Donn, Bertram. The problem of the evolution of interstellar grains.

The problem of the evolution of interstellar grains has become closely tied to the larger problem of the evolution of the galaxy as a whole as a result of the intimate connection between spiral arms and interstellar obscuration. The obscuration also appears to be the basic factor for the occurrence of spiral arms. Consequently the grains must be as old as the spiral arms and thus origin of the solid particles belongs to a period when significantly different conditions prevailed in the galaxy. Although preliminary results of a number of investigations of the development of galaxies have been reported, they are far from being sufficiently definite to be used as the starting point for the present problem. Those investigations of interstellar grains, which have been carried out under the assumption that conditions have remained unchanged must be regarded as first approximations although essential steps for more refined studies.

A second limitation to tracing the evolution of the grains arises from the incomplete knowledge of the basic processes which comprise the gas-grain interaction in space. These include the formation of molecules by radiative association; condensation, evaporation and adsorption on contaminated surfaces at low temperatures; properties of the surface film; and, finally, chemical reactions on the surface. Considerable risks are involved in extrapolating results over long time intervals when procedures remain as uncertain as they are at present.

In view of these difficulties an appropriate method of attack consists of studying the restricted problem of current interaction between the gas and solid particles and thus determining the behavior of interstellar matter at present. This has been done by extending the work of Cernuschi and of van de Hulst and developing a theory of condensation and adsorption for contaminated surfaces.

The type of grain suggested by van de Hulst, which consists of a heterogeneous aggregate of various molecules, was adopted as a working hypothesis and its development traced according to the theories described above. This indicated that such a grain would be stable under present conditions. Considerations of catalysis and chemical reactions together with the probable absence of surface mobility make molecular formation on the grain unlikely. The very limited data on collisions of non-reacting atoms or radicals with surfaces does not favor any appreciable conden-

sation of the atomic constituent of the interstellar gas. Consequently the grain although stable would not show significant growth and hence the model employed does not seem to be a satisfactory one. The discussion of the first paragraph allows for other possibilities.

The results found in this analysis must also be considered tentative in spite of the further development of the theory. Until the basic processes enumerated earlier have been more fully investigated, it will not be possible to obtain a definite conclusion regarding the gas-grain interaction and the development of the grain itself.

This investigation was begun while the author was an Atomic Energy Commission Predoctoral Fellow at the Harvard College Observatory.

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Dunn, Richard B. A quartz polaroid birefringent filter for the K line.

Since the birefringent filters for the $H\alpha$ line have been so successful in showing prominences and disc features on the sun it seemed worthwhile to build a filter for the K line. The filter should be very effective because the K line is such a wide absorption line in the solar spectrum. On the other hand, scattered light is about eight times more intense at the K line than at the $H\alpha$ line. A 4A half-width filter was designed and constructed at the Harvard College Observatory. It consists of 13 quartz plates and 5 polaroids arranged in the Evans' split-element design that reduces the number of polaroids required. The thickest plate is 17.8 mm, which is about one-third the thickness of the equivalent $H\alpha$ plate. Type KN 36 polaroid was selected for the polarizing elements.

Prominences and some disc features have been photographed with SA 1 film and a $2\frac{1}{2}$ mm thick Corning 5874 glass filter and the birefringent filter. The speed of the system is about ten times slower than the corresponding $H\alpha$ filter. This low speed results in part from absorption in the telescope and polaroid, and from the slower film. Present plans include trying different polaroids, and various auxiliary filters to improve the speed and contrast of the filter. Additional plates may be added to narrow the filter to 1 A.

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