

## ASTRONOMY

# Dust Clouds Form Comets

English scientist suggests theory that primitive comets are formed when the sun and planets penetrate interstellar dust clouds in the Milky Way galaxy.

► PRIMITIVE COMETS are formed when the sun and its family of planets pass through interstellar dust clouds in their journey through space.

This theory, proposed by Dr. R. A. Lyttleton of St. Johns College, Cambridge, England, is based on the known fact that interstellar dust is found on a large scale in the Milky Way galaxy in which the sun is located. The sun must therefore interact with any gas clouds it encounters.

This interaction results in the individual particles in the cloud sweeping around the sun and converging behind it to form a narrow stream. Since the particles are then quite far from the sun, they gravitate toward each other, forming weakly bound swarms of particles that tend to fall almost directly towards the sun. These are the primitive comets.

Small deflections from passing stars and the action of the planets prevent a fair pro-

portion of these swarms from actually striking the sun. Those thus influenced become comets, a few of which are occasionally so spectacularly visible in the heavens to the naked eye. Most are spotted only on photographs, however.

Since some 250,000 long-period comets are known and their directions are randomly distributed, Dr. Lyttleton suggests that the sun must have passed through several clouds having different directions of relative velocity.

How the comets then evolve determines how much matter they contribute to the dust of interplanetary space. Many comets escape from the solar system. A long-period comet changed into a short-period one by a close brush with Jupiter would no longer be held together. Its particles would spread out, resulting in a meteor stream. To support this idea, Dr. Lyttleton notes that many short-period comets have disappeared within

recorded times, and many meteor streams are known without associated comets.

Other effects also cause the particles to spread out. When the comet is closest to the sun, the particles above the general orbital plane of the comet must cross down through it and vice versa. Colliding particles will have their energies slightly changed, so will move gradually away from the comet as a whole to give a meteor stream.

These collisions will also pulverize the particles, producing still smaller particles, some of which may be driven out of the comet by radiation pressure to form the tail.

Another result of the collisions, Dr. Lyttleton suggests, could be intense local heating at the tiny areas of contact resulting in sufficiently high temperatures to drive off volatile constituents.

This could be the main method for production of gas in a comet, not solar heating.

Although the gas release amount cannot now be estimated, Dr. Lyttleton believes that this gas release causes the nucleus formation. He reasons that, if huge numbers of particles in a swarm each give out a small amount of gas at a high temperature, a center must form somewhere within it from which the gas as a whole will stream radially outward. This, he reports, could possibly account for the formation of the nucleus as a comet approaches perihelion and its disappearance later as the comet recedes.

Dr. Lyttleton proposes that the tails of comets could serve as indicators of interplanetary gas. Some have been observed to be highly disturbed, as if "blown sideways by an interplanetary breeze," he reports in *The Observatory* (Oct., 1958).

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## ENGINEERING

# Paper From Corn Stalks

By BENITA TALL  
From Tel Aviv, Israel

► SOME TIME next year Israeli businessmen will probably be writing on "home-made" paper produced from corn stalk pulp.

The American Israeli Paper Mills at Hadera, about 18 miles north of Tel Aviv on the road to the seaport of Haifa, is pushing ahead with plans to use corn stalks, a local agricultural waste product, in its paper making. The company believes this will be the first commercial use of corn stalks in paper manufacture.

Results from pilot plant studies in the U. S. have shown that corn stalks are much like sugar cane, which is now being used to make pulp in several Latin American countries and in other places where the material is plentiful. Cereal straw, another local raw material, could also be used in the new pulp mill under construction. Experience obtained during the past two years in using imported straw pulp shows that these agricultural residue pulps can lessen Israel's dependence on costly imported wood pulps.

Many problems in using corn stalks, such as removing the soft center of the pith and transporting the bulky material quickly and economically, faced the paper mill engineers. With the cooperation of researchers, here and in the U. S., they have largely been solved. When the pulp mill begins

operation, an elaborate system of water flumes, tested at the hydrology laboratory of the Technion in Haifa, will float the bales of corn stalks to their destination. There also has been provision made for using pith as an auxiliary boiler fuel.

Depending on the kind of paper being produced, the corn stalk and cereal straw pulp will make up from 100% to about 20% of the final product. Imported wood pulp will still provide some 50% of the mill's pulp needs. The new pulp mill, part of a \$10,000,000 expansion program, will also be able to take in other agricultural residues, such as cotton stalks and sugar cane.

Israel now ranks third in the world in the per capita publishing of books. One in four persons from a population of more than 2,000,000 persons is enrolled in a classroom. These facts, together with the increasing use of paper products in advertising, packaging and wrapping, and a fast-growing population, indicate that every corn stalk and bit of straw will be grist for Israel's new pulp mill.

At the entrance of the paper mill's grounds there is a sign identifying the building that also reads: What Israel Makes, Makes Israel. The slogan, which seems at first an incongruous bit of American advertising, is truly "a sign of the times" as industry and advertising, in the shape of the Middle East's first major paper mill, comes to this old-new country.

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**CORN CANAL** — Bales of corn stalks, bound for the pulp mill, ride water flumes constructed to help Israel produce more paper.