

IONIC PROPULSION

Title: PRIVATE VORARBEIT ZUR WELTRAUMFAHRT
(PRIVATE PREPARATORY WORK TOWARDS ASTRONAUTICS)

Author: Hermann Oberth

Source: "Probleme der Astronautischen Grundlagenforschung"
(Proceedings of the Third International Astronautic Congress,
Stuttgart, September 1952) p. 11-19

DAC ABSTRACT

Within a scope of a somewhat polemic article on what should be done to solve some of the fundamental problems of astronautics and what can presently be done by private enterprise, outside the scope of secretive military and governmental laboratories, Oberth maps out, among various other suggestions, several power plant projects, viz:

- (a) He implies that much can yet be done to improve chemical rockets (notably solid fuel rockets) and promises to elaborate in a future publication.
- (b) The search for the best energy source of an electric propulsion system should be pushed forward by theoretical investigations concerning the relative merits of a solar thermo-battery and a solar radiation steam turbo driving a generator or an electro-static machine.
- (c) Particular emphasis should be placed on laboratory studies of "impulse electrodes". He shows two diagrammatical sketches of how he envisages ion guns: one comprises a molecular pump evacuating a long pipe closed at the other end by a high voltage electrode. It looks as though the ions are to be impelled through the pump. Neither picture nor text reveals how new gas is to be admitted or how accumulated charges are to be dissipated. The second picture is still more rudimentary; it purports to show a laboratory set-up with an ion gun tube closed by a membrane.

DAC COMMENT

When Oberth read the paper before the Congress (which I attended) he had the audience chuckling many times by his sarcastic remarks and caustic criticism of his contemporaries who had just heaped honors upon him. He had the same audience baffled by his mystifying allusions to ion gun experiments which he intimated have already yielded gratifying results about which he did or would not elaborate, claiming to be under an obligation of secrecy by his then employer (the Italian Navy).

A HYPOTHESIS ABOUT GRAVITATION (untitled)

Author: Douglas Shearer (MGM)
December 19, 1952

ABSTRACT

The author, who has been head of the sound department of Metro-Goldwyn-Mayer studios for many years, has attempted to formulate a theory of gravity which he believes should be amenable to proof by experiment. It was conceived 20 to 30 years ago. The author has discussed it with several famous physicists, among them Prof. Joseph Kaplan, Dr. Ernest Lawrence, and Dr. Vannevar Bush. He has written up his views in a 51 page letter (with 19 pages of Appendices) addressed to Dr. David Hall, Los Alamos, dated December 19, 1952. A copy of this letter was turned over to me on December 30, 1954 at a meeting arranged upon the suggestion of Cmdr. G. Hoover of ONR who had drawn my attention to Mr. Shearer's studies at the occasion of my visit to the ONR office in November 1954. On or about October 27, 1954 Mr. Shearer had delivered a lecture on the subject of his theory before the ONR in Washington. This lecture was reviewed in #120 of the "Originator" (a news leaflet of the ONR) as follows:

"Mr. Douglas Shearer of Metro-Goldwyn-Mayer made a presentation of a general field hypothesis last Friday to the Office of Naval Research. Mr. Shearer, Director of Technical Research for MGM, began speculations in 1915 which resulted in the development of a unique qualitative hypothesis concerning the nature of the universe. In his presentation Mr. Shearer developed a model of the universe correlating gravity, magnetism, electricity, and radiation.

"The conventional viewpoint is that the universe is an empty space full of particles which we are in the habit of calling matter. Mr. Shearer's hypothesis calls for the reverse of this concept in that space becomes full of a medium which is not apparent until it is set in motion, and the motions in the medium then produce vortices which become apparent and correspond to what the conventional theorists consider to be matter particles. The particles which constitute matter as now known, are represented by holes in this medium, which is of ultimate simplicity and possesses only the quality of inertia. This medium differs from former theories of ether which filled space, since in these earlier theories ether usually existed separate from matter. The proposed inertia-space-medium is the actual means of forming whirlpools. To a casual observer the whirlpool is usually identified as a hole, whereas the real whirlpool is actually the water rotating around the hole.

"By less dependence on mathematics, Mr. Shearer's hypothesis aims at an understanding of nuclear and cosmic behavior by a larger group of people than could comprehend and utilize the present highly mathematical theories. It also aims at stimulating experimentation not spontaneously suggested by the present theories.

"The Office of Naval Research learned of Mr. Shearer's hypothesis, which departs from conventional concepts of the universe currently held by physicists and mathematicians, and without endorsing his ideas, invited him to make his presentation to the ONR staff."

COMMENT

A careful perusal of the "letter" report by members of the Douglas Aircraft Company Engineering staff has led to the following critique"

1. The report is written in a popular and entertaining vein, in a pleasantly flowery language, easy to follow. It steers clear of mathematics and attempts to convey an idea of the mechanism of the universe which purports to eliminate the mystery of action at a distance.
2. However, the hypothesis as expounded contains new mysteries in the form of the properties of the fictitious space substance which defies detection. The hypothesis departs radically from approaches proposed by most scientists who are endeavoring to develop a field theory embracing electromagnetism as well as gravity within a common framework.
3. Mr. Shearer's notion of gravity being a manifestation of a centrifugal action due to a space rotation which floats the holes or vortices (representing the apparently heavier but really lighter particles) towards the center is vulnerable to the argument that centrifugal forces lie in a plane normal to the axis of rotation while the gravitational field has a spherical geometry. The two phenomena do not, therefore, lend themselves to mutual substitution. The notion of tumbling axes which Shearer introduces somewhat vaguely does not help to overcome this obstacle.
4. Mr. Shearer's theory of the behavior of the vortices in the all pervading inertia fluid (which he calls "inertium") is not derived from or compared with the laws of hydrodynamics which should apply with appropriate assumptions for the physical properties of the fluid, be they ever so mystical.
5. Much of the edifice of physics of electrons and atoms ("bathed by radiation containing some frequency resonant with the orbital rates of the electrons . . . The inertia gradients of this incident radiation could rationally exert tipping forces on the axes of the electrons and thus restore or rejuvenate their progression around the orbit. Since each electron should tumble to its initial axial position for each complete turn around the orbit, then each half wave length of any passing resonant radiation should remain in appropriate phase to continue imparting energy to the electron axis tumble and produce forces tending to accelerate the electron around the orbit . . .") is a diffused word picture which the author finds appealing, but which is in no clear correspondence to the contemporary state of knowledge of theoretical physics.

6. Mr. Shearer concludes that under certain conditions, space as envisaged by him should become opaque to radiation. He sets out to demonstrate this by ad hoc experiments hoping thereby to prove the validity of his underlying theory:
 - (a) The author relates that around 1940 he was prompted by his theory to suggest to Dr. J. Kaplan to switch to higher gas pressures in his investigations of afterglow spectra of excited pure gas molecules. While Dr. Kaplan (interviewed by phone) recalls that the intuitive suggestion proved fruitful, he can see no bearing at all of this outcome on the validity of Mr. Shearer's conjectures about the nature of the cosmos.
 - (b) In 1938 Mr. Shearer conducted an experiment in which an electric alternating current of 50 cps at 40,000 V was applied to a row of parallel electrical conductors which were interposed like a grating into a beam of heat rays from a focussing electric heater impinging on a blackened thermometer beyond. When the AC was turned on, the thermometer read lower than when off. Mr. Shearer's explanation of this observation is that "a space storm set up between the wires caused irregular time distortion between them . . . analogous to long cylindrical lenses . . ." It would seem that the heat waves in the air surrounding the wires would act just like that and thus diffuse the previously focussed heat beam, without yielding any clue regarding his theory. A simple check test with DC or with non-electric heaters could have been performed to decide the issue.
 - (c) In 1941 Mr. Shearer observed clicks in a conventional aircraft weather station radio receiver tuned to 400 KC when a 30 caliber rifle was fired 10 feet away from the far end of a 300 ft antenna. During May 1952 the experiments were repeated with more elaborate instrumentation and extended over a wide frequency band. Recordings were taken which show reception of a signal. Just what the observations can prove is not quite clear: It is conceivable that the phenomenon can be explained by conventional assumptions involving shock waves.
 - (d) In April and May 1952, Mr. Shearer obtained recordings on receivers tuned between 16 KC and 15 MC of radio signals interpreted as emanating from atomic bomb tests conducted in Nevada several hundred miles away; they were time-correlated by reference to the WWV time signal. Again it is not clear what such signal reception proves.

- (e) Mr. Shearer proposes a crucial experiment intended to reveal a "red-shift" in a microwave radiation transmitting circuit in the form of an octagon, 100 miles in diameter, with relay stations midway on each side and prismatic refractors at each corner. ("Space curvature is lumped as a function of the effect of the prismatic refractors".) Again just how the result of expected observation of "a change of the initial pulse frequency after a sufficient number of loop transits which will require an increase of the index of the prismatic refractors" can be interpreted in support of the basic hypothesis is not made clear.
7. Mr. Shearer's discourse does not contain any proposal of controlling gravity or of eliciting forces to counteract it. However in conversation with me on December 30, 1954, he emphasized that any progress in the understanding of the nature of gravity should bring us nearer to deciding what means of controlling it might or might not come within our power. -- To this I agreed.

W. B. Klemperer
January 4, 1954

Title: DIE BEWEGUNGSENERGIE DER KORPUSKEL DES WELTRAUMES ALS
EINHETTLICHE GRUNDLAGE ALLER STRAHLUNGS - UND KRAFTFELDENENERGIEN
(THE KINETIC ENERGY OF COSMIC CORPUSCLES AS A UNITARY BASIS OF
ALL RADIATION AND FORCE FIELD ENERGIES)

Author: Hans Schier, edited by Benno Fiala-Fernbrugg (Vienna)

Source: Manuscript (in German)

INTRODUCTION

This document is one of a few extant carbon copies of a ponderous type-written manuscript of a cosmic theory purporting to explain gravity along with radiation. This opus was prepared by Benno Fiala (von) Fernbrugg (a World War I aviator in the Austrian Air Force and later engineer of the Junkers Works in Dessau, Germany and friend of the late Professor Hugo Junkers. Fiala resides in Vienna; he gave me this copy at the occasion of my visit there in 1950, requesting that I bring it to the attention of appropriate American authorities. The manuscript is written in German in a vein and style for which Fiala appears to be the responsible author. The fundamental theories, hypotheses and calculations which are expounded in this treatise are stated to have been conceived and developed by Hans Schier, who taught physics in Prague during the thirties and lives in Vienna as a refugee from Czechoslovakia.

His scheme is based on and referenced to older (nearly forgotten) "classical" theories such as those advanced by Le Sage (1782), W. Thomson-Kelvin (1873), Preston (1877) and Maxwell (1879), but allegedly independently developed, during the years 1925-1933 and amplified since then.

DAC ABSTRACT

The fundamental principle of Schier's mechanistic cosmos is the postulation of an all-pervading cosmic gas consisting of sub-nucleonic particles (which he calls "Ergons"). They behave like the molecules of a real gas according to the kinetic gas theory, only that the ergons fly at the universal velocity of light, in random straight free paths of enormous length *) with rare collisions; they are extremely small and have a "bimaterial" nature to which are attributed both inertial and electro-magnetic properties. They are also envisaged as the last building stones of matter, its protons, electrons, neutrons etc. The ergon is pictured as having a shape, viz., a subnucleonic sphere of "protene" to which is tied a "streamlined shell of electrene", carrying the positive and negative charge principle respectively. Gravitation is explained as the impact of the hail of external ergons, while those coming in the direction from a gravity endowed astral body are shielded or slowed down by such a body (as the Sun and the Earth). Some rather fanciful assumptions have to be introduced to explain the inverse square of the distance law.

*) Average 2 light years!

Among the peculiar consequences of their theory, Fiala and Schier postulate the existence of an electro-voltaic gradient with depth in the bodies of water on the Earth notably in the oceans and they seriously propose to exploit this as a vast source of electric power. A crucial experiment should be easy enough to perform but this has been delayed because the inventors are land-locked in Austria and have not been able to interest any hydrographic or oceanographic station in the proposition (among the Western powers; they do not wish to attract the attention of agencies of the Eastern powers).

NOTE: I have brought this question to the attention of the Scripps Oceanographic Institute in LaJolla, Calif., and of the Carnegie Institute, but received no response. I have submitted the entire Fiala-Schier manuscript to Professor Paul S. Epstein of CalTech who on Jan. 6, 1951 after cursory study of it rendered the opinion that "apparently the authors are not specialists in physics and that they had obtained much of their information on atomics and radiation physics from popular second-hand sources quoted, many of them obsolete, some inaccurate, some misunderstood; and that many of the alleged discrepancies of accepted theories which the authors propose to resolve exist only in their imagination".

However it is interesting to note that theories linking gravitation with subnuclear particles flying along enormous free paths at enormous velocities have been repeatedly advanced by a good many people of various degrees of knowledge of contemporary physics. For instance in 1950 a previously unknown manuscript by Heavside dealing with such a hypothesis was found under dramatic circumstances in England. Recently Gamow has calculated that chargeless neutrinos might penetrate millions of miles of lead and has suggested that if there are neutrinos and anti-neutrinos and they annihilate each other in collision, such a process might result in the emission of gravitational waves. *)

*) Reference "The Neutrino" by Dr. Norman J. Bowman in Rocket News Letter, Vol 2 #5, December 1948, p. 33 (in Collected Technical Reports, published by the Chicago Rocket Society).

Astronautics Literature Review

Serial 031

NUCLEAR PROPULSION

Title: THE THEORY OF ATOMIC ROCKET FUELS

Author: Wayne Proell

Source: Chicago Rocket Society Collected Technical Reports from Vol. 1,
Numbers 1-20 of the Rocket News Letter, 1949, p. 11-19.

AUTHOR'S ABSTRACT

"The theory of operation of a large rocket combustion chamber using a dilute fuel is presented with mathematical calculations for a neutron producing alloy lined chamber and using a dilute fuel comprising .1% uranium 235 dissolved in a solvent such as hydrogen peroxide. Using cross section data in the current literature a chain length of 20,000 fissions per initial neutron is needed to supply the desired amount of energy. Conditions needed for this are discussed. It is concluded that this chain length is impractical, and that a reduction of chain length should be sought for by altering the basic conditions used as assumptions in the discussion, such as the pressure of the burning gas. A change in the character of the dilute fuel from a true solution to a colloidal suspension of the fissionable component is also recommended. It is pointed out that the effects calculated herein are independent of critical mass effects, and should be susceptible to testing on bench scale apparatus as a check on calculations."

EXCERPT

"The following means of applying atomic energy have been suggested:

1. Direct heat exchange from an enriched pile to rocket feed liquid or gases. (Rockets (U.S.R.S.) Winter 1945)
2. Dissociation of hydrogen in an enriched pile to yield monatomic hydrogen gas for rocket fuel. (Moore, Rockets of Feb. 1946 and also Young in J. Am. Rocket Soc. 66-67, p. 35).
3. Injection of small slugs of fissionable material into a conventional rocket chamber; detonation by unspecified means. Thrust from mass of ambient gas. (Gardner, loc. cit.)
4. Use of dilute fuels (solutions of U or Pu in fuel) detonated in combustion chamber by a neutron atmosphere. Thrust from hot gas from diluted component of the fuel. (Proell loc. cit.)

Besides these, a number of suggestions have been made which are obviously impractical, such as detonation of fissionable slugs in the absence of other mass components."

DAC COMMENT

The first two of these are dismissed as impractical by the author, the third is held fairly feasible, the last is examined in greater detail for a subcritical nuclear rocket motor chamber which is lined with a neutron emitting alloy, and covered by a reflector; it is meant to yield 600,000 HP of power. Hydrogen peroxide serves both as a diluent and as a monopropellant.

NOTE: Whether the calculations and assumptions are realistic would have to be checked by another expert in nuclear reaction engineering.

Listing: A-GC 1138

W. B. Klemperer
1-12-55

PHOTONIC PROPULSION.

Title: GAMMA RAY SHIELDS FOR ROCKET SHIPS

Author: Wayne Proell

Source: Chicago Rocket Society Collected Technical Reports from Vol. 1,
Numbers 1-20 of the Rocket News Letter, 1949, p. 20-25

DAC COMMENTS

While the author examines the mechanism of Gamma ray shields necessary for the protection of the crew of a manned rocket ship and does not consider their possible application as a means to beam the radiation rearwards in order to generate thrust, his remarks are of interest in this respect inasmuch as they point out the limitation of known reflector material. All of the substances listed have a critical angle of total reflection counted in minutes of arc, most of them having less than half a degree, only quartz about $1\frac{1}{2}^{\circ}$. Hence curved reflector vanes in a microscopic grating structure would be required to deflect gamma rays to any significant extent. The search for a suitable construction would have to be preceded by an extensive laboratory research program.

1-12-55

W. B. Klemperer