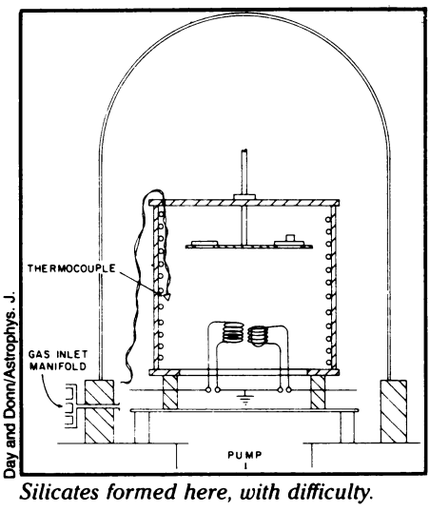
Astrophysical silicates: Dust unto dust

The space between the stars is filled with tenuous clouds of matter. It is perhaps invidious to call it junk, but that is the word used by some of the astronomers who are busily engaged in studying it. The junk consists of gaseous molecules, of which about 40 different varieties have been identified, and solid flakes, the interstellar dust, which appears to be one kind of silicate or another.

Astrophysicists want to know how the various molecules are made and what happens to them after they are made. One way to test theories of formation is to try to mimic the situation in the laboratory and to see if the desired compounds form. The trick can't be played exactly. The temperatures and to some degree the extreme vacuum are available, but the vast spaces in which nature plays the game are unreachable. Still, a number of experiments to see whether certain gaseous compounds would form under simulated space conditions have been done. In the May 15 ASTROPHYSICAL JOURNAL LETTERS, K. L. Day of the University of Arizona and Bertram Donn of the NASA Goddard Space Flight Center "report...the first laboratory results of an experimental and theoretical study of the formation of solid particles in astronomical systems."

The experimental runs were done in a vacuum oven in which an atmosphere of argon or hydrogen was present at very low pressure (a few torr). A cloud of smoke formed, out of which solid particles condensed. The condensates were carried upward and deposited on a collection plate about 15 centimeters above the crucibles. A large variety of silicates with varying magnesium/silicon ratios appeared.



Day and Donn/Astrophys. J.

Silicates formed here, with difficulty.

At low condensation temperatures (a few hundred degrees C) the condensates were mostly amorphous and had "widely varying" proportions of the three elements involved, and the most thermodynamically stable silicates did not form. At temperatures above 700° C it was difficult to nucleate any silicates at all. "This shows that surface energies and kinetic effects, which determine the stability and growth of small clusters, are very important in determining under what conditions condensation will occur." Yet although it proved difficult to condense refractory silicate grains at temperatures of a few hundred degrees C — which are likely to obtain in the space near a star — the spectra of those that did form have "a strong resemblance to those observed in many astronomical clouds." □

U.S. sensors may go on Soviet moon mission

For several years, U.S. scientists studying the moon have been advocating the development of a Lunar Polar Orbiter, an unmanned spacecraft that would provide close-up data on the whole moon rather than being restricted to isolated landing sites or to the latitude limitations of near-equatorial orbits. The proposed mission has failed to appear in three successive space agency budgets, at first because of the Office of Management and Budget and most recently because the National Aeronautics and Space Administration itself concluded that LPO was too low a priority to consider for at least the next five years.

Now it is possible that some of the planned LPO instruments may reach the moon after all — on a Soviet spacecraft.

In March, Soviet officials attending the Lunar and Planetary Science Conference in Houston revealed that a Soviet LPO-style mission was actually in the works, to take place "within five years" (SN: 3/25/78, p. 182). The idea had been discussed the year before, but in less concrete terms. (Some NASA and private sources feel that the "abandonment" of the U.S. plan may have prompted Soviet officials to go ahead with their own.) As a result of subsequent discussions, a group of scientists and NASA officials will meet next week with some of their Soviet counterparts to explore the possibility of sending U.S. sensors along as part of the Soviet mission.

Of about a dozen instruments that had been considered for the U.S. LPO, four are expected to be the chief topics of discussion (beyond the basic question of undertaking the joint mission at all). Three of these were flown in an earlier form aboard the Apollo 15, 16 and 17 command modules, though their data were limited by the plane of the orbits to about ±30° latitude: a gamma-ray spectrometer to locate radioactive elements; an X-ray fluorescence spectrometer to identify the lighter elements; and an electron-backscatter counter to indicate remnant magnetism in the lunar surface, possibly related to the relative ages and evolution of the moon's outer layer. The fourth instrument, to discriminate among mineral types such as pyroxene and plagioclase (common in lunar basalts), is a spectral reflectometer whose development was cut off by fading LPO plans about a year ago, just before its hardware was to have been built.

The U.S.-Soviet discussions, scheduled for June 7 through 9, will take place in Innsbruck, Austria, in conjuction with a meeting of the Committee on Space Research (COSPAR). Another topic, besides the lunar mission, is expected to be the possibility of cooperating in studies of Venus. Soviet officials reportedly plan to attempt an unmanned Venus mission that would arrive close to the time of the U.S. Pioneer Venus spacecraft, and a Soviet-French mission is said to be in the works in which French-built balloons would hover in the Venusian atmosphere. □

China's plan to spur scientific research

The People's Republic of China, which sees itself trailing "capitalistic" nations in scientific and technological achievement, seeks to counter the trend with an ambitious program to rapidly develop competitive research and skills. It includes a three-year crash program in advanced fields — such as laser technology, computer development and genetic engineering — and an eight-year program in a broader range of fields. The overall plan was described at a Peking science meeting last month and reported this week by the New York Times.

Fang Yi, minister of the Scientific and Technological Commission, said China lags advanced countries by 15 to 20 years in many fields. "Only by developing at a higher speed can we catch up with or surpass the capitalistic countries" by the year 2000, he said. China's draft plan lists 108 specific projects, including a 30- to 50-billion electron-volt proton accelerator, coal gasifiers, launches of scientific and applied satellites, and development of ways to improve crop yields.

Teng Hsiao-ping, Senior Deputy Prime Minister, cautioned against "blind opposition to everything foreign." In fact, China has already entered several exchange programs with the United States. Members of the U.S. nuclear-power community returned from Peking last month after touring a research reactor and radioisotope-separation facilities. They were told China wants to catch up with industrialized countries in nuclear-power development. And the Committee on Scholarly Communication With the People's Republic of China is sponsoring exchanges this year in chemistry, oceanography, rural health, earthquake engineering, engineering education and Han Dynasty culture. □