medical Aspects.

(1) Playing and especially conducting music can be an enormous stress, not only emotionally but physically as well. A scientist had measured the heartbeat, blood pressure, sweating and breath of several conductors during performance. The results were alarmingly drastic, even stronger than a tough physical workout could produce with the same persons. It has even happened a few times that conductors died of heart attack in the climax of a concert. There are some good medicines available for avoiding or smoothing stress, reducing this danger for the conductor, but the trouble with it is that the music then gets less fascinating for the audience. Thus no conductor wants to take his medicine.

(2) A very similar problem is with stage fright. Many famous virtuosos get terribly nervous at start, making mistakes and getting more nervous. Doctors would like to help them, but run into the same trouble. In an experiment, where the virtuoso had taken the proper pills before the concert, two music critics (who had known him for years but did not know about the pills) were asked afterwards how they liked the concert; and both said they didn't understand what was the matter with the artist, that never before had they heard him playing so flawless, but never so dull either.

V. Universal Music? Finally, after all this science of music, I gave a lecture on its science fiction. Suppose we ever get contact with some other civilization out in space. What could we talk about with each other? Most probably about mathematics and physics, maybe chemistry, less likely about biology, and certainly not about politics. But what about music? I think that some features of our music are so general and universal that at least at some other places I would expect the same.

(1) Our chromatic scale divides the octave into 12 equal parts (semitones). But why? Whenever higher harmonics play a role, one wants to divide the octave such that these divisions reproduce the higher harmonics well enough. Now, it all depends up to which harmonic do we go. In our music, we go up to the 5th harmonic (only prime numbers count here) whereas no key on the piano comes close to the 7th harmonic of any other key. One then can show with some arithmetic that a close reproduction of the first five harmonics (and their combinations) needs just this division into 12 parts. But with a finer hearing than ours, some other people might go to the 7th harmonic as well, and then the octave must be divided into 31 equal parts. And with a duller hearing, going only to the 3rd harmonic, a division into 5 parts is all one needs. Thus, I expect that at other places the octave may be divided into 5, 12, or 31 equal parts, but nothing in between.

(2) If it comes to harmony, there will be only two modes, major and minor, and nothing else. All tones of the major chord are

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different higher harmonics of a common base; and all tones of the minor chord are different bases of a common higher harmonic. And since pitch, as a scalar, has only two directions, up or down, there can only be two such modes, no matter on which planet.

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COMPUTER TERMINAL

Bob Vance

An IBM System 2922 (360/20) has been installed in Room 233 of the Jansky Lab as a remote terminal to the Charlottesville IBM 360/50. Jobs may be submitted from Green Bank for running on the 360 in Charlottesville with output returning to Green Bank or routed to the CV computer room. Jobs may also be submitted from CV with output routed to Green Bank.

The system consists of:

2922 - Terminal Control Unit
2922_2 - Terminal Printer
2922_3 - Card Reader
1422 - Card Punch
2152 - Console Typewriter
3872 - MODEM

The present IBM Modem (2400 Bits/Sec) will be replaced with an IBM Modem (7200 Bits/Sec) in the near future. This should speed up the transmission of printed and punched output to Green Bank.

This remote terminal is available 24 hours a day (except when the 360/50 is down). It cannot be used as a stand-alone system as was the IBM 1130.

KEYS AND SECRET CODES ARE NOT NECESSARY TO GAIN ADMITTANCE TO ROOM 233.

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Anyone can get blisters on his hands -- unless he has calluses.

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DETROIT-Early records show the price of gasoline before 1900 was often less than one cent per gallon in the U. S.

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"For all you budding cosmologists, a query from David Backer (age 4): 'What happens to the world when it is nothing?' Any comprehensive replies may be sent to David Backer, 3D Eastway, Greenbelt, Maryland."

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BASKETBALL

Dave Williams

NRAO basketball is approximately half way through the 73-74 season with 11 games thus far played. Their record is 10 - 1, with the lone loss coming at the hands of the Pocahontas High/Green Bank Grade Faculty team.

The 10 - 1 record also includes a game with CV, which proved to be a disaster for the CV charges. GB handed them an 87 - 59 loss, which should keep them quiet for a day or two. In that game F. Owen, of CV, dislocated his shoulder. Dr. Aga reset it and he was able to drag himself to the cafeteria for the feast that followed the game. There is expected to be a return match, probably sometime in March at CV.

As can be seen by the statistics (page 12), "Giant" George Patton is well out in front in the scoring race with a 30.4 per game average. Not only is he the leading scorer, he is also leading in personal fouls committed. Maybe that partially explains his high scoring average.

The best foul shooter on percentage versus attempts is none other than the ex-mayor himself, "Cussin'" Carl Davis. On 5 chances from the foul line he has yet to miss. Even at an age when most persons his age are looking for a rocking chair, Carl is still in there pushing and shoving as usual.

Another regular who has not missed from the foul line is "Bitchin'" Basil Gum. As can be noted he has not yet shot a foul which explains his perfect record.

Mike Kane has been doing the officiating with some very capable substitution by yours truly.

Games are on Wednesdays at 7:00 p.m. and are free for the watching. Also anyone desiring needed exercise, come on down and join in. --continued, next page--

BASKETBALL STATISTICS

NAME	GAME	FIELD GOALS	FOULS ATTEMPTED	FOULS MADE	TOTAL POINTS	AVERAGE POINTS	FOUL SHOOTING %	PERSONAL FOULS
Patton	11	153	47	28	334	30.4	59.5%	28
Poling	11	97	26	16	210	19.1	61.5%	10
Howell	10	81	28	20	182	18.2	71.4%	21
Monk, R.	11	70	45	28	168	15.3	62.2%	23
Monk, W.	11	79	9	6	164	14.9	66.7%	21
Bonebrake	1	5	0	0	10	10.0	-	1
Taylor	1	4	2	2	10	10.0	100%	0
Vrable	11	52	2	2	106	9.6	100%	8
Spargo	5	21	2	1	43	8.6	50%	9
Brundage	4	16	2	1	33	8.3	50%	8
Gordon, D.	8	26	9	5	57	7.12	55.5%	11
Friel	9	30	14	4	64	7.11	28.6%	9
Shuman	2	6	3	1	13	6.5	33.3%	1
Gordon, R.	2	5	2	1	11	5.5	50%	5
Smith	11	24	10	7	55	5.0	70%	5
Ervine	8	17	6	3	37	4.6	50%	10
Shank	3	6	3	0	12	4.0	00%	6
Cate	1	2	0	0	4	4.0	-	0
Valencia	1	2	2	0	4	4.0	00%	0
Gum	8	14	0	0	28	3.5	-	18
Jeffries	1	1	2	0	2	2.0	00%	3
Davis	10	7	5	5	19	1.9	100%	15
Coe	6	4	2	2	10	1.7	100%	6

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COMET KOHOUTEK: RADIO ASTRONOMERS PLEAD "NOT GUILTY"!

W. E. Howard

Well, to the lay public--and I suppose that includes most of the readers of this article--Comet Kohoutek was a first class astronomical dud. Hardly anyone I've talked to was able to see it with the naked eye, and only a few people were venturesome enough to try to observe it with binoculars or anything stronger. Of the approximately 100 individual, independent estimates of the comet brightness between the end of November and the middle of January, only five observers estimated a brightness exceeding third magnitude and those estimates all occurred within one week of perihelion (the point of nearest approach to the sun) when the comet was a difficult object anyway. And even a third or a fourth magnitude comet is not a spectacular sight when it is seen against the background of a dawn or sunset sky. Nor are we comforted by the fact that the bad weather which persisted along the eastern seaboard throughout most of the evening apparition time for Comet Kohoutek would have prevented us from seeing the comet most of the time even if it had been bright!

But let us now look on the bright side. As many readers know, an Operation Kohoutek desk was set up at NASA in Greenbelt, Maryland in order to co-ordinate observations from Comet Kohoutek made from ground-based radio and optical observers and the orbiting astronauts in Skylab. One telephone number was available for observers to phone their data into NASA, and another telephone number was available for out-putting this information to observers. Known colloquially at NRAO as the "dial-a-comet" number, it could be called by all observers throughout the United States to keep themselves abreast of scientific developments concerning the comet in order to optimize their own observing programs. This simple system set up by NASA proved extremely effective and was supplemented by daily Telex messages sent to each major U. S. observatory engaged in observations of the comet. NASA deserves our thanks for setting up this system.

In my last article, I mentioned that radio astronomers had not yet detected a comet. This is no longer true (and you owe me a beer, Bob Brown!). In early December, Ned Conklin and Bobby Ulich detected methyl cyanide (CH_3CN) at the NRAO 36-ft telescope. While most of us feel that the discovery observations looked good, other teams using equipment at the 16-ft telescope in Texas, and later at the 36-ft telescope, were unable to confirm that detection. One explanation is that the comet was unusually active at the time of the detection but that the activity had died out two weeks later. The first confirmed detection was made by a former NRAO visiting scientist, F. Biraud, using the Nancay radio telescope in France. He and his French collaborators found the principle OH lines in absorption. This discovery, confirmed almost immediately by Barry Turner at the 140-ft telescope, represents the first confirmed radio detection of a comet. Later in December, and in early January, Dave Buhl, Lew Snyder, and Walter Hubener found the HCN molecule in Comet Kohoutek at the 36-ft telescope. On January 21 a Harvard-Smithsonian team of Black, Chaisson, Ball, Penfield, and Lilley reported a detection of the 9 cm CH emission line in the comet. There are strong theoretical reasons to believe that the nucleii of comets contain such basic molecules as NH_3, H_2O, CO, and CN. Despite many hours devoted to trying to detect these basic molecules in Comet Kohoutek, they were not found. Nor were the molecular species of CH_3OH, NH_2CHO, CH_3C_2H, HNCO, HNC, or the enigmatic line of X-ogen.

At least two detections of the comet were rumored to have been made by continuum observers. First, 1 mm wavelength radiation was found by John Rather and a team of French visitors at the 36-ft telescope around New Year's Day. About one week later, a team of NASA observers detected 3 cm radiation using the 140-ft radio telescope. These continuum observers were probably seeing radio emission coming from the dusty head of the comet just after it swung around the sun.

Why was the comet so faint? One explanation that I have heard advanced is that the volatile gases that are evaporated from the nucleus into the comet head as it gets near the sun just did not volatize! The implication is that some sort of cometary cosmic "glue" kept the gases from escaping at the expected rate. Comets are typically very

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fickle astronomical objects. Since Comet Kohoutek was exceptionally bright when it was first detected on its way into the solar system, we certainly had every reason initially to expect that we would soon be witnessing a spectacular cosmic event, but to paraphrase Fred Whipple's remark when a newspaper reporter asked him what happened --"if you want a sure thing, bet on a horse, not on a comet!"

While I have not attempted to summarize optical observations of Comet Kohoutek, our optical colleagues also had a field day. Although Comet Kohoutek was a disappointing object to the layman, it appears to have given us valuable scientific information that will undoubtedly take years to digest. It was certainly the best observed comet so far. Thus, the astronomical plea--"Not Guilty"!

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FICA CONTRIBUTIONS CHANGE IN 1974

As a result of recent legislation in Congress, Social Security (FICA) contributions will be paid on a higher portion of salary in 1974. During 1973, both employee and employer contributed 5.85% on the employee's first $10,800 in annual wages. In 1974 the 5.85% tax rate will remain the same but the taxable earnings base will increase to $13,200. The maximum Social Security tax, therefore, will increase from $631.80 to $772.20

As a result of the above change, the required contribution to the Retirement Plan which is based on the Social Security taxable earnings base, will be decreased in 1974. This year employees will be required to contribute 5% of base pay in excess of $1100 per month ($13,200 per year). Formerly, employees were required to contribute 5% of base salary in excess of $1000 per month ($12,000 per year). The Observatory's contribution will remain at 10% of each participant's base pay.

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No American city is less unhurried by hurry.

*****

GREEK WEEK

Seth Shostak

Greece; cradle of democracy. Some say that Papadopolous has robbed the cradle, but this rugged land, strategically situated between East and West, continues to offer limitless attractions to the adventuresome tourist - particularly the tourist on a restricted budget. Thus it was that four stargazing adventurers, Dick Sramek, Bob O'Connell, Valdar Oinas (U. of Nebraska) and yours truly, spent several weeks last summer prowling the topography of this historic land. Considerations of space and good taste preclude an account of many of our activities, but I thought a short descriptive article might serve to edify those readers who have not yet had the opportunity to travel in the Mediterranean.

Greek coastline, taken by moonlight, near Argos. From this point sailed the Argonauts and the heros of the Trojan war.

We came to Greece via Italy, and therefore had been exposed to the monumental monuments and miscellaneous memorabilia which testify to the greatness of the Roman Civilization. The Golden Age of Greece predated the Roman Empire by 400 years, and as the Latins extended their political influence, they incorporated more and more of the

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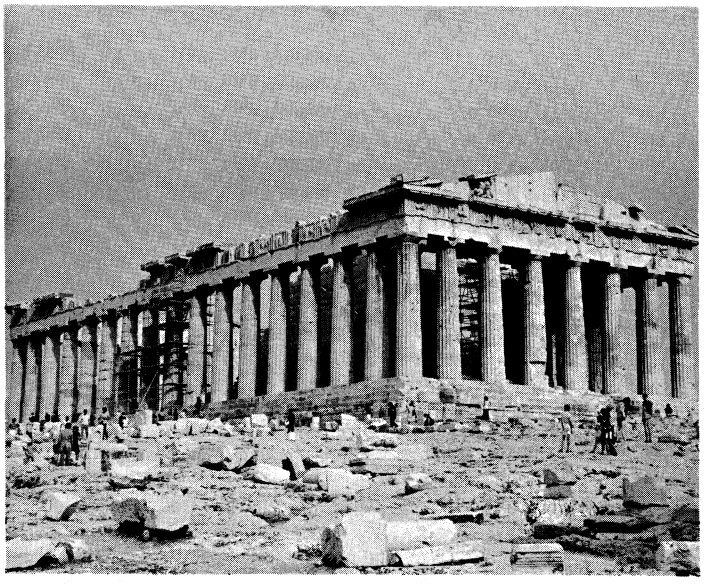
established Greek culture into their lives. Roman arts and sciences, practically without exception, were plagiarized from the dying city-states of Greece, often via the simple expedient of directly importing educated Greeks. The Romans, insecure only in matters of intellect, distrusted these men from the East. For their part, the Greeks considered their Roman masters boors. After all, wearing garlic in your hair is a little gauche. It is true, therefore, that the classical remains one sees in Greece are both older, and often more esthetically original, than those of Italy.

Our first major stop was Athens, most celebrated of both ancient and modern Greek cities; home of Socrates, Plato, Aristotle, and Melina Mersouri. According to the guide books, Athens is a "raw, blunt" city, and I must say that for once the guide books are right. Tens of thousands of raw, blunt Greek citizens daily crowded the sidewalks as we struggled to reach ruins and restaurants. Anthenian trolleys were so fully packed that had the natives been anything but blunt, serious injuries would have been common. Our hotel was located on a main thoroughfare where traffic just wouldn't quit. A steady parade of unmuffled Vespas, Mercedes trucks and Greek Army tanks roared their way past our necessarily open window every night, resulting in a decibel level rated "dangerous" by the International Boilermakers Union. I tried wrapping a pillow around my head, but the resulting tide of sweat floated me out to the balcony. Finally, I decided that the answer to sonic insomnia was to imbibe some of the local liquor (a licorice-like drink called Ouzo), but was soon convinced otherwise--I spent the night lying on the tile floor of the w.c. embracing the toilet and uttering very sincere oaths concerning my future consumption of alcohol.

The next day, we set out with piton and Pentax to conquer the Acropolis, an easy class IV climb which, curiously, we were not the first to make. The Acropolis is covered with a lot of first-rate civic architecture, primarily the work of the sculptor Phidias and dating from the second half of the fifth century B.C. Foremost among the many edifices arrayed here is the Parthenon, named for the Virgin Athena (etymologically derived from the word for virgin, as in "parthenon-



This is either the Parthenon or a Shell station outside of Athens. If it is the Parthenon, its occupants had a real blast in 1687 (see text).

genesis", or virgin birth. Not that that's relevant, but it's the only way I can get sex into this article.) The Parthenon is famous for its multiple distortions of line and shape, deliberately incorporated into the design to compensate for the effects of perspective and lighting. Today, such distortions, less deliberately made, are called "builder's errors". Several good examples can be seen in the Jansky Lab. Remaining largely intact for 2000 years, the Parthenon suffered major damage when it was accidentally blown up in 1687. The Turks, defending the city against invading Venetians, had chosen to use the basement of the building as a powder magazine and it caught a wild shell. Needless to say, one could question the artistic sensibilities of the Turks in using the supreme achievement of Doric architecture as a military bunker.

Despite these cultural highlights, the sheer rawness and bluntness of Athens soon began to have its toll, and in a moment of exhaustion our peripatetic foursome decided to take a one-week tour of the Greek islands, a decision only our wallets ever regretted. Soon we were lolling about the decks of our

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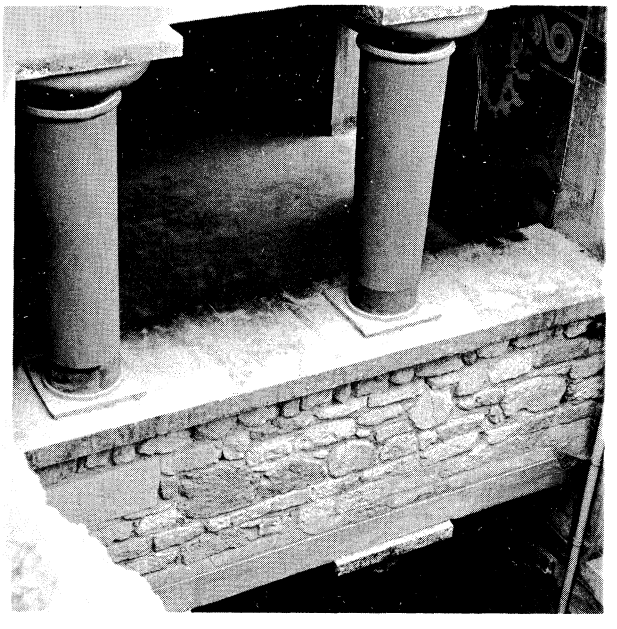
cruise ship, heading for new adventures. First stop was the isle of Mykonos, a paradise-on-earth if there ever was one (the only other possible candidate being Sandusky, Ohio). Here we spent leisurely afternoons snorkeling in the glassy blue waters of the Aegean, and endless evenings sitting at outdoor cafes watching the native girls go by (the restless natives didn't go by). Mykonos is also the home of a famous nude bathing beach, but only Sramek had the nerve (and the suntan in the right places) to venture onto those silky sands to expose his epidermis. As it turned out, it was a decision to be regretted since he soon had a painful run-in with a jellyfish which had the bad manners to attack him in an unsportsmanlike location. Sramek walked funny for a day and a half.



3000-year old Minoan palace at Knossos in Crete. Note that this photograph is two columns wide.

After that it was Crete, largest and southernmost of the islands. At first it felt strangely comfortable to be surrounded by Cretins, but that soon wore off and we undertook an archeological expedition embracing the major Minoan memorabilia. A thousand years before the construction of the Parthenon, the Minoans had established cultures of considerable sophistication. Their plushy palace at Knossos, site of the celebrated labyrinth of mythological fame, had such refinements as aquaducts and indoor plumbing. Mysteriously, about 1400 B. C. the Minoan civilization took a dive, perhaps quite literally. Current theory holds that the cities were destroyed by huge tidal waves and earthquakes due to volcanic eruptions on the isle of Thera, sixty miles north. It has been speculated that this event forms the basis of the legend of Atlantis, the sunken city. Crete is still ideally suited for swimming, and the four of us soon bore an uncanny resemblance to albino prunes. Our boat back to Athens was a converted slave ship; fortunately we had tourist class tickets and could sleep above decks. On occasion we would peer down the hatches at the el cheapo class accomodations, there to see about a million Greeks sweating and slicing cheese in what can only be politely described as a fetid atmosphere.

Once back in Athens, we split up. Sramek claimed to have seen enough fluted rubble, and caught the next boat back to the islands. The rest of us stocked up on Arrid Extra Dry and caught a bus for the Pelaponessus, the large, history-riddled peninsula south-west of Athens. There we saw the ruins of Olympia, sacred city of the classical Greeks, and site of the original olympiads. As I surveyed row after row of column after column, I couldn't help but think how much Mark Spitz owed this place. Two days later we were inspecting the remains of Mycaenae, ancient home of Agamemnon, husband of Clytemnestra and loving, but unloved, daddy of Orestes, Iphigenia and Electra. Our home base for these latter sights was the small seaport of Nafplion which, due to a local Greek theatre festival, was booked to the park benches. Consequently, our first night there we were compelled to stay at a (get ready for this) student hostel (with plenty of hostile students). It was like being in boot camp with women recruits. I had to fight a German girl for the right to a shower stall, prevailing only because she had the misfortune to slip on some soy-vlaki left over from lunch. The next day I'm afraid we overreacted, and quickly checked in at the classiest hotel in town. Our travelers checks suffered, but we were soon sunning ourselves on a private beach, quaffing Greek beer, and wondering what it was about youth that delighted so in "taking it".

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Several days later, we boarded big 747's and began to wing our way westward. Thinking back over all the sweating, missed connections, lousy hotels, endless walking, amoebe-ridden food, primitive plumbing, sleepless nights and evaporated funds, I wondered why anyone bothered to travel at all. But then I remembered: it's so that at that next cocktail party, when some young lass asks if you've ever been to Europe, you can sip on your brandy and casually reply, "Why yes, I believe I have."

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SUPPLEMENTAL RETIREMENT ANNUITY ANNOUNCED

Monroe E. Petty

As of February 1, 1974, NRAO employees have a new retirement option available to them in addition to the Regular Retirement Plan. The new program is called SUPPLEMENTAL RETIREMENT ANNUITY (SRA) and, like the regular plan is administered by TIAA-CREF. This plan is designed to augment the regular plan and is particularly suited to those employees who would like to make additional contributions toward possible early retirement but do not wish to "tie up" their extra money permanently in the event they require it for other purposes prior to retirement.

The Regular Retirement Plan is intended to serve strictly as a retirement income program after an individual terminates his employment at NRAO. For this reason, the cash accumulations resulting from the Observatory's 10% contribution, the required contribution by the employee (5% of base salary in excess of $13,200 per year), and any voluntary contributions by the employee are payable only after a participant has left the Observatory's employ. These payments are usually made on a monthly basis, and once commenced, continue for the rest of the person's life. Except for those employees retiring after age 55, the regular plan does not provide for any lump sum payment of accumulated funds. Persons retiring at age 55 or over may receive up to 10% of their TIAA-CREF accumulations in a single sum, but the remaining 90% is payable only in the form of annuity income.

The Supplemental Retirement Annuity is specifically designed to be more flexible. It allows participants complete freedom of choice as to when they wish to withdraw their funds and the manner in which they wish to be paid. The funds may be withdrawn at any time before or after retirement and are payable in lump sum form, in installments for specified periods, or like the regular plan, in lifetime annuity income. Another advantage to this program is that a participant may withdraw his money from one SRA contract in one year and begin a new SRA contract the following year.

Contributions to the Supplemental Retirement Annuity must be made under a "salary reduction" or "tax sheltered annuities" agreement. By entering a salary reduction agreement, an employee elects not to receive a portion of his salary and, therefore, does not have to pay income taxes on it. Instead, this portion is contributed directly to his TIAA-CREF retirement annuity by NRAO. When the employee retires and begins to receive this money in the form of income payments, it is then completely taxable as ordinary income. If one waits until his retirement years, when his income presumably will be lower, he will probably gain a tax benefit from a salary reduction agreement because he will probably be in a lower income tax bracket. However, if one draws his Supplemental Retirement Annuity while he is still employed, his tax benefit would probably not be as great because his total income would not be lower. Also, a salary reduction could work to one's disadvantage even after retirement if income tax rates are raised substantially.

A salary reduction agreement affects one's salary only for income tax purposes. It does not affect base salary for such things as Social Security withholding, group insurance coverages which are based on salary, or overtime premiums.

The minimum SRA contribution allowable is $10 per month ($2.30 per week) if you participate in TIAA or CREF only, or $20 per month ($4.60 per week) if you participate in both funds. The Observatory will not contribute to SRA. TIAA is currently crediting 7-1/2%. interest (compounded annually) on net SRA contributions. Contributions to CREF are used to purchase units of ownership in a broadly diversified com-

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mon stock portfolio. The value of each CREF unit changes from month to month in relationship to the market price of CREF's common stock investments. Dividends received by CREF are credited to each participant in the form of additional CREF units.

TIAA deducts a 4% administration fee from each premium payment; CREF deducts 1.75% from each premium payment received and, if benefits are later paid under an income option, a 1.5% charge is deducted from each payment. If CREF benefits are taken in a lump sum, there is no 1.5% charge. In addition, CREF charges a very small percentage, .007 of 1% per year to cover investment expenses. The expense fees charged by TIAA-CREF are modest compared to what most commercial insurance companies might charge for a similar service.

So here is an opportunity to automatically invest a part of your salary with the future possibility of considerable tax savings. Participation is completely optional and open to all regular employees regardless of age. If you are interested in further details, please give Personnel a call.

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GASOLINE CONSERVATION MEASURES

Ross Jeffries

A recent regulation from the General Services Administration imposed on the National Radio Astronomy Observatory's leased sedans, station wagons and vans has created very strict policing of these vehicles by the Administrative Services Division.

The regulation seeks to achieve a 15% reduction in miles driven based on calendar year 1973 mileage. We are now given a fifteen day mileage allocation for each group of vehicles. It is our responsibility to limit the number of miles driven in that fifteen day period to the allocation.

We solicit your co-operation in this matter by:

1. use the shuttle
2. combine trips
3. schedule trips in advance
4. give advance notice of trips
5. ship by public carriers
6. eliminate unnecessary trips.

These guidelines apply to both personnel and materials.

*****

NOTIFICATION OF CHANGE OF ADDRESS TO TIAA-CREF

Each year around late February, TIAA-CREF sends a report to each participant reflecting the status of his TIAA and CREF investments. This report, in addition to other periodic information, is mailed to each participant's home.

If you have moved recently and have not advised TIAA-CREF of your new address, please be sure to do so.

You may write them at:

Teachers Insurance & Annuity Assn.
College Equities Retirement Fund
730 Third Avenue
New York, New York 10017.

*****

YOUR FIRST VEGETABLE GARDEN

Eric W. Greisen

During the past year we have witnessed large increases in the prices of meat and fresh vegetables and, because of the fuel shortage, prices are certain to rise even further. Thus, it makes good sense to grow some of your own food. Garden-fresh vegetables taste better and are more nutritious than the "fresh" vegetables found in supermarkets. In addition, there is a considerable psychological satisfaction from growing your own vegetables. We had some success in our first year of gardening and I've been asked to pass along some of the things we learned last summer.

Gardens do need a lot of attention, but aren't really all that much work. The most effort is expended at the beginning when you prepare and fertilize the soil. After that you must keep the weeds in check and make sure the plants have sufficient water. Weeding with a hoe is good exercise and is

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surprisingly efficient and effective. It is important to weed regularly since large, well-established weeds are much harder to remove and kill. Rainfall will normally take care of the watering, but the plants will be seriously weakened if they are not watered during dry spells. Last summer we spent most of our gardening time simply picking the vegetables. Plants will produce better over longer periods if the vegetables are picked as soon as they are ripe. Thus, it is a good idea to check the garden every day, at least during the height of the season.

Vegetables need good soil and lots of sunshine. Set your garden in a place which receives direct sunlight nearly all day. There is at least one exception to this rule. Lettuce will go to seed rapidly if it is grown in full sun during the middle of Charlottesville's summer. Plant your spring and fall lettuce in full sun, but plant the mid-summer crop in a partly shaded area. The hard clay soil around Charlottesville is reasonably fertile, but it must be well-worked (i.e., broken up) so that the plant roots may grow. It is a good idea to work in a mulch such as steer manure or peat moss in order to loosen the soil. Fertilizer is usually needed. Large amounts of manure are best, but commercial 5-10-5 is also useful.

You won't need much land or much equipment to grow vegetables. The minimum equipment we found was: 1 - a hoe and a trowel for weeding, 2 - a hose for watering, 3 - scissors for pruning and picking, 4 - a bucket for carrying the vegetables, and 5 - a book for telling you what to do. The book we found to be most useful is the Sunset Book entitled Vegetable Gardening. The amount of land required depends on your ambitions and on what you want to grow. A tomato plant or a hill of summer squash requires only a few square feet while some plants such as sweet peppers and eggplants can be grown in large flower pots. Short (say ten-foot) rows of lettuce, beets, carrots, swiss chard, collards, etc., will supply all you'll want of each type. Longer rows are needed for peas and bush beans. Moderate areas (i.e., 150 sq ft) are needed for some vine plants such as cucumbers and cantaloupes while really large areas (i.e., 400 sq ft) are needed for the winter squashes. Corn is a favorite vegetable for home gardens, but is not all that productive per square foot. We were surprised at how productive vegetable plants can be. Two hills of summer squash, or four tomato plants, or three hills of cucumbers or cantaloupes will produce much more than 2 people can eat.

Try to plan your garden in advance - deciding what to plant where and when. Separate summer squash, winter squash, cucumber and cantaloupe areas since these plants can cross-fertilize each other with undesirable results. Put corn in short, parallel rows over a limited area to insure fertilization. Corn tends to ripen all at once and to last only a couple of days. Thus, it is best to plant small amounts of corn every couple of weeks. Staggered planting of other things such as bush beans, lettuce and beets is also recommended.

In case you grow more than you can eat, most vegetables can be frozen and/or canned. Remember that canning can be dangerous. All jars should be thoroughly sterilized and properly sealed. Only pickles and tomatoes should be canned unless you use a pressure cooker. Do not can non-acid fruits and vegetables in a hot water bath - use a pressure cooker.

You will have to protect your garden from animal and insect pests. A good fence should keep dogs, cows, sheep and horses out. Poison and guns work on rabbits, raccoons and groundhogs, but are likely to cause more harm to neighbors and their pets than good for your garden. There are a great many insecticides on the market. The safest one for pets and humans is Savin dust. It is readily available and quite effective even on Japanese beetles. Put the dust in a burlap bag and shake it lightly over the plants. The dust has to be applied to dry leaves after every rain and should not be applied to leaf plants (i.e., lettuce, chard) which you expect to eat within a few days. Detailed instructions come with the dust. We found the beetle traps (sold at Gleason's in Charlottesville among other places) to be quite effective against Japanese beetles.

The hardest problem in vegetable gardening is deciding what vegetables to plant. I recommend planting those vegetables of which you are most fond and for which you have the space. Home-grown tomatoes, corn and cantaloupe are far better than those in the stores, while you probably can't improve much on store-bought potatoes and onions. Swiss

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chard is a little-known spinach substitute which is far easier to grow than spinach and is prolific, long-lasting, and excellent both cooked and in salads. If you like them (we don't), collards can be planted in the fall and seem to survive Charlottesville's winter weather. Tomatoes, sweet peppers, and egg-plants are difficult to grow from seeds. Buy started plants from your local nursery or farm-supply store. Carrots require a fairly soft soil in which to grow. The clay soil of our garden led to a very disappointing carrot crop. Choosing among the very numerous varieties of vegetables is also difficult. Some varieties which did well for us are listed below:

Bush beans - Topcrop
Bush peas - Wando (heat-resistant)
Pole beans - Kentucky Wonder
Corn - Iochief (far stronger plants than various early varieties)
Tomatoes - Big Boy (large size)
Small Fry (small, cherry tomatoes)
Bush limas - Fordhook 242
Cucumbers - Burpee hybrid
Cantaloupe - Burpee hybrid (large, delicious)
Hearts of Gold (prolific, but ordinary)

Your county agricultural extension service will provide lots of useful information as will most any experienced gardener.

Now is the time to start planning your first vegetable garden. If you show reasonable restraint in your planning, you'll find gardening relatively easy and rewarding. Try it - you'll like it!

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The measure of our happiness is the gifts of ourselves which we give to others.

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He who can no longer pause to wonder and stand rapt in awe is as good as dead.
--Albert Einstein

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Domestic happiness depends upon the ability to overlook. --Roy L. Smith

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CREF UNIT VALUES

Starting this year, the OBSERVER will publish the monthly changes in the CREF unit value for employees interested in keeping tabs on this part of the retirement plan. Listed below are the monthly unit values for 1973:

January	$50.36	July	$44.80
February	47.11	August	44.06
March	46.44	September	46.63
April	43.69	October	47.06
May	42.06	November	41.30
June	41.40	December	42.61

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TEN YEAR SERVICE AWARDS DINNER

Ross Jeffries

The seventh annual Ten Year Service Awards Banquet was held in the Green Bank cafeteria Tuesday evening 8 January 1974. Dave Heeschen presented certificates and service awards to the guests of honor (those employees reaching ten years of continuous service with the National Radio Astronomy Observatory as of 31 December 1973):

Thurmond R. Cosner
Jack L. Daniels
Gail T. Geiger
Lloyd H. "Bill" Hunter
Anthony J. Miano
Troy S. Moore
Eugene L. Marcum
Bearyl E. McLaughlin
Bernard Pasternak
William W. Powell

Donald J. Cardarella of Tucson was also an employee in this select group.

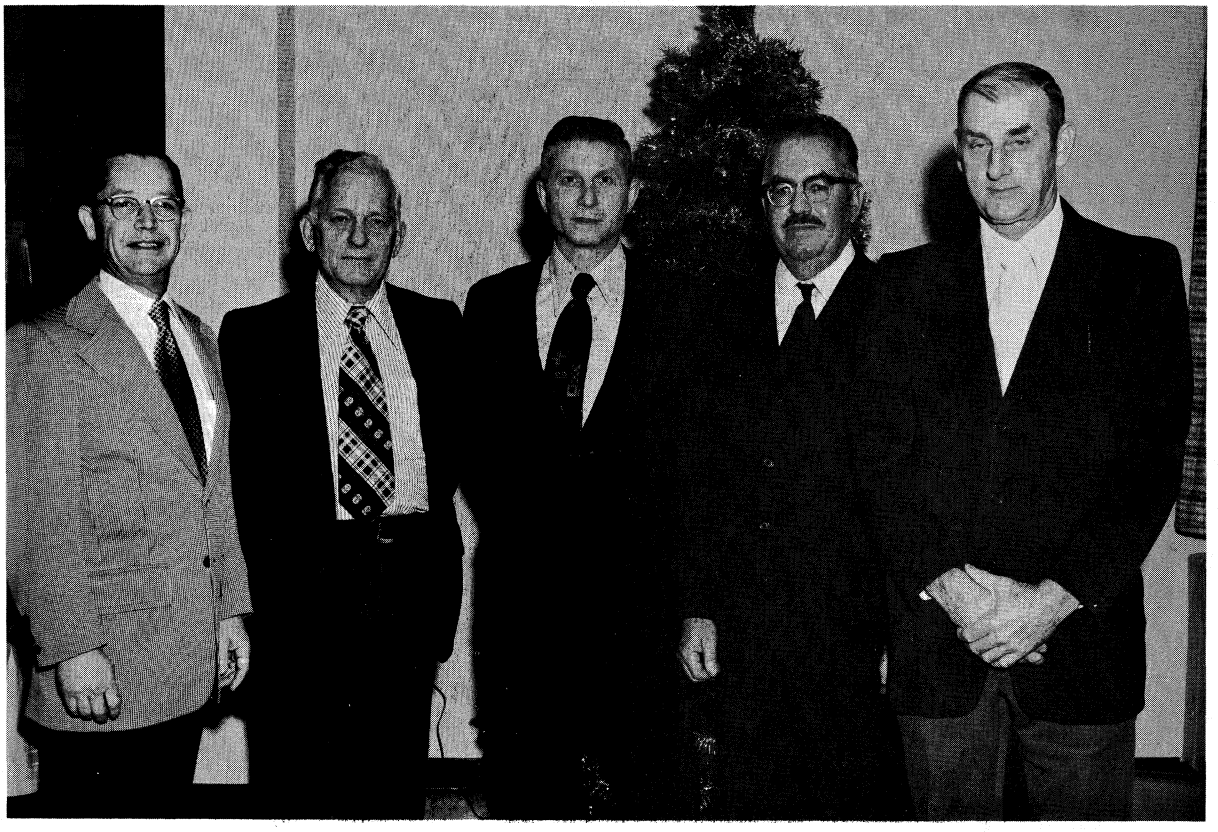
Dave Hogg welcomed the entire group which included fifteen year employees, retirees, assistant directors, and division heads, to the dinner.

Photographs on page 21 show ten year, fifteen (and over) year and retired employees.

There have been 94 NRAO employees who have completed ten years or more of service. Of the 94, only 10 have resigned, retired or are deceased. There are 12 active fifteen-or-more year employees.

--continued, next page--

10-Year Awards



Left to right: Thurmond Cosner, William Powell, Eugene Marcum, Troy Moore, Lloyd Hunter.

Also attending the 10-Year Awards

15 years or more

Left to right: Pat Hall, Bob Elliott, Sid Smith, Dave Heeschen, Beaty Sheets, Fred Cole, John Findlay, Fred Crews.

Retirees

Left to right: Lyle McPherson, Verna Tracy, Maudie Wenger, Ed Wilson.

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1974 NRAORA

Richard Fleming

Your Recreation Association Board of Directors has already begun to plan another big year that will include many of the events sponsored last year with possibly a few new ones. The January meeting consisted of elections of officers for 1974 and the calendar-of-events planning. The officers and members are listed below.

As always, your board members are interested in planning and sponsoring events that you enjoy and are therefore open to any suggestions or comments. There is also a suggestion box in the Lab lobby, and NRAORA bulletin boards are located around the site. The regular monthly meeting is held each third Monday at 3 p.m. Meeting minutes, notices and memos are posted each month as well. You are requested to make your wishes or suggestions known to the board members so we can attempt to serve you better.

In closing, I would like to thank the members of the board last year for their hard work, much of which was on their own time. We had a great year because some great people worked hard. Many thanks are also deserved by Ross Jeffries and his staff, Duane Madron and his hard working people, and Dr. Hogg for his continuing interest and support.

1974 NRAORA BOARD OF DIRECTORS

MEMBERS

X	Richard Fleming	President
*O	Harry Wooddell	Vice President, Chairman Finance Committee
X	Jane Chestnut	Secretary
*X	Pearl Clarkson	Treasurer
X	Ronnie Monk	Central Purchasing Agent
-O	Bill Shank	Chairman By-Laws Committee
O	Russell Poling	Sports Advisor
-O	Judy Moore	
-X	Boyd Wright	
*O	Everett Arbogast	
*O	Charles Brockway	

* Member of Finance Committee
\- Member of By-Laws Committee
X Serve as Member until December 31, 1974
O Serve as Member until December 31, 1975

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FIRST REIMBURSABLE SICK PAYMENTS MADE IN JANUARY

Last year a new reimbursable sick leave program was announced to regular non-exempt employees of the Observatory. The program provides for cash payment for all sick leave accrued and unused in excess of 108 days as of the end of each calendar year. Payment is at the rate of 1 day's pay for each 4 days of unused sick leave.

During 1973 there were 87 non-exempt employees with sufficient service (5 years and 1 month) to be potentially eligible for reimbursable sick leave. Of these 87 employees, 56 received special payments last month. Fifteen of these employees (all from Green Bank) had perfect attendance in 1973 and received maximum payments.

Was it the flu shot, or Vitamin C? Who knows?

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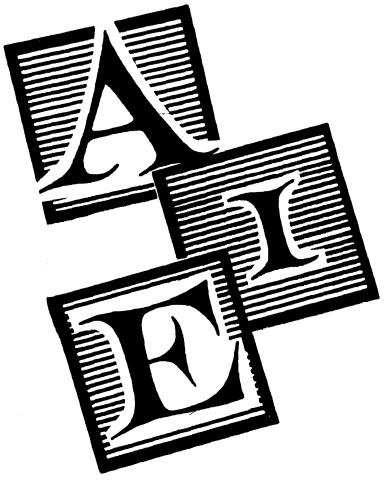

PRE-SCHOOL PLAYGROUP

David Kellermann

Every Tuesday and Friday morning, my friends and I meet at the Pocahontas County Free Library for our Pre-school Playgroup.

Active participants include Paul Fomalont, Eric Spargo, Ryan Cate, Kurt Behrens, Sean Mahoney, Ann Michele Brundage, Bryan Coleman and others.

Under the supervision of our mothers we play with toys, read stories and scribble in coloring books. There is also an open bar with juice and cookies.

All children from ages two to four - more or less - are invited to join us. For further details, please contact my mother.

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