SKY-ADS

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PHOENIX ASTRONOMICAL SOCIETY, INC.
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(242-1581)

November, 77

SKY-LINES

phoenix astronomical society, inc.

Very Large Array, Friday Nov 18

Nov. 18, 1977- Phoenix College- 8:00PM C102 S.E. Corner of the campus.

The Talk?- "Project VLA"

What is the VLA you ask? The fact that you had to ask indicates that not much is discussed about radio astronomy in the club circles. VLA stands for "Very Large Array" now being constructed in New Mexico under the auspices of AURA. It is going to be a large radio telescope involving a number of dishes. If you wish to do a little bit of homework before the meeting, the October issue of Astronomy has an article on observatories that might give some background.

Actually, as many of you know, radio astronomy has provided more than just another eye on the universe or our own galaxy. It has in some instances provided the only eye we can see with. Structures which have been obscured by interstellar dust and gas to optical telescopes have been explored by radio scopes with comparitive ease. In fact the combination of radio and optical telescopes have provided a double punch in the effort to puzzle out the origin and evolution of the universe.

Furthermore, it is interesting to see the kinds of instrumentation being used by fellow astronomers.

Mr. Rob Ridgeway of ASU is more than qualified to bring us up to date on the status of the VLA as he has been involved with its construction for some time. Further he has a number of pictures (some of which may be somewhat less than totally public) to show.

So, come and enjoy another area of astronomy.

Bill Anderson

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Thanx,

Chuck

PS: Last chance to Pay Your Dues!

FILTER TECHNIQUES FOR PLANETARY AND LUNAR OBSERVATIONS

The following is the complete article from SKY & TELESCOPE, August, 1958. I decided that it would be better to reprint the entire artical than to try to condense it. This should give us a head start on Charles Capen next month.

Color Filters are of great value to the planetary observer. They help overcome image deterioration caused by scattering in the planet's atmosphere and in the earth's, as well as by atmospheric prismatic dispersion. They permit separation of the light from different levels in the planet's atmosphere, and they increase hue contrast between areas of differing color. Finally, they help reduce irradiation in the observer's eye.

All of these functions of filters concern, in a rather intricate manner, the sharpness of surface and cloud detail that is seen on a planet. For simplicity let us consider each factor separately.

Scattering interposes a luminous veil between the observer and his subject. The first quantitative study of the laws of atmospheric scattering was made in 1871 by Lord Rayleigh. He showed that for particles of a given size the scattering is inversely proportional to the fourth power of the wave length of the light. Hence, violet light of 4000 Å is scattered about 16 times more than deep red light of 8000 Å; the blueness of the daytime sky is the result of this property.

From past empirical observations, it appears that the Martian and Venusion atmospheres also have some form of scattering which allows observation of different relative atmospheric depths. Here the filter comes to our aid, for with a suitable one we can eliminate the scattered blue light and observe planetary markings in red and yellow.

Prismatic dispersion by our atmosphere is most evident when a star or planet is seen near the horizon. It results from refraction being less for longer wave lengths; each point source spreads into a tiny vertical spectrum, the red appearing nearer the horizon. This effect can be reduced by observing through a filter transmitting only a narrow spectral region.

Atmospheric penetration. To explore a terrestrial-type atmosphere to various depths, molecular scattering can be exploited. Since the shorter wave lengths are scattered more, it follows that ultra violet light scarcely penetrates an atmosphere at all, violet light penetrates to some depth, blue still deeper, while blue-green may reach the solid surface. Filters applying these criteria can be used, for instance, in studying Martian atmospheric phenomena.

Color contrast is affected by sharpness of boundaries and by differences in color and shade. Light yellow and orange filters are useful in judging the colors of the low-hue cloud belts and zones on Jupiter and Saturn. To bring out a white area on a reddish background, a green filter is useful. For example, a light yellow-green filter will sharpen the boundary of a white frost area on Mars by darkening the ochre desert, while allowing adequate penetration of the Martian atmosphere. A blue-green filter will similarly increase the contrast of an atmospheric cloud above an ochre desert region.

Irradiation occurs between adjoining areas of unequal brightness. The amount the bright area appears to encroach upon the fainter one is approximately proportional to their intensity difference. This is evidently a physiological effect, originating within the eye itself. Some astronomical examples are the apparent enlargement of the Martian polar caps and of Venus' cusp caps, and the apparent reduction in size of canals and dark spots on Mars. In photography, there is an analogous spreading of bright images in the emulsion called turbidity.

Some solar system objects display dark lines against a light background, for example, lunar rills and the narrow Martian canals. Irradiation causes these dark features to shrink, and sometimes to disappear completely.

The Eastman Kodak Wratten filters listed in the table have useful transmission characteristics for planetary and lunar work. The columns in the table are Wratten number, general color characteristic, over-all percentage of light transmitted by the filter in the wave-length region 4000 Å to 7000 Å, dominant transmission wave length, and approximate range of transmission within the same spectral regime.

Filters can be used with eyepieces of any power, but irradiation is less with fainter images, high magnifications help reduce it. If the quality of the seeing permits, a power of 50 per inch of aperture for reflectors and 30 per inch for refractors is recommended as a minimum for observing the moon, Mercury, or Mars. Somewhat higher powers are necessary to lessen irradiation on the disk of Venus.

Color filters of low transmission heighten contrast of surface detail or clouds and at the same time cut irradiation. For instance, a violet filter W47, is useful for the low-contrast shadings of Venus because of the yellowness of these markings. Red, yellow, and green filters generally disclose little detail, but there is apparently an alternating color change from red to blue in the atmosphere of Venus. I have seen dark shadings with the aid of Wratten filters 25, 47 and green 58. For dazzling lunar detail, filters 11, 15, 21, and 23A are recommended. Also, No. 3N5 is excellent for lunar work, being a combination 25% transmitting neutral filter and a W3 yellow.

Using the less-scattered yellow and red wave lengths gives an image with increasing definition and contrast. Most of the scattered blue light in Mars' atmosphere may be filtered out with a deep yellow or orange filter (15, 21, or 23 A); these also reduce the light from the blue and green areas, darkening the maria, oases, and canal markings while lightening the orangish desert regions of the planet. A lighter yellow filter (8 or 12) will stop the scattered blue light also, but will allow passage of more green light from the maria. On the other hand, a red filter W25 transmits red and some yellow light, but cuts out all blue and green, thus giving maximum contrast. Too deep a red filter will probably cause a loss of very fine detail.

Techniques for observing planetary atmospheres usually require blue-transmitting filters, but their uses vary widely. For instance, only a very light blue filter with high transmission, such as W82A, is useful with a filar micrometer in determining the latitudes and longitudes of faint Jovian and Saturnian cloud and wisp formations. A most effective colored filter for observing the low contrast hues of blue and red that exist in the Jovian atmosphere is that of green W58. A pure green filter cuts out both the red and blue colors, thus enhancing the contrast of red and blue detail.

To restrict observations to the top of Mars' atmosphere, a rather dense W47 violet filter would be useful to sharpen the boundaries of high-lying clouds. Also, a green filter W58 may be employed for further cloud comparisons directly above the planet's surface.

Sometimes it is difficult to determine whether a Martian white area is a high-altitude cloud, a low-lying one, or a frosted ground area. If the white patch lies in an ochre desert region, make comparative observations with green W58 and violet W47. If the cloud is larger, brighter, or better defined with filter W58 it probably lies near the surface, but should be high-altitude if W47 gives a superior view.

Most of Mars' yellow-type clouds seem to be close to the surface, on the basis of these tests. Martian cloud studies are of definite value in ascertaining meteorological conditions on the planet.

One puzzling phenomenon of Mars is the "blue clearing." When this occurs, surface features can be photographed and seen in blue light. The phenomenon is quite variable, and not enough is known about it to predict its occurrence. Therefore, observations of its appearance and disappearance are important. For this purpose, compare surface features seen through yellow and red filters W15, W21, and W25 with detail observable through blue and violet filters W38A and W47.

Filters can also disclose daily changes in the Martian atmosphere near the poles. A polar hood of haze is seen to vary in extent and density from night to night, but is detected only in blue and green light. Red light apparently penetrates the hood and clearly shows the surface markings beneath. These facts have been verified photographically as well as visually.

WRATTEN FILTERS

No.	Color	%	Dom.	Extreme Range
3N5	Yellow-Neutral	27	5700	4400-7000
8	Light Yellow	83	5720	4600-7000
11	Yellow-Green	40	5500	4100-7000
12	Yellow	74	5760	5000-7000
15	Deep Yellow	66	5790	5100-7000
21	Orange	46	5890	5400-7000
23A	Orange-Red	25	6030	5700-7000
25	Red	14	6150	5900-7000
38A	Light Blue	17	4790	3800-5650
47	Violet	1	4500	4000-5000