ASTRONOMY

Dust Changes Starlight

Dust particles spinning like a football in space are the latest proposed theory to explain the polarization of light from stars, one of the newest astronomical puzzles.

➤ ELONGATED dust particles containing a small amount of iron and spinning like a football end-over-end in a magnetic field in space were proposed to the American Astronomical Society, Tucson, Ariz., to explain the polarization of light from the stars.

This new theory to solve one of the newest puzzles in astronomy was proposed by Dr. Jesse L. Greenstein, of Mount Wilson and Palomar Observatories, and Prof. Leverett Davis, Jr., of the California Institute of Technology.

In recent years astronomers have found that the light from certain stars is polarized partially. Some of the light rays are constricted to vibrate in certain planes instead of being free to vibrate in planes of random orientation. Evidence for this has been found chiefly by John S. Hall, now of the U. S. Naval Observatory, and W. Hiltner, of Yerkes and McDonald Observatories. Their observations have been interpreted as requiring a specific orientation of elongated particles of interstellar dust. Through clouds of matter containing dust and gas all starlight must pass on its way to the earth from the distant parts of the Milky Way system of stars. These clouds of interstellar matter are not uniformly distributed, but distinctly patchy in their distribution.

The only mechanism for orienting particles of matter seems to be the action of a magnetic field in space on the iron content of the interstellar dust grains. Recently, to explain the origin of cosmic rays, Dr. Enrico Fermi of the University of Chicago proposed the presence of a magnetic field in space (intensity about 3 x 10-5 gauss). Dr. Fermi imagines this field to exist, with lines of force parallel over small regions, but randomly oriented from cloud to cloud. The astronomical observations of polarization favor the uniformity of the direction of the field over regions measuring 300 light years across or more.

Chief difficulty with the magnetic field hypothesis has been the necessity to fill space with particles of dust composed mostly of iron and therefore more or less permanently magnetized (ferromagnetic) and relatively at rest so the magnetic field could act on them.

Dr. Greenstein had already shown that near bright stars the gases are at temperatures of as much as 10,000 degrees. Each dust or gas particle is constantly being bumped into by other particles, all moving around at high speeds. Such collisions would destroy any orientation produced by a magnetic field and prevent the dust particles from doing any polarizing of starlight.

From a football game, the California scientist could have got their explanation as to how spinning particles could go on spinning and nevertheless "look" to light passing through them like oriented particles. If a football spins end over end as it goes through the air it looks like a circle as seen from the side. But it looks like the ellipse that is seen from the front or back. If it is spinning around its long axis, the way it is usually thrown, it looks like a circle from its front or back, but like an ellipse from the side. Dr. Greenstein believes that spinning interstellar dust particles can be lined up to spin like end-over-end footballs by a magnetic field of the intensity proposed by Dr. Fermi. Small amounts of iron in the dust particles are all that are needed to make them susceptible to the action of the magnetic field, that is, paramagnetic. They need not be mostly iron.

"Thus we picture these slightly paramagnetic dust grains as spinning rapidly around an axis which keeps being disoriented by collisions with hydrogen atoms, while the magnetic field patiently keeps trying to keep the axes oriented," Dr. Greenstein said. The shortest axis of a dust grain, regardless of its shape, will be the one around which it will tend to spin.

Statistically, because of the collisions, not all the particles will be properly oriented to produce polarization, but enough to produce the partial polarization actually observed can be explained by this theory. In the absence of his theory, Dr. Greenstein points out, a magnetic field 10 times as strong would be needed, the interstellar cloud would have to be at a temperature near absolute zero (10 degrees Absolute) and the particle would have to be ferromagnetic.

Science News Letter, December 31, 1949

OCEANOGRAPHY

Present Water Shortages Are Only Mild Beginning

➤ THE current water shortages, not only in New York but throughout the world, are only the beginning. In a few thousand million years or so there won't be any water left at all. Dr. Hans Pettersson, Swedish professor of oceanography, made that clear in a lecture to the Royal Institution of Great Britain.

Dr. Pettersson said that the earth is suffering from progressive dessication, an ailment common to all aging planets. It is drinking all the water in the oceans, converting the water into components of its solid crust.

"It will then have reached the present tragic state of its neighbor Mars, with its oceans gone," said Dr. Pettersson, "and with them, inevitably also, its oceanographers."

Science News Letter, December 31, 1949

PHYSICS

Radioactivity Detector Has Probing Nose

➤ LESS danger to workers using radioactive products and byproducts from atomic energy developments is promised with a new radiation detector which has a four-foot probing nose. The new instrument was revealed by General Electric in Schenectady, N. Y.

The business end of the detector is an electronic tube at the tip of the probe. Attached to the tube is a phosphor, a material that gives off light in the presence of radioactivity. Light from the phosphor acts upon the electronic tube, and is converted into electrical energy. This activates a meter in the instrument itself.

A lightweight battery, carried in a special case by the operator, provides the electric power for the instrument.

Science News Letter, December 31, 1949

LONG RANGE DETECTION—A long-probe radiation detector, which permits the operator to measure radioactivity from a distance, is demonstrated by Charles Lemmond, engineer in the G-E General Engineering and Consulting Laboratory, Schenectady, New York.