On this model, prominence activity associated with spot groups should originate in the surrounding material rather than in the spots themselves. Careful comparison of the relative location of spots and prominences will provide an observational check. Also correlations should be sought between the detailed character of spot groups and the types of associated prominences.

The enhanced flux of mechanical energy involves increased dissipation and hence above-average heating of the chromosphere and corona near spots. These effects should appear, as in fact they do, before a spot has surfaced. Prominences visible as dark filaments on the disk may similarly be associated with submerged magnetic fields. Although the main energy source for prominence activity is probably mechanical, the actual motions will be influenced strongly by local magnetic fields and may, in turn, also influence those fields.

It is our view that the normal convection of the quiet sun is sufficient to produce both chromosphere and corona. The tenuous extremities of the latter may, as Chapman has suggested, reach beyond the earth. Shock waves, arising from the activity near spots and amplified by passage through a medium of progressively lower density, can produce many of the features of solar prominences. A knot ejected from an active region will exhibit a Doppler displacement even if the matter composing it changes constantly. The phase and amplitude cross-modulation, referred to in the accompanying paper, permits propagation velocities in excess of the sound velocity in the medium.

Stars having a general magnetic field sufficiently intense to inhibit atmospheric convection should possess extended envelopes to make up for the lower efficiency of energy transport. Although no detailed models have been worked out, we note that stellar magnetic fields and the mechanical disturbances associated with them may be responsible for certain varieties of stellar variability, especially those involving expulsion of matter from the surface and asymmetrically distended atmospheres.

The research in this paper has been supported in part by the Geophysics Research Directorate, Air Force Cambridge Research Center, Cambridge, Mass., under contract with Harvard University.

Krook, Max and Wild, Paul. 1957, *A. J.* 62, 22.

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Krook, Max and Wild, Paul. On the theory of solar radio bursts.

If a sharp pulse of small amplitude is generated in an ionized gas, it propagates as two separate pulses—a slow one carried by electrons and ions together, and a fast one carried by the electrons alone. For pulses of large amplitude we have to consider the additional effects arising from cross-modulation in both amplitude and phase of the Fourier components. Various modes of behavior are then possible, including the generation and propagation of shock waves. Wild has classified solar radio bursts into three main types. The behavior of his types II and III is consistent with the interpretation that they are associated with shock waves in the electron-ion gas, and in the electron gas, respectively. This interpretation is supported by examples from Wild's "rogues gallery" of solar bursts, which includes combinations of events that are to be expected on the basis of cross-modulation.

The burst disturbances generally originate near sunspots. We suggest that they may arise from instabilities that are just enhanced forms of the instability responsible for the existence and maintenance of the chromosphere and corona. The fluctuating character of the outer boundary of the convective zone results in the transfer of mechanical energy through the overlying material and its eventual dissipation there. Biermann has suggested that the magnetic field of a spot inhibits convection. The energy prevented from flowing through a sunspot leaks out through the surrounding material. We note that this implies enhanced convective motions and enhanced mechanical energy transfer to the overlying material. In particular, the fluctuating top of the convective zone may approach the top of the photosphere and may even sometimes break through it.

The research in this paper has been supported in part by the Geophysics Research Directorate, Air Force Cambridge Research Center, Cambridge, Mass., under contract with Harvard University.

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Cambridge, Mass.*

Kupperian, J. E., Jr. and Milligan, J. E. Sources and stellar fluxes in the far ultraviolet.

Identifications of the discrete sources observed by E. T. Byram *et al.* (1956) in the far ultraviolet have been made. The strongest are γ Velorum, ζ Puppis and Regulus. There also appear

to be a small number of sources above the galactic plane for which there is no obvious explanation. The approximate flux from each of these stars was determined. The observed values of flux will be compared with values computed by model atmosphere techniques. Many more observations will be required before the law of interstellar reddening can be determined for this spectral region.

Byram, E. T., Chubb, T. A., Friedman, H. and Kupperian, J. E., Jr. 1956, *A. J.* 61, 9.

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Layzer, David. On the interpretation of galaxy counts.

This paper describes a simple and flexible model for the spatial distribution of galaxies, and develops formulae connecting parameters that characterize the model with parameters that can be derived from an analysis of galaxy counts.

The number of galaxies contained in a fixed volume fluctuates from one region of space to another. These fluctuations arise partly from the statistical character of the distribution and partly from a tendency toward clustering. The essential feature of the present model is that it distinguishes between the two sources of fluctuation in an explicit way.

To take account of the tendency toward clustering we introduce a continuous random function of position, $\lambda(x)$, which we may regard as the density of a fictitious continuous medium co-extensive with the actual discrete distribution. We postulate that the medium is statistically homogeneous and isotropic. This implies that none of its average properties, such as the mean density, the variance of the density, and the density correlation, serves to define a preferred position or direction in space.

To relate the properties of the continuous medium to those of the discrete distribution we make the following assumptions. (i) For any realization of the medium the numbers of galaxies in non-overlapping regions of space are mutually independent random variables. (ii) The probability of finding n galaxies in any given region V is given by Poisson's law $P(n) = e^{-\Lambda} \Lambda^n / n!$, where $\Lambda = \int \lambda(x) dV$. Thus, if we take the average mass of a galaxy as our unit of mass, and contemplate a large number of non-overlapping regions of the same mass Λ , then the numbers of galaxies in these regions have a Poisson dis-

tribution about the mean value Λ . One can show that these postulates are consistent. They define a model that can be made to exhibit any degree of clustering, from none at all to a hierarchy of distinct, well-separated aggregates.

From a formal point of view, average properties of the discrete distribution result from two successive averaging processes, the first over all realizations of the discrete distribution for a given realization of the continuous medium, the second over all realizations of the continuous medium. We assume that the order of averaging can be inverted, and that the double ensemble average is identical with a simple spatial average. The second assumption, whose justification lies in the realm of ergodic theory, is made plausible by the statistical uniformity of the distribution.

The properties of the model have been worked out in detail. One unexpectedly simple result is the following: The quasi-correlation coefficient $Q(r)$ of the counted numbers of galaxies in two volume elements whose centers are a fixed distance r apart approaches the true correlation coefficient $R(r)$ of the fictitious medium as the volume elements diminish in size.

The problem of tying in the present model with galaxy counts has been treated along lines laid down by Neyman and Miss Scott, who make full use of probability-generating functions and their properties. The present discussion differs from previous discussions of similar problems chiefly in the handling of the cosmological aspect.

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Lovell, D. J. and Miczaika, G. R. Practicable limitations to infrared stellar photometry.

The noise-equivalent powers of several photoconductors are compared. Lead sulfide is shown to be advantageous for many problems associated with infrared stellar photometry. Cell design is an important adjunct to techniques designed to achieve optimum cell performance. Electronic techniques to attain optimum results include synchronous conversion of the modulating frequency and the subsequent use of an RC filter. The basic elements of such a system are designed in block diagram form which shows schematically how the signal and noise voltages are separated. The limitations of these techniques are discussed.

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