Physical Sciences Notes

OPTICS

Formula Predicts Color Perception

The color a man sees in an object depends on the color of surrounding objects—a fact well known to artists, interior decorators and advertisers.

Studies at the National Bureau of Standards may make it possible to predict exactly how much color change can be expected from varying backgrounds.

Colors are classified according to three variables: hue, which distinguishes one color from another; value, which measures the lightness of the color; and chroma, which measures the strength or weakness of a color. Red and green are different hues; pink and maroon have the same hue, but different values, since pink has a lot of white in it and maroon a lot of black. Value is measured on a scale of nine quantities, called Munsell values.

In the NBS experiments, carried out by Dr. Hiroshi Takasaki, backgrounds of different values were used to measure their effect on a target color. A white background—Munsell value 1—surrounded a middle gray target—value 5. Observers were then shown a black background—value 9—and asked to pick the value that matched the original target. The values picked ranged from two to four Munsell values higher than the middle gray used originally.

Dr. Takasaki developed a formula which predicts the change in value depending on background, and found it fit the observed facts not only for black and white but also several different hues.

OPTICS

Resolving Power Simply Determined

A simplified way of figuring the resolving power of a lens is the result of computer-derived tables published by the National Bureau of Standards.

Resolving power is a measure of a lens' ability to reproduce detail. It is usually computed by taking a picture of a series of fine lines, and counting the number of lines per centimeter that can be separated in the picture.

Experiments by Dr. F. E. Washer at NBS showed that resolving power depends on several more easily measured factors, including the longitudinal chromatic aberration and the depth of focus of the lens.

Dr. Washer derived an experimental formula which gave the resolving power in terms of the other variables. These computed values matched those measured by the usual methods.

He then plugged into the formula a large number of values for chromatic aberration, which measures the distortion caused by light of different colors being bent a different amount by the lens, and depth of field, which is the distance an object can be located from the camera and still be in focus at any one setting.

ASTRONOMY

Historic Star Positions

The positions of 88 stars during a 5,000-year period have been calculated and published by the Smithsonian Institution.

The star positions are given at intervals of 100 years for the period from 2501 B.C. to 2500 A.D. All the stars listed have a visual magnitude brighter than 2.99.

A second table gives the position of the same stars at 500-year intervals back to 10,000 B.C.

The work was carried out by Dr. Gerald S. Hawkins of the Smithsonian Astrophysical Observatory and Dr. Shoshana K. Rosenthal of the Harvard College Observatory. The scientists say the data are useful in various aspects of the history of science.

REACTOR TECHNOLOGY

Thermocouples Affected by Radiation

Thermocouples, routinely used to measure temperature in atomic reactors, may be giving misinformation, recent experiments show.

The thermocouple consists of two different kinds of metal joined in a wishbone shape. A voltage develops across the two open ends which depends on the temperature of the joined end. The device has been widely used to measure reactor temperature because ordinary thermometers can't stand the corrosive conditions.

Theoretically, the radiation of the reactor should affect the output voltage of the thermocouple too.

To test this, Dr. James H. Leonard of the University of Cincinnati immersed a thermocouple into a tank of boiling water, to keep its temperature constant. Then he put the tank in a railroad car and backed it up against the reactor.

The reactor's neutron bombardment of the thermocouple in its container caused the radiation effects to show up. As the radiation level was changed, the voltage fluctuated.

The experiment was carried out at the 10-megawatt test reactor at Wright-Patterson Air Force Base, Ohio.

ASTROPHYSICS

Quasars May Be Close

The bizarre astronomical objects known as quasars may not be billions of light years away in space, as many scientists have thought.

Instead, quasars are relatively close objects, conclude Drs. G. R. Burbidge and E. M. Burbidge of the University of California, San Diego.

The two astronomers base their conclusion on the fact that the red shift of seven quasars is identical. Distances of stars, quasars and galaxies are measured by the shift in their light toward the red end of the spectrum.

The red shift is generally interpreted to mean that the source is receding from the observer. But if all seven quasars have the same red shift, then according to that theory all of them would be receding from the solar system at exactly the same rate.

The probability of this happening is "fantastically small," the Drs. Burbidge claim in the current ASTROPHYSICAL JOURNAL.

The red shift, instead of indicating a motion away from the earth at distances of 10 billion light years, could be caused by gravitation. If that, or some other explanation were the case, their distance might be no more than 130 million light years, either within the Milky Way galaxy or relatively close to it.