ASTRONOMY

# Most of Light In Night Sky Comes From Sun, Not Stars

## Displays of "Northern Lights" Have Same Explanation, Solar Electrons Produce Light in Atoms of Air

THE HIKER caught out after dark on a moonless night may feel very thankful for that faint illumination which he calls starlight. But he is wrong in thinking that it all comes from the stars. Only about one-fifth of it is of stellar origin. Most of it is produced by particles of electricity, hurled from the sun at enormous speeds, and "striking sparks" as they collide with the molecules of the upper atmosphere.

Prof. Georges Déjardin, of the University of Lyons, France, describes the experiments which have led scientists to accept this theory. (*Reviews of Modern Physics*, Jan.)

One may wonder how the sun can be responsible for this light when it, itself, is on the other side of the earth. The answer to this is that the electrons are bent around by the earth's magnetic field so that almost as many fall on the far side, where it is night, as fall on the near side.

Displays of "Northern Lights" are quite similar to the light of the night sky when examined with the spectrograph, and have, in large measure, the same explanation. The night sky is brighter at times of the year when the northern lights are also most in evidence, says Prof. Déjardin.

Some nocturnal light, while also coming from the sun, reaches the earth by another route. Just as sunlight is reflected from the moon, this glow is reflected to us from small pieces of matter which fly about in empty space.

### Lighter Near Horizon

The hypothesis that most of the night light is produced in the earth's atmosphere is verified by the fact that it is stronger near the horizon than directly overhead. When we look straight up, we look through less atmosphere and therefore see less of the light.

Examination of the night sky with a spectrograph shows very nearly what one would expect from collisions of electrons from the molecules of our atmosphere. The photographic plates show abundant evidence of the presence of oxygen and nitrogen.

These spectra did hold some surprises for physicists, however. The usual oxygen spectrum shows some gaps in its systematic scheme of lines. These gaps have been given the name of "forbidden lines." But in the night sky spectrum these forbidden lines are conspicuously present. After this discovery it was found possible to produce in the laboratory oxygen spectra in which these lines also appear. Most of the light from the nitrogen in the air also comes from a rather rare form of the gas called "active nitrogen." This form of nitrogen has also been produced in the laboratory and appears only when the gas is in a very rarefied state.

Other substances whose spectra can be detected in the night sky include water vapor and argon.

The extreme reaches of the upper atmosphere have long been supposed to consist of the very light gases, hydrogen and helium. But the nocturnal spectrograms indicate that oxygen and nitrogen extend as far as the confines of the atmosphere.

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PHYSICS

# New Tool of Science Is Itself Little Known

IT MAY seem strange to the layman to find scientists using something about which they possess scanty knowledge as a tool to find out more about the physical laws underlying nature. But such is the case for cosmic rays.

No less an authority than Prof. Arthur Compton, Nobel prize-winner from the University of Chicago, states, ". . . the immense individual energies of these (cosmic) rays give them a unique place in the physicist's atomic artillery."

"Used as a tool," he adds, "they have resulted in the discovery of the positron, they seem about to become an adjunct of the telescope for collecting astronomical data, and they now afford a means of extending our knowledge of the laws of electricity and of the properties of matter to energies a thousand times greater than are available from any other known source."

As only one example, cosmic rays are being made to tell something about magnetism *inside* a magnet. Science has long studied with success the effects of external magnetic fields of magnets, and exact laws governing the behavior of all manner of matter in such fields is fairly well known. But what happens inside the magnet is still highly obscure.

### Each Bit a Small Whole

The obvious method of taking the magnet apart to see what makes it work is useless, for once broken each little piece exerts its own external field and the original situation is repeated only on a much smaller scale.

Cosmic rays provide the tool whereby a magnet can be kept whole and yet something of what happens inside can be determined at the same time. The trick is to allow cosmic rays to penetrate the magnet. In fact, it is quite hard to prevent them from doing this because of their great energy and piercing power.

Because cosmic rays are largely electrical in nature they are bent in passing through the magnet and the strength of the field inside the magnet can be determined.

### Origin Still Puzzling

The situation is somewhat comparable with the measurement of the force of a hurricane at sea by deciding by simple calculation how much a ship is blown off its course.

Prof. Compton, writing in the Physics Forum of the *Review of Scientific Instruments* (February), summarizes what science now knows about the nature of cosmic rays but admits that the more basic question of their origin still proves puzzling. There exist hypotheses to explain the origin but all of them, he declares, lack the amount of experimental proof required for general acceptance.

"The cosmic origin of cosmic rays, though perhaps not established," he states, "appears now more probable than ever. How they originate is still obscure; but increased knowledge of their characteristics has helped to limit the types of hypotheses that are admissible."

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