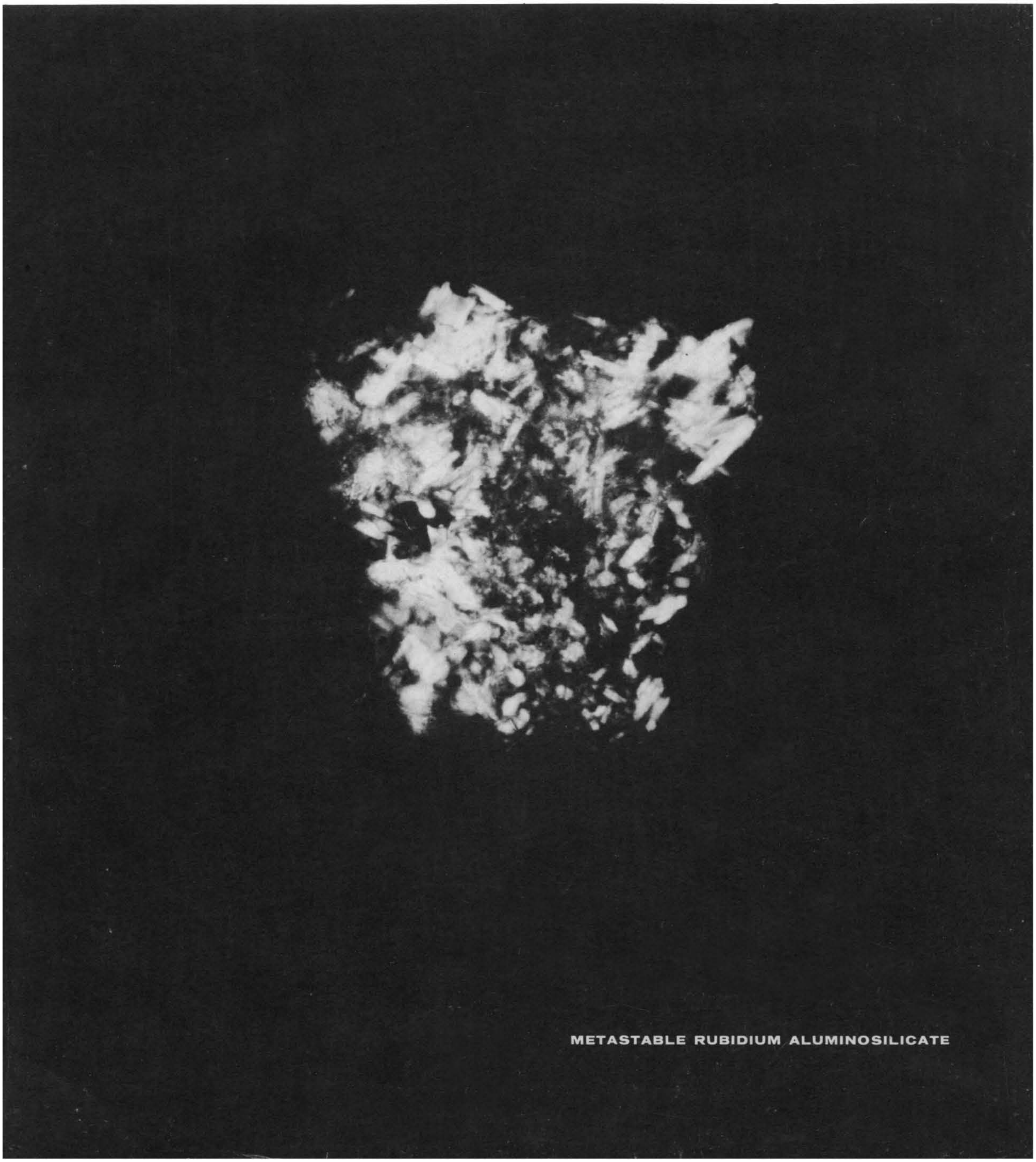
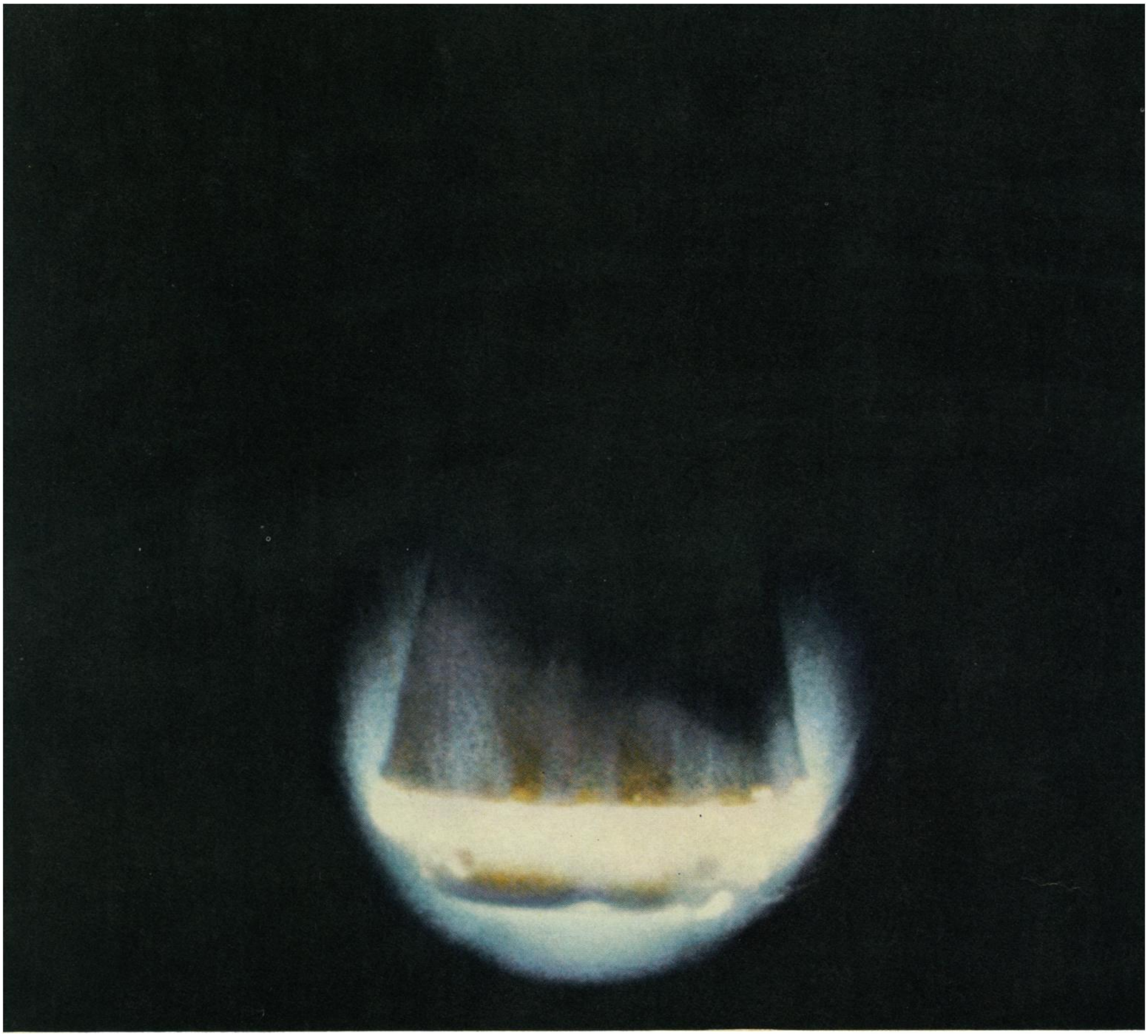
SCIENCE

6 September 1963
Vol. 141, No. 3584

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE



METASTABLE RUBIDIUM ALUMINOSILICATE



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Each Project Fire capsule—weighing 200 pounds—will carry a blunt heat-shield, heat-measuring devices, and telemetry equipment to speed the data to ground stations. Radar and optical tracking will also be used. Data on materials performance, radio signal blackout and surface ablation will be collected the only meaningful way: during an actual re-entry.

We built the two Project Fire capsules and did preliminary testing in our labs. Designs and materials were selected to survive short-duration gas cap temperatures over 20,000°F and velocities above 37,000 feet per second. The capsule above was photographed during ablation tests in our Re-entry Simulation Lab.

Project Fire will pay off twice. First, when the capsule probes the earth. And then again, when a manned vehicle takes the hot ride home.

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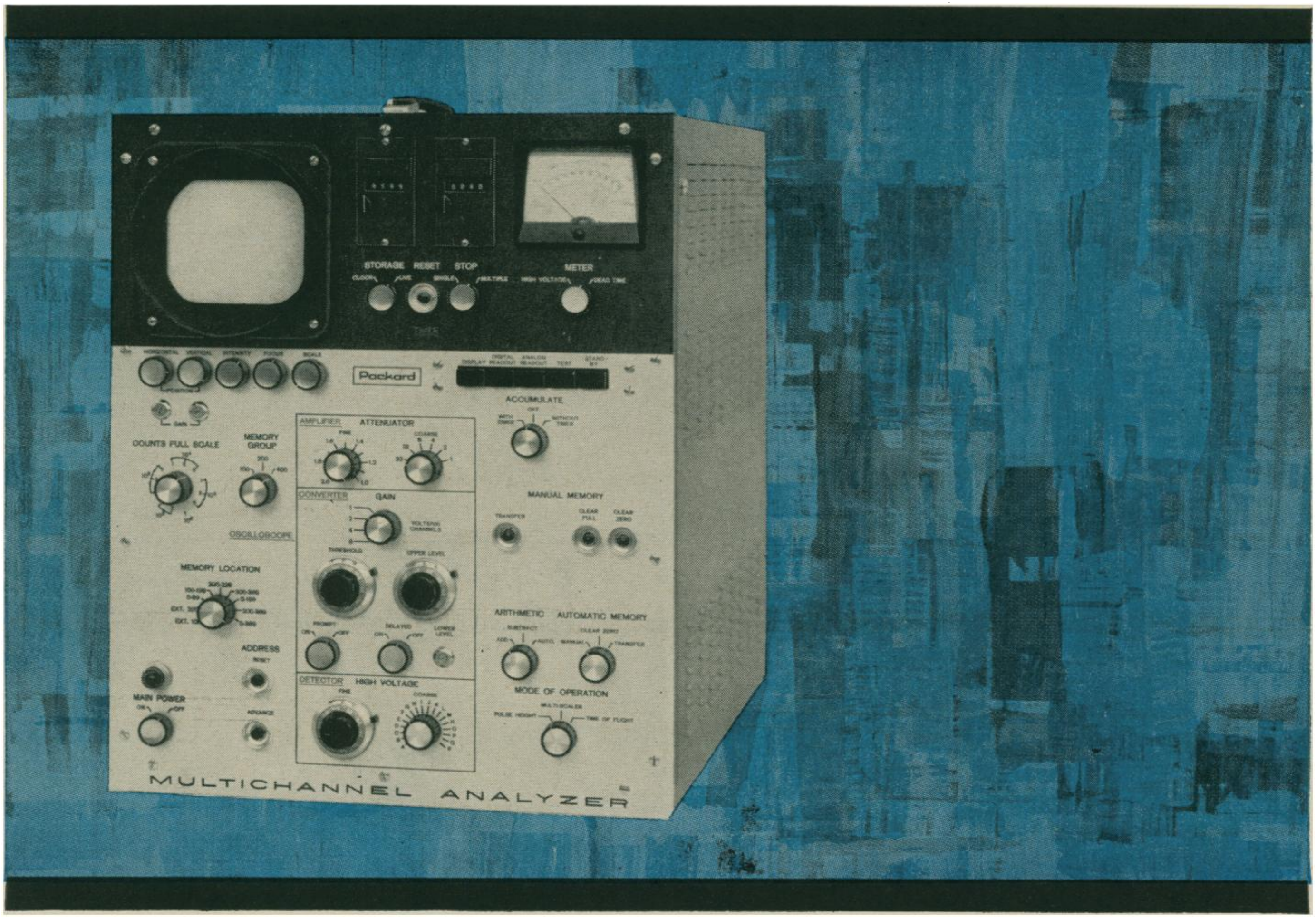

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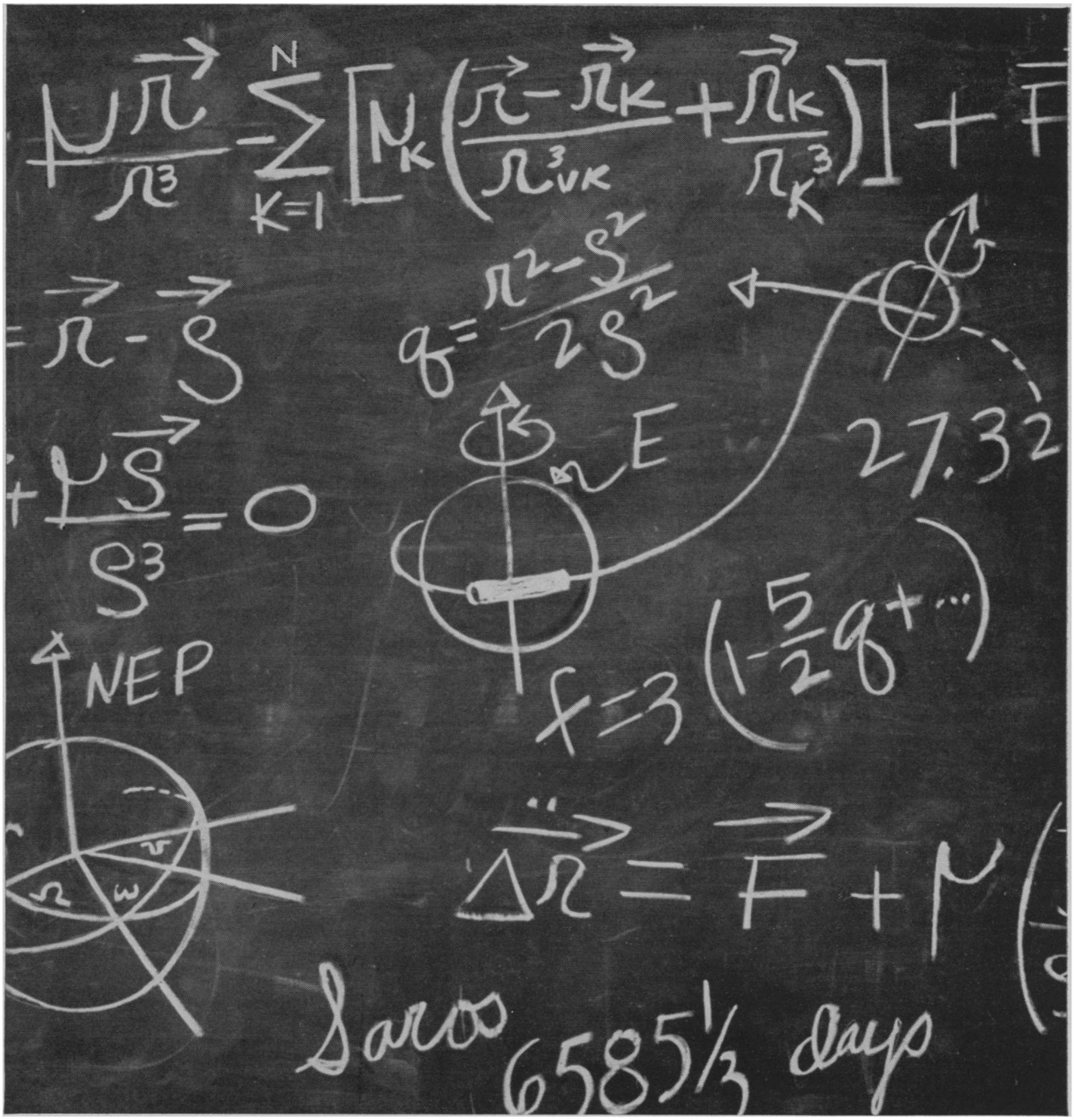
COVER

Crystals of metastable hexagonal rubidium aluminosilicate ($RbAlSi_3O_8$). They were formed from a melt at 1710°C and are well crystallized with moderate birefringence and distinctly lath-like habit. This sample, embedded in uncrystallized glass, was photographed in oil ($n = 1.54$) under a petrographic microscope with crossed nicol prisms (about × 270). See page 917.



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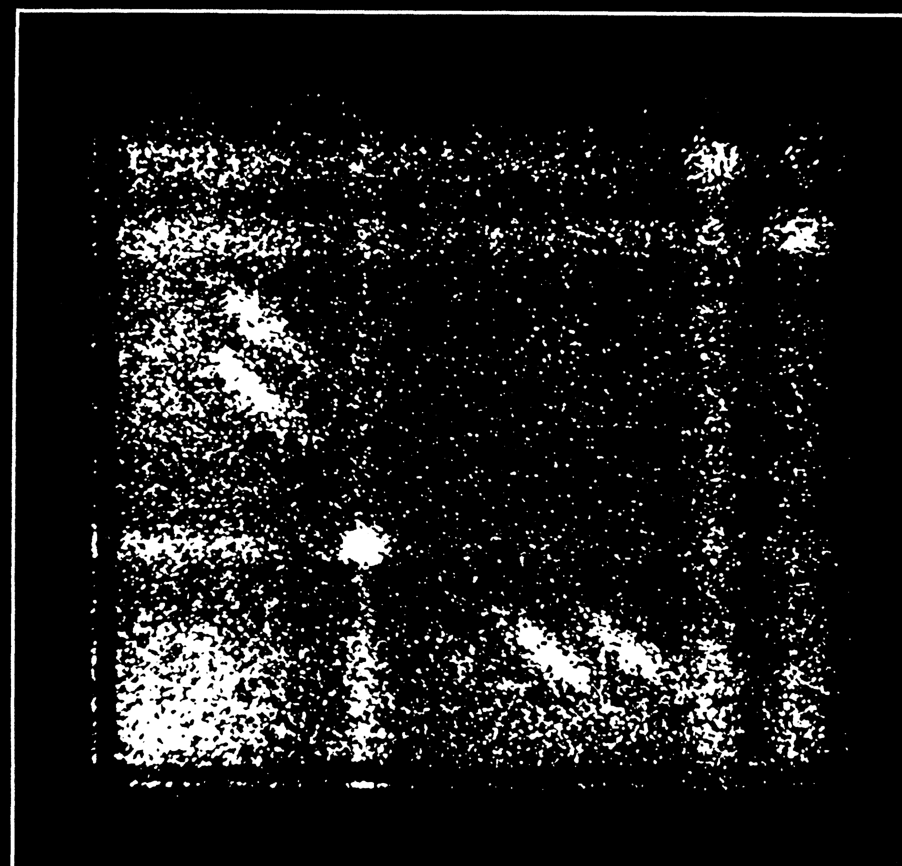
A 1024 x 1024 representation of a compound Na^{22} – Co^{60} spectrum showing one Na^{22} and two Co^{60} photopeaks (lower left and upper right quarters) and miscellaneous Compton and backscatter peaks. The photograph was made by integrating the light flashes from a 5-inch CRT screen with Polaroid film.

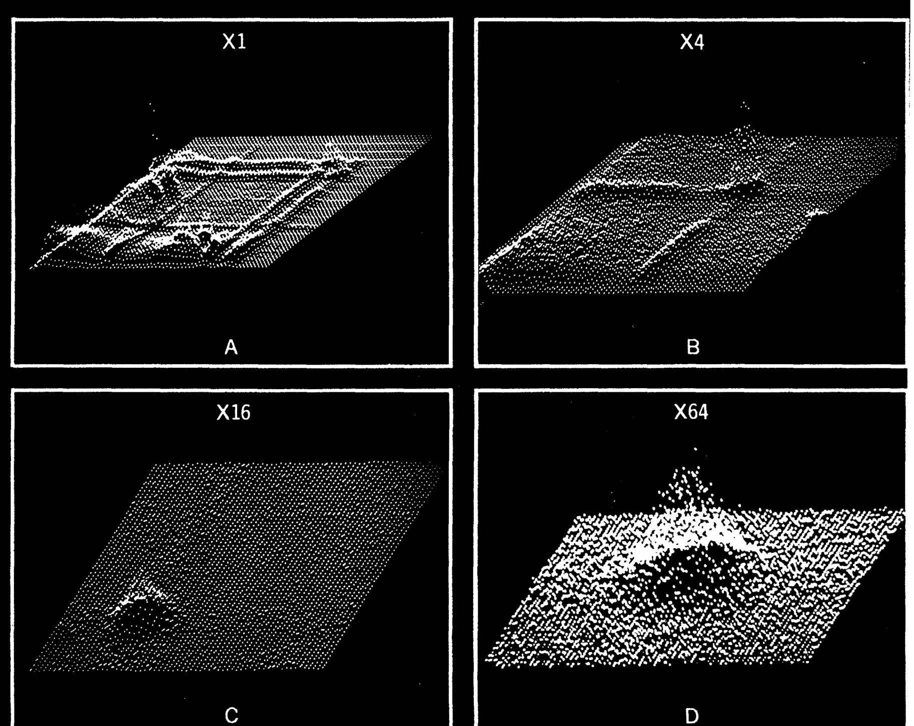


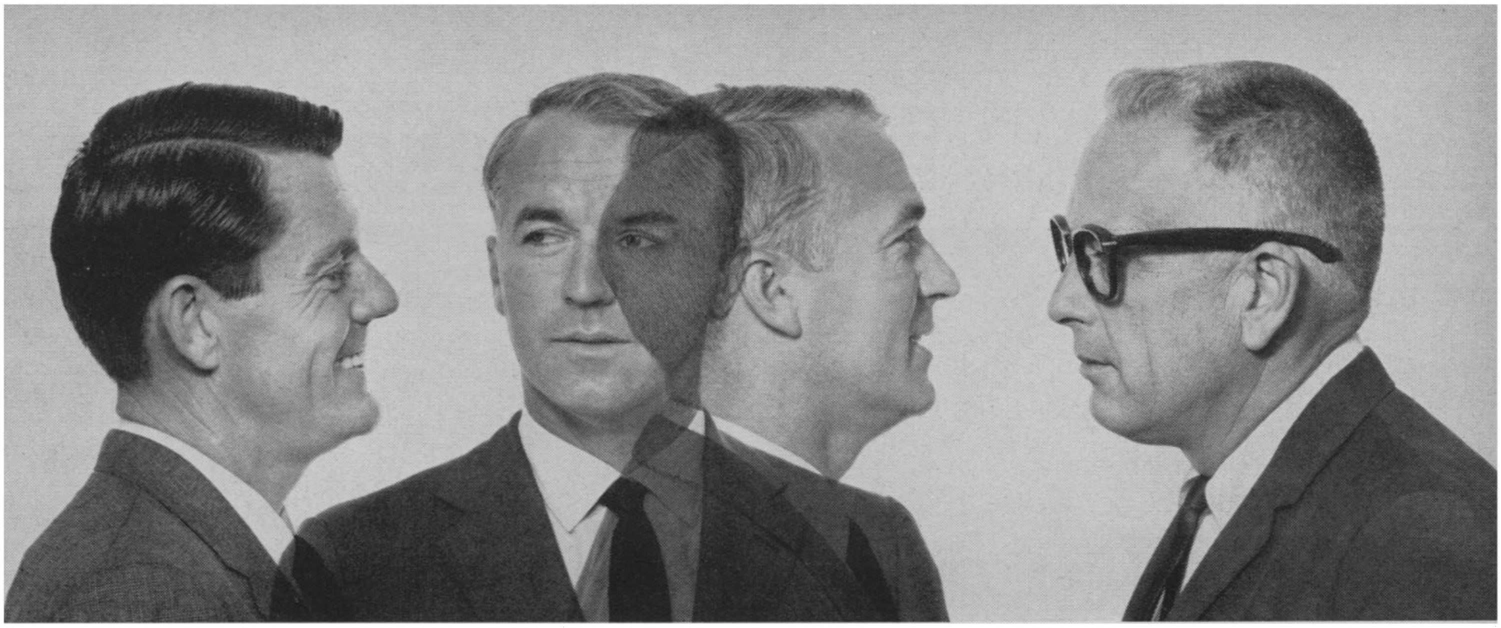
Display Capabilities o

64X magnification of spectrum components . . .

A series of 4 isometric displays of the Na^{22} – Co^{60} spectrum. (A) is a 64 x 64 channel representation of the spectrum. (B) is a display of the lower left quarter of the (A) display with resolution of the Na^{22} peak improved by a factor of 4. (C) is a further increase in resolution of the upper right quarter of photo (B) again by a factor of 4. (D) is the lower left quarter of photo (C) further magnified by a factor of 4.

All photos were made on the TMC 4096-channel system with a Polaroid oscilloscope camera on the RM 503 oscilloscope display. They are just a sample of the extreme versatility of TMC multi-parameter, mega-channel systems.





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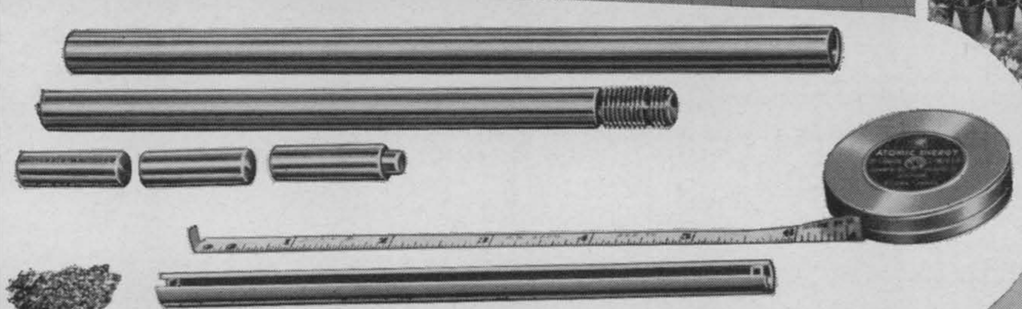

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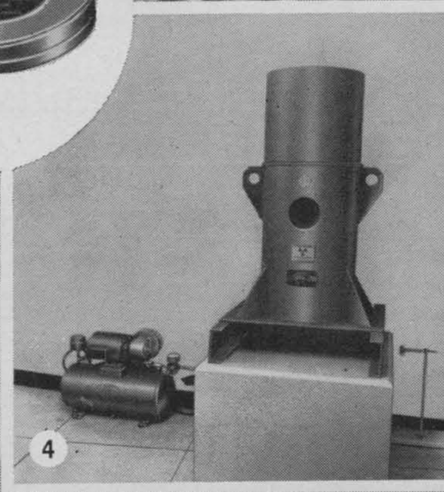
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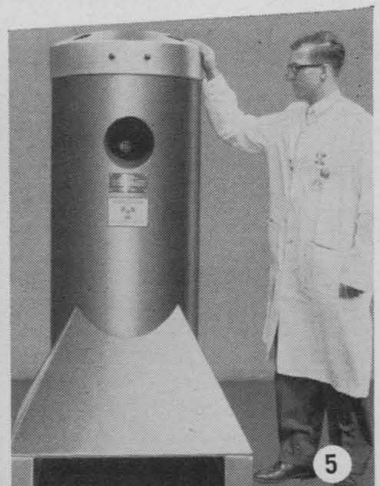
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6 September 1963, Volume 141, Number 3584

SCIENCE

Congressional Frustration

There is a growing feeling among congressmen that major procedural and organizational changes are necessary to restore Congress to a position of power comparable to that of the executive and judicial branches. Part of this unrest comes from congressional difficulties in understanding and dealing with research and development. Two weeks ago *Science* reported a Rules Committee proposal to appoint a select committee to investigate federal research, a proposal that is likely to be interpreted as an attack on research support and management. This interpretation may accurately represent the attitudes of some supporters of the proposed investigation, but it is not the whole story. Several of the sponsors have long supported governmental scientific and educational activities; and the strongest opposition has come not from the friends of research and development but from the chairmen of committees whose power might be reduced by the reorganization that a special committee might propose. In short, the argument is not primarily over whether R & D support has been too generous or R & D funds mishandled, but rather over how Congress should be organized to carry out its responsibilities.

Dissatisfaction is also evident in Senator Bartlett's proposal for a Congressional Office of Science and Technology that would serve Congress as the Office of Science and Technology serves the President and the executive branch. Earlier agitation for a cabinet-level Department of Science, the use by some committees of ad hoc panels of scientific advisers, and the occasional search for a qualified scientist to serve on a committee staff are also evidence of dissatisfaction with the existing organization.

Immediate and sweeping action is altogether unlikely, but as frustration grows, so does the pressure for change. There is some opportunity for the appointment of scientists as members of committee staffs, but it will be difficult to recruit top-quality men; such an appointment is not an accepted part of a scientist's career, whereas a comparable appointment is a commonly accepted part of the career of a lawyer or political scientist. Some weeks ago a *Science* editorial proposed the appointment, perhaps by the National Academy of Sciences, of a rotating panel of devil's advocates who would give Congress independent advice on proposals received from the executive branch and its scientific consultants. Senator Bartlett's bill would establish a permanent group of scientific advisers.

Perhaps gradually, but certainly not immediately, a change will come about, for Congress cannot continue to rely primarily upon the well-informed but rarely impartial advice of the executive agencies just because it is they who have technically qualified staff members and consultants. Senator Bartlett stated the problem in this way: "It is disturbing but true that at the present time Congress does not understand science and it is also true that science does not understand Congress. Communication between the two must be improved. . . . Congress does not appreciate the importance of scientific decisions and as a result they are made, not in the halls of Congress but elsewhere, not by the elected representatives but by unknown administrative officials."

The fact that Congress is growing uneasy about its lack of scientific and technical competence poses two problems for scientists. One is of perhaps special concern to political scientists—to consider organizational changes that will help Congress to acquire a greater competence in dealing with scientific matters. The other and more general problem is for scientists to consider how they can best assist congressmen and their staffs to learn more about science.—D.W.

the use of the quasi-geostrophic equations to circulations which cross the equator was presented by Jules Charney, and Lester Hubert discussed the problems of interpreting circulation patterns from satelite pictures and presented a new method for expressing the field of divergence from these pictures. The principal difficulty is that of determining the height of the photographed clouds.

Meteorological satellite pictures have provided a means of reexamining classical models of cloud distributions associated with the intertropical convergence zone, the easterly wave, and other perturbations. H. M. Johnson presented photographs that confirm what long has been suspected—namely, that the so-called convergence zone in the equatorial trough is in no sense continuously convergent but rather consists of a series of perturbations. Sigmund Fritz showed cloud photographs of other perturbations apparently associated with, or accompanying, hurricane systems, which are attended by separate areas of heavy rain and severe weather.

Still the most perplexing problem of the tropics is the means by which perturbations develop and intensify. Results of theoretical, experimental, and analytical research all point to the singular role of convective scale motions in the initial growth of tropical disturbances. The two areas of major uncertainty are the initial generating source of organized convection and the instability mechanism by which convective scale motions generate synoptic scale disturbances. M. Yanai used case studies and climatology to describe a unique superposition of circulations in the upper troposphere upon those of the lower troposphere. This superposition generates convection and gradually creates a column of warm air, of synoptic scale, suitable for the development of tropical cyclones. M. Alaka discussed the role of anomalous winds and of dynamic instabilities in triggering the development of hurricanes. The source of these winds remains obscure.

In a theoretical study, G. Arnason demonstrated that a disturbance of convective scale, developing in a slightly baroclinic field, would grow to synoptic-scale proportions if account were taken of the β effect. Other important progress has been made in the development of mathematical-physical models of the intensification of disturbances. J. Spar, in surveying previous efforts, pointed out that investigators had had difficulty in modeling the release of latent heat. In recent months this problem has been attacked with greater success by Kasahara, Ooyama, Kuo, Estoque, and Rosenthal. Kasahara considered latent heat as a space variable, constant in time, while Ooyama considered large-scale circulation as a quasi-balanced vortex in two layers, with heating stemming from moisture advected by the lower inflow layer. Kuo's model, which has not yet been tested, starts with the establishment of a water budget, then supplies the necessary flux from the ocean to satisfy this budget. Rosenthal uses large-scale pseudo-adiabatic motion, assuming complete saturation of the volume. All of the models tested have shown good similarity to the hurricane circulation; the main difficulty is the rate of development. Kasahara's model required 10 days to generate winds of hurricane force, while Rosenthal's took only a few hours.

In a survey of recent progress on problems of tropical convection, Joanne Malkus emphasized the role of penetrative convection in the tropics and the need for identifying the physical mechanisms that generate and sustain these tall towers. She also presented the results of preliminary studies of diurnal variations in cloud patterns on the island of Barbados and noted that progress in understanding tropical convection had reached the point where scientific experiments in modifying weather in the tropics are now in the planning stage or in progress.

Patrick Squires discussed a "double plume" model for penetrative convection, consistent with observations, and Boyd Quate described a model for the generation of convection, the intensity of which depends upon the depth of dry air in the upper troposphere. In other studies of convection, two interesting reports on laboratory fluid models were presented. Douglas Lilly showed pictures of a convectively driven, tornado-like vortex in which vertical circulations were well identified; and Willem Malkus presented a quantitative theory of penetrative convection with constant vertical heat flux; this makes it possible to predict thermal structure and degree of penetration and provides a basis of comparison for the atmospheric problem.

While most aspects of hurricane structure are well described from observations of research aircraft, Noel LaSeur pointed out the uncertainty

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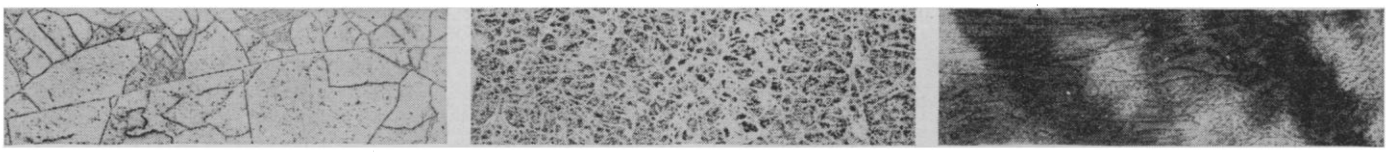
The tritium tells



Courtesy of Aluminum Company of America, which, in a paper in *Nucleonics* this April that describes this technique for precipitating tritium to delineate defect structures in solids, says, "Eastman Kodak Company 1 x 3 in. Autoradiographic No-Screen nuclear plates are employed exclusively," which is a kind and probably useful remark to make publicly. It certainly justifies our offering free reprints of their paper on request to Eastman Kodak Company, Special Sensitized Products Division, Rochester 4, N. Y.

Zone-refined aluminum (×6.5). Only the continuous diagonal grain boundary was visible until tritium precipitated where vacancies have condensed . . .

. . . whereas after severe strain and annealing, vacancies migrate out of the cell boundaries and no longer collect tritium . . .

. . . but the tritium sure shows the dislocations piled up at slip bands of an aluminum tensile specimen.

Opium and europium

The core of the following message is simply that Distillation Products Industries, Rochester 3, N. Y. (Division of Eastman Kodak Company) stands ready, willing, able, and anxious to supply professionally prepared persons with any of a vast array of compounds, as detailed in "Eastman Organic Chemicals List No. 43," obtainable on request.

Many years ago it was a practice, when investigating the possibility that a victim had been drugged, to test the contents of suspicious vials with Marme's Reagent. This threw down a yellowish-white precipitate with salts of alkaloids.

Papaver somniferum, the opium poppy

Opium was known to be rich in alkaloids. They were defined as organic substances of alkaline nature. As time went on, fences were erected against this sweeping generality. Not mere alkalinity *per se* but precipitation by certain inorganic "alkaloidal reagents" was required to qualify as an alkaloid. (Concepts can shrink by swallowing their tails.) One such was apparently devised by somebody named Marme from KI and CdI_2. We doubt he knew why a precipitate formed by this concoction correlates with the dream world. (Neither do we, but we have to appear more knowledgeable.)

When a request for Marme's Reagent was received recently, we consulted an old chemical dictionary to find out what it was. Then we put a 1963 orientation on the matter.

In 1963 chemists can't afford to make their own reagents unless they happen to be in the reagents business, which we are. So we made Marme's Reagent, but we don't think of it that way. We offer it as a dry compound named *Potassium Iodocadmate* (EASTMAN 8814). We think of it not as $CdI_2 \cdot 2KI$ but as $K_2^{+}[CdI_4]^{=}$. We see that cadmium ion with its four hybridized orbitals (from the 5s and the three 5p orbitals) coordinating to the four iodides, and we see that $[CdI_4]^{=}$ ion forming its precipitate in response to the electron-hunger of the heterocyclic nitrogen that gives the "alkaloids" their alkalinity. We look around a little and note that while Marme's name is little heard any more his ion is still talked about for identifying amines, imines, and heterocyclic N's in general, judging from an excellent review of chelatometric quantitative organic analysis in *Chimie Analytique*, *43*, 449 (1961). We also note that EASTMAN Organic Chemical No. 8814 is not very organic, but it does not upset us.

The coordinate-bond chemistry arising in those hybridized orbitals is now leaping the walls of its old temple, the analytical laboratory. Suddenly there is a lot more to be said about fluorescent chelates than that they are useful for the determination of something or other. Let us merely record that

1) it has not escaped the notice of the Kodak Research Laboratories (which are strongly optically oriented) that the rare earth ions in general and Eu^{+3} in particular exhibit very sharp fluorescence lines because the 4f subshell involved is well shielded by the 5s and 5p subshells

2) this fluorescence leaves the ion in a state from which it drops so quickly to ground state that the jump-terminating level remains thinly populated

3) here is the kind of setup wherein the stimulated emission of laser action can compete successfully against the spontaneous transitions of fluorescence and absorption

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5) chelating the rare earth ions shields them from influences that might prematurely discharge the inversion

6) the ligand of the chelate absorbs over a broad u-v band and passes the energy along from its own metastable triplet states to excite the 4f levels of the rare earth ion

7) *Tris(1-phenyl-1,3-butanediono)europium* is now EASTMAN 8989, *Tris[4,4,4-trifluoro-1-(2-thienyl)-1,3-butanediono]europium* is EASTMAN 8990, and *Tris(1-phenyl-1,3-butanediono)cerium* is EASTMAN 8629

and 8) anybody finding himself in a state of personal excitation over any ligand-lanthanide combination (except Pm) has but to name it and he may find we have a little on hand.

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which remains about fluxes of heat and momentum in the boundary layer, the role of convective-scale motions, and the role of internal and surface friction in the more intense core of the hurricane.

The role of the satellite in the study of some illusive aspects of structure was considered by Robert Fett, who identified a pronounced ring of apparently subsiding air near the "rim" of outflow cloudiness and discussed a hypothesis concerning the generation of pre-hurricane squall lines, an anticyclonic wind maximum near the outer edge of cirrus cloudiness, and the development of secondary vortexes in the upper troposphere. Cecil Gentry reported on an investigation of the release of kinetic energy in spiral rainbands. In this study he used wind data from aircraft observations and found that the rainbands generate kinetic energy at the rate of 10^{14} kilojoules per day. This result is consistent with computations of other investigators for the entire storm.

A new hypothesis of hurricane-rainband generation was presented by David Atlas. It is proposed that the band is formed initially by the evaporation of precipitation advected downstream from a prominent cumulonimbus. No initial convergence mechanism is required for this generation. Several difficulties with the hypothesis were brought out during the discussion: rainbands seem to propagate upstream as well as downstream; moreover, it is not obvious why the precipitation should be advected from the tops of large cumuli while the cumuli themselves lag behind in a system where tangential wind speeds decrease with height.

Several interesting papers were presented on the air-sea-earth interaction in hurricanes. Banner Miller gave results of computations, based on data from hurricane Donna, which show that the decay which follows the movement inland is due to removal of the oceanic heat source rather than to increase in surface friction. Robert Stevenson showed the remarkable influence exerted by hurricane Carla on the upper waters of the Gulf of Mexico.

James Black discussed the design of a weather-modification experiment in which asphalt coatings would be used to create an artificial "thermal mountain" (as described by J. Malkus) to augment precipitation from tropical clouds. A succession of preliminary experimental and theoretical investigations will be conducted to determine the feasibility of using such coatings and the required scale of the cover.

In discussing weather-modification efforts aimed at reducing the wind hazard from hurricanes, Robert Simpson described the design of an experiment for cloud seeding in hurricanes and the results of the first such seeding in hurricane Esther (1961). The principal result was a change in radar reflectivity downstream from the seeded area. This and other evidence was considered sufficiently interesting to warrant continuance of the project, known as "Stormfury," for several years.

In another discussion of weather modification, Ed Kessler, drawing upon knowledge of microphysical factors in convective systems, suggested that a convective system tends to compensate so rapidly for local changes which are induced artificially that little overall change in precipitation from the system might be expected, and that, therefore, the best means of influencing the effectiveness of a convective system is to alter the timing or distribution of the precipitation.

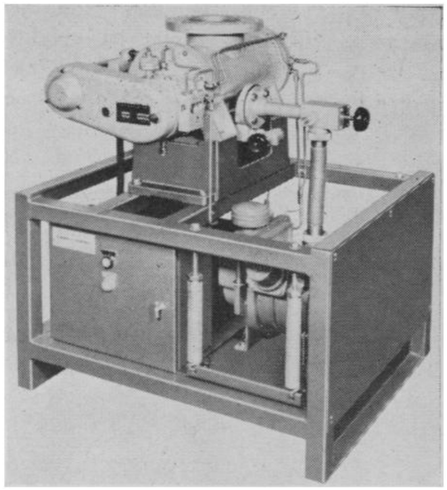
In surveying progress in hurricane forecasting, Gordon Dunn pointed out that the areas of least progress were those of forecasting the genesis and dissipation of hurricanes. A number of very useful objective methods have been developed for predicting their movement and for estimating storm surge. However, the greatest problem in prediction is that of accurate analysis. Until more information is available routinely for analysis, this problem is not likely to be eliminated.

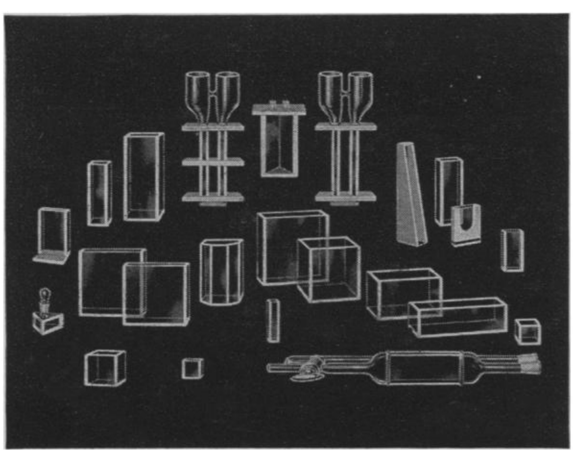
Charles Jordan suggested that, in tracking hurricanes, better results would come from tracking "the whole storm" than from tracking some singularity which is frequently difficult to locate. He proposed that center tracking be abandoned.

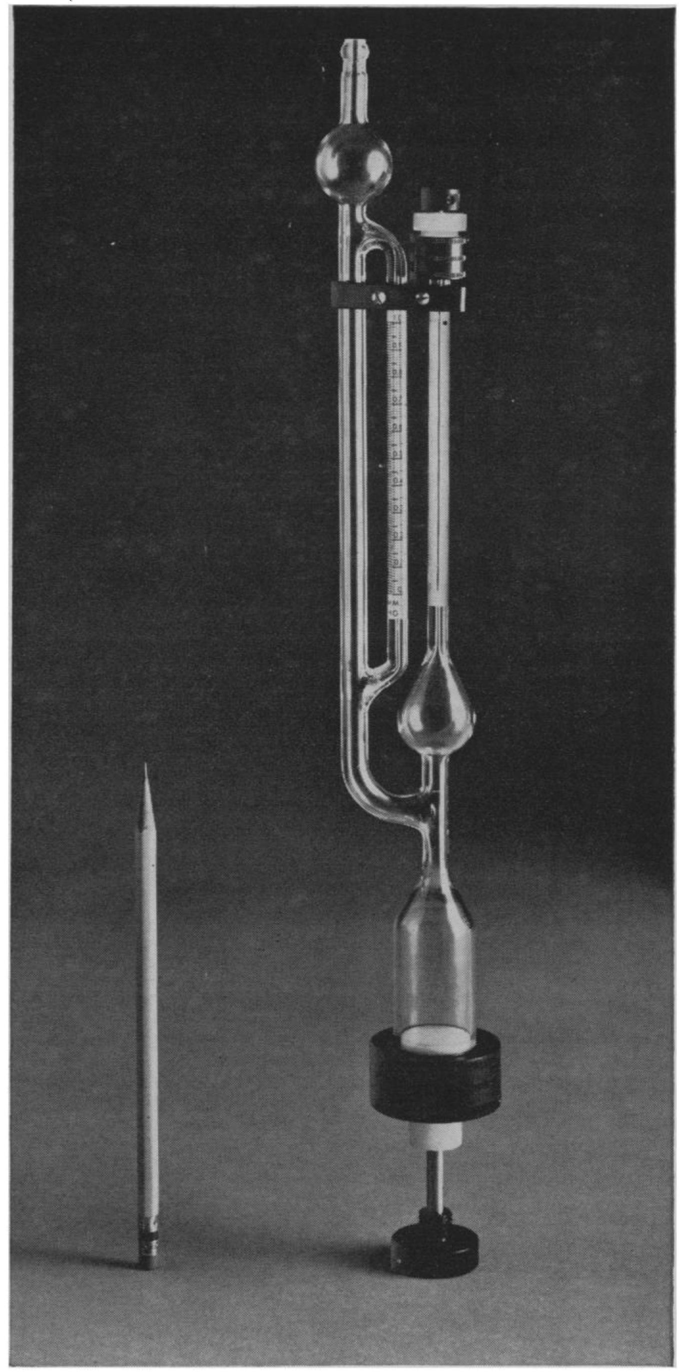
H. Riehl and F. Baer presented a new regression method for predicting cyclogenesis. It is based mainly upon the rate of mass inflow in the lower troposphere; supplemental parameters are associated with circulation patterns in the middle and upper troposphere.

George Morikawa discussed a numerical model for predicting hurricane trajectories, an extension of earlier work on the translation of a geostrophic point vortex.

ROBERT H. SIMPSON
U.S. Weather Bureau,
Washington 25, D.C.







Forthcoming Events

September

10–12. **Space** Rendezvous, Rescue, and Recovery, symp., Edwards Air Force Base, Calif. (K. Irwin, AFFTC (FTFE), Edwards Air Force Base)

11–13. American **Fisheries** Soc., Minneapolis, Minn. (AFS, 1404 New York Ave., NW, Washington 5)

11–13. Administration of **Research**, 17th natl. conf., Estes Park, Colo. (S. A. Johnson, Jr., Denver Research Inst., Univ. of Denver, Denver, Colo.)

11–17. Pacific **Dermatologic** Assoc., Honolulu, Hawaii. (G. MacDonald, 4294 Orange St., Riverside, Calif.)

12–13. **Engineering Management**, 11th joint conf., Los Angeles, Calif. (Inst. of Electrical and Electronics Engineers, Box A, Lenox Hill Station, New York 21)

12–14. **Chemical** Inst. of Canada, 6th western region conf., Trail, B.C., Canada. (D. A. Craw, Chemical Inst. of Canada, 48 Rideau St., Ottawa, Ont.)

12–14. Institute of **Management Sciences**, New York, N.Y. (H. C. Cauvet, P.O. Box 273. Pleasantville, N.Y.)

12–14. American Soc. of **Photogammetry**, Wellesly Island, N.Y. (J. Starks, Analytical and Photogammetric Sales, Bausch & Lomb Inc., Rochester 2, N.Y.)

15–21. Metabolism and Physiological Significance of **Lipids**, conf., Cambridge, England. (R. M. C. Dawson, Biochemistry Dept., Inst. of Animal Physiology, Babraham, Cambridge)

16–18. Applied **Spectroscopy**, 10th Ottawa symp., Ottawa, Ont., Canada. (J. Kelly, Steel Co. of Canada, Metallurgical and Chemical Laboratory, Wilcox St., Hamilton, Ont.)

16–20. **Electronic Information** Display Systems, 2nd inst., Washington, D.C. (M. F. Wofsey, Center for Technology and Administration, American Univ., 1901 F St., Washington, D.C.)

16–21. **Antarctic Geology**, symp., Cape Town, South Africa. (F. C. Truter, Geological Survey, P.O. Box 401, Pretoria, South Africa)

16–21. **Arid Regions**, Latin American conf., Buenos Aires, Argentina. (A. Sanchez Diaz, Academia de Ciencias Exactas, Las Heras 2545, Buenos Aires)

18. Arctic Branch, Alaska Div., **AAAS**, College. (J. Morrow, Univ. of Alaska, College)

18–19. **Industrial Electronics**, 12th symp., East Lansing, Mich. (T. Collins, Kellogg Center, Michigan State Univ., East Lansing)

18–25. **Information Retrieval** Cooperation among Examining Patent Offices, intern. committee meeting, Vienna, Austria. (H. Pfeffer, Office of Research and Development, U.S. Patent Office, Washington 25)

19–20. **Logistics** Symp., Washington, D.C. (A. Blumstein, Inst. for Defense Analyses, 1666 Connecticut Ave., NW, Washington, D.C.)

19–21. **Biochemistry**, joint French-Swiss-German meeting, Strasbourg, Austria. (Société de Chimie Biologique, 4 avenue de l'Observatoire, Paris 6^e, France)

20–22. **Gynecologists and Obstetricians**, 5th intern. congr., Hamburg, Germany. (W. Schultz, Bulowstr. 9, Hamburg)