in lowest-order perturbation theory, works much better than one might expect. Coleman also discussed the electromagnetic mass splittings within isotopic multiplets, and the selection rule in strangeness-changing non-leptonic weak decays.

L. A. Radicati (Brookhaven National Laboratory) reported on higher symmetry schemes. The success of SU(3) has stimulated interest in the study of higher symmetry schemes which include SU(3) as a subgroup. Although SU(3) was quite successful in baryon and meson multiplets and the GMO mass formula, a number of questions remain unanswered. The SU(6) group provides the right multiplets, reproduces the GMO mass formula, gives the correct ω-ϕ mixing angle, and the correct ratio of the magnetic moments of the neutron and proton. But it is not consistent with Lorentz invariance.

Relativistic particle theory was discussed at the final session, under the chairmanship of J. R. Oppenheimer. The first paper was given by R. Cutkosky (Carnegie Institute of Technology), who discussed S-matrix theory. He noted first the distinctions between the descriptive aspects of S-matrix theory and constructive S-matrix theory, and between the formal and empirical approaches to S-matrix theory. The formal approach is concerned with proving theorems, while the empirical approach is more directly related to the interpretation of experimental data. In constructing a consistent S-matrix theory one usually starts with particles which have definite masses and which interact with definite coupling constants. In calculating measurable quantities, one has to deal with the symmetries, the dynamics, and the approximations. The most outstanding problem is to find out how these items are interrelated. Cutkosky raised the question whether we can understand the dynamical origin of the symmetries, or whether we must impose the symmetries on the theory.

Recent developments in axiomatic field theory were reviewed by A. S. Wightman (Princeton University). The first part of his talk was concerned with the relations between the four so-called axiomatic approaches to a relativistic quantum theory of matter. Some progress has been made, but much remains to be done. Whatever the relative merits of these four theories, they all suffer from the major defect that there are no nontrivial examples. The second part of Wightman's talk was concerned with the attempts to construct a nontrivial field theory in two-dimensional space-time. However the models studied so far seem to be trivial; that is, they are essentially free fields. This suggests that to solve the existence problem in local field theory, one must tackle directly the ϕ^4 theory.

The final paper was by K. Hepp (Institute for Advanced Study), who presented his proof of the LSZ asymptotic condition for a local field theory. This result proves that, in the framework of the Haag-Ruelle collision theory, the LSZ asymptotic condition can be derived for a dense set of states.

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Micrometeorology

In response to the ever-growing need for the application of micrometeorological information to problems of air pollution, national defense, and agriculture, the first national conference on micrometeorology was held 13–16 October 1964. Sponsored by the American Meteorological Society and held in Salt Lake City, Utah, the conference offered an opportunity for exchange of ideas among scientists in the many disciplines which contribute to micrometeorology, including hydrodynamics, aerodynamics, thermodynamics, and statistics.

The micrometeorologist is concerned with the conditions and operative mechanisms in the lowest hundred meters of the atmosphere which influence the distribution and dispersal of substances in the air. In the case of air pollution, the substance of interest could be industrial waste, vehicle exhaust, or any other product of urban civilization. Defense interests include surveillance systems, materials and weapons testing, and field operations. Especially important are the safety criteria in weapons testing, reactor destructs, and the effects of the highly toxic gases and volatile liquids released during the storage and firing of rockets and missiles. The evaporation and dispersion of water are of primary interest for agriculture and conservation of natural resources.

The basic driving force for all atmospheric motions is solar radiation. The flux divergence between the incoming and outgoing radiation describes the gross temperature fields and, indirectly, the wind structure. These factors and the role of convection in the mass and energy transport in the lower atmosphere were discussed. Some attention at the conference was directed to the evaluation of the radiative equilibrium equations for model atmospheres. J. I. F. King suggested that the usual assumption of isotropy be reconsidered. He proposed a solution of the equations which would eliminate the unrealistic temperature discontinuity at the earth-atmosphere interface.

As in any experimental science, the acquisition of data is of vital importance in micrometeorology. One session of the meeting was devoted to discussion of instrumentation. Since the transport and diffusion of aerosols in the atmosphere depends on the structure of turbulence, that is, on the small-scale variations in the wind and temperature fields, much attention was directed toward the accuracy and response of the instruments used in the laboratory and in the field. Care must be taken that data are not affected by the instrument itself or the tower which supports it. Designs for data-acquisition systems which minimize foreign influence while satisfying the additional requirements of flexibility and mobility were presented, and techniques for rapid processing of the large amounts of data were discussed.

Another session dealt with the evaporation of water from reservoirs and from bare soil and with interactions at the air-water interface. Knowledge of this portion of the hydrologic cycle is vital to studies of water supply for agriculture and human consumption. The meteorologist attacks this problem by measuring and analyzing eddy flux, radiation balance, and evapotranspiration.

A link exists between the macroscale atmospheric motion, which can be forecast with some degree of accuracy, and the microscale motions. This link is the mesoscale, or local, wind circulation. Both horizontal flow fields and vertical wind profiles were examined, and reports were presented on several studies aimed at determining prevalent wind patterns at various sites. The results apply only to the specific

sites studied, since the effects of local terrain cannot be ignored in describing turbulence and diffusion. In addition, Heinz Lettau presented a new hypothesis which relates eddy velocity and mean wind velocity by means of a three-dimensional vector expression. Application of proper boundary conditions to the problem leads to realistic wind profiles.

The greatest interest at the conference centered about turbulence and its relationship to the diffusion of aerosols. A theoretical approach to the problem of turbulence was offered by Hans Panofsky, who reviewed the principles of similarity theory and showed how some statistics of turbulence can be related to lapse rate, terrain, height, and mean wind speed.

F. N. Frenkiel pointed out that rigorous solutions of the complicated equations of fluid dynamics are becoming practical through the use of high-speed computing techniques. Computers are also valuable for processing the large amounts of experimental data involved in the microscale of turbulence. A large part of research on turbulence consists of statistical analysis of data obtained during field studies of wind. Several papers reported investigations of this type over various terrains. Measurements were made of vertical and horizontal wind fluctuations at several heights. Analysis included spectral energy distributions over ranges from small-scale mechanical turbulence to semidiurnal cycles. Many such studies are needed to increase our understanding of microscale processes.

Diffusion problems are currently studied directly by making measurements at grid points of tracer dosages from a known source. However, forecasting the dispersal of contaminants depends on ability to predict the fine structure of the winds. Several theoretical and empirical models are used to evaluate diffusion on the basis of turbulence statistics, which include terrain effects, source size and release time of the contaminants, and wind speed. Factors which are important in selecting the time and space scales to be used in various studies for the prediction of dosage levels and distributions were also the subject of many of the papers presented.

The conference was concluded with a panel discussion of the relation between turbulence and diffusion, chaired by Morton L. Barad. Members of the panel were S. Corrsin, H. E. Cramer, F. N. Frenkiel, F. A. Gifford, Jr., G. R. Hilst, and H. A. Panofsky. Much of the discussion revolved about the problems inherent in using Eulerian turbulence statistics to describe the basically LaGrangian process of diffusion. While data leading to Eulerian statistics are easily obtainable with current instrumentation, diffusion studies require data on moving "parcels" of turbulence which cannot be obtained with the sensing systems now available. Bubbles and balloons which simulate such parcels can be tracked but tend to influence the microscale system under study. A feasible approach in the future could include the use of lasers. Another suggestion was the greater use of high-speed electronic computers as experimental tools. Increased attention to and use of wind-tunnel modeling and testing by engineers and classical fluid dynamicists should be encouraged. In conclusion, the perennial request for increased communication among related disciplines was made during both the panel discussion and the discussion from the floor which followed.

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Relativistic Astrophysics

Quasi-stellar sources, commonly called "quasars," are the most distant observable objects in the universe; they are so vast and so brilliant that their very existence cannot be explained by present physical laws. Their ability to generate enormous amounts of energy is not understood. The second of a series of symposiums on the subject (sponsored by the University of Texas and the Southwest Center for Advanced Studies, Dallas, Texas) attracted about 500 participants from various disciplines and many countries to the university in Austin for 5 days in December 1964; present were physicists and astrophysicists, relativists and mathematicians, radio and optical astronomers.

At this second symposium much more information on many more quasars was presented, but no clear solutions to the questions posed by these observations emerged. The hypothesis of gravitational collapse, a process of implosion followed by explosion, that was favored at the first