

OBSERVABLES
EVENT DOCUMENTATIONWHEN
WHO
WHAT
WHERE
WHY

1. Date, Time and/or Duration of Event.
2. Observer - Who or What Accomplished Observation
3. What was Observed
 - A. Physical or mechanical object or objects
 - B. Lights, Sounds, Reactions or Other Phenomena
4. Place of Occurrence
 - A. Where Did Event Occur
 - B. Point in Space
 - C. Geophysical Location
5. Physical Description
 - A. Size, Shape, Color, Texture, Doors, Material
 - B. Dynamic Activities - Lights, Sounds, Motions, Velocities
6. Force or Energy Field Effects - Static or Dynamic
 - A. Electromagnetic, Magnetic or Electric
 - B. Accoustical or Mechanical
 - C. Particle Radiation - Radio Activity
 - D. Gravitational
7. Physiological Effects
 - A. Event, Post Event, Residual or Delayed
8. Psychological Effects
 - A. Event, Post Event, Residual or Delayed
9. Plant and/or Animal Reactions
 - A. Event, Post Event, Residual or Delayed
10. Other Coincidental Occurrences
 - A. Pre-event, Event and Post Event
 - B. Local or Wide Spread - i.e., Power Failure, Animal Unrest, etc.
 - C. Atmospheric, Geophysical - i.e., Holes in the Clouds, Earth Tremors, Explosions, Loud Noises, Fallen or Deposited Materials

OBSERVABLES
SENSORS & OBSERVATIONAL
CAPABILITIES

1. HUMAN (Direct)

A. Visual - Direct Observational Sighting

Time of observation

Position in space or location - direction of motion - duration
(relate to standard reference and/or absolute coordinates
with instrumentation aids)

Physical description

Size, shape - apparent changes - erratic or unusual movements
Motions - Rotation, Velocity and position changes or movements
Color - Photon emission - Glowing - Pulsating - Paint or
Material, etc.

B. Hearing - Sounds

With and without auditory aids - Kind, Amplitude, Duration as
compared with characteristics of familiar sounds or unusual,
new experience.

C. Smell

Associated odors as compared with familiar, usual or unusual
experiences. Relative strength and duration (residual).

D. Taste

A particular sensation of tasting not necessarily associated
with smell - brackish, acid, salty, sweet, etc.

E. Touch (Physical Feelings)

Sensations of warmth, coldness - feel of material surfaces -
texture, structure, vibration, etc. Burns or other physiological
body changes, etc., Immediate or delayed

F. Feelings (Psychological)

Pre-event, Event and Post Event - residual or delayed. Possible
PSI phenomena.

2. HUMAN (Indirect) - Measureable or Analytically Obtained:

A. Material Phenomena - Physical Changes in or on Materials -

Burns, Marks or Scars - Changes in Position, Color, Texture,
Possible Radiation Effects. Pre-Event, Event and Post Event,
Residual, Delayed, Temporary or Permanent Permutations.
Physical Residue.

Sensors & Observational Capabilities (Contd.)

- B. Instrumented Observations & Recorded Data - Optical, Electromagnetic, Acoustical, Mechanical.
3. ANIMAL (Direct & Indirect)
Pre-event, Event and Post Event, Delayed or Residual
Actions or Reactions - Physiological Changes
Laboratory Analysis - Possible PSI Phenomena
4. PLANT (Direct & Indirect)
Physical Changes - Immediate, Residual or Delayed
Bent, Broken, Burnt, Died, etc.
Laboratory Analysis - Possible PSI Phenomena

QUESTIONS

1. How would we decide that the technical information contained in a contactee report is worth considering?
2. If every UFO report were true, it would contain technical information.
 - A. How to group and/or classify the kinds of information so as to be subsequently most useful.
3. What are the principle characteristics of an object that would cause an Air Base to scramble fighters and/or attempt to intercept?
4. In a multiple witness sighting, how do we determine which witness has the most accurate overall description of event?

17 FEB. 1969

To: ~~Approved~~ A 836

From: W.P. Wilson Jr A 833

SUBJECT: FIELD DATA ACQUISITION REQUIREMENTS

~~From~~

COPIES J. M. BROWN, DB HARMON H C BJORNLIE

WWH?

REF. FR

INTRODUCTION

This memorandum ^{discusses} presents the sensor and operational requirements for a mobile field data acquisition system designed to obtain the signature of unidentified flying objects, i.e., UFO's. The rationale applied rationale is an attempt to define potential anomalous targets with their space-time outputs which may produce observable effects. By relating a general description of their possible outputs to the normal background of physical phenomena it is possible to obtain an understanding of sensing requirements.* The first section of this memorandum presents the operational requirements such as set-up time, time on station and fail safe considerations.

* Following the UFO sensing requirements, the ~~needs for~~ requirements for sensing ball lightning and various other meteorological phenomena are developed.

17 JAN 1970

2

VFO Targets

a basic analysis of VFO reportings strongly indicates that their presence and operation may be associated with ~~any one~~ or a combination of several observable physical phenomena.

They may produce steady state and cyclic changing:
Magnetic, electric, electromagnetic (photon) and gravitational fields. They may emit nuclear particles, and generate steady state ~~and~~ or acoustical atmospheric pressure fields and have pronounced residual effects.

The targets may produce weak or strong signals with respect to the ^{ambient} background and may be within range of the sensor for long periods to short time intervals. The short interval would most probably be associated with a close range fly-by. For this reason, it ^{may be} well seen that the shorter ~~the~~ times might produce the strongest signals.

For example, a fly-by at 10,000 ^{very close} feet per sec. could ~~be~~ be within the range of practically all sensors for a period of several seconds. A data system that would not saturate and could record all possible signals ~~would thus~~ for these conditions would provide significant information. Therefore, sensor system capabilities which will respond in the magnitude range of ambient to a high level, to give spectral content (and polarization, where applicable), and to be activated over the full time of event, would be ~~very~~ ^{the} ideal system for these extremes.

ANOMALOUS ATMOSPHERIC PHENOMENA
FIELD DATA ACQUISITION FACILITIES
(FDA)

MOBILE & SEMI-FIXED (PARTIALLY SELF-SUSTAINING)

MOBILE - DESIGN FOR OBJECTIVES

1) FOR TOTAL MOBILITY, UTILITY & RELIABILITY WITH

OPTIMUM QUANTITY & QUALITY OF DATA CAPABILITY

2) A TO OBJECTIVELY & SUBJECTIVELY OBSERVE & OBTAIN OVERALL SIGNATURES OF UFO'S

OR OTHER ANOMALOUS PHENOMENA.

3) B. TO BETTER UNDERSTAND PRESENT OBSERVABLES & DISCOVER AREAS AND/OR MEANS
TO SEND POSSIBLE PRESENTLY UNOBSERVED PHENOMENA,

C.

FIELD DATA ACQUISITION

MDAC-WD's Atmospheric Sciences Branch and Advanced Concepts Joint Portable-Mobile Field Data Acquisition Facilities.

INTRODUCTION

In the furtherance of certain objectives in Advanced Concepts research and to provide critical data for the Atmospheric Sciences Department, it has been observed that much of the information needs (as to atmospheric phenomena and electrical disturbances), are similar.^{1 2} It therefore seems advisable to provide a Portable-Mobile field data acquisition capability jointly useful for these and other efforts.

Through extended discussions between concerned persons, a basic summary and outline for the general scope and depth of observations has been suggested as outlined on pages 2 and 3.

It is hoped that a further study of instrumentation and supplemental requirements will result in recommendations for an adequately outfitted, extremely versatile portable-mobile capability. To this end additional related discussions will be conducted and findings will be reported as a continuation to this document.



W. P. Wilson, A-833
11 November 1968

cc: R. M. Wood; A-830
A. D. Goedeke, A-830
W. W. Hildreth, A-830
J. M. Brown, A-833

¹ Ball Lightning Research Report, January 1968, DAC-60941, K. M. Evenson and A. D. Goedeke.

² Proposal to Investigate Ball Lightning, 23 August 1968, MDAC-WD Space Sciences Department, DAC Letter A-13P1349-68-508Q.

BASIC REQUIREMENTS
FIELD DATA ACQUISITION

(1) MOBILE-READY ACCESS, MANNED

- Earth Sciences
- Atmospheric
- Cosmology

(2) PORTABLE-REMOTELY INSTALLED, SELF-SUSTAINING

AREAS OF OBSERVATION

- Reexamine prior observations,
and make new observations for
possible unreported effects

Anomalous
Phenomena

INSTRUMENT TO OBSERVE & RECORD

Magnetic Gradients

Electric Gradients

Gravity Gradients

Air-Earth Currents

Conductivity

EM Spectrum

X-Ray

UV

Optical

IR

Radio

Particles (Nuclear)

Acoustic Phenomena

Seismic

Subsonic

Sonic

Ultrasonic

- Time

- Location

- Direction

- Density (Magnitude)

- Energy/Frequency

- Polarization

o Events

o Quantitative

o Qualitative

o Time Domain

Basic Requirements - Field Data Acquisition (Contd.)

Meteorological

Air, Temperature, Humidity, Pressure
Wind, Speed and Gradient
Temperature Gradient
Ion Pair Production
Aerosol Number
Weather - (Observe or photograph)
Clouds, Rainfall, Ice, Snow, Etc.

Cosmic & Atmospheric Events
Physical - Solid Objects, etc.

Coherent Radiation

- Location

- Time

- Magnitude

- Far & near field
- Ranging & Locating
- EM & Mechanical
(Light, Radio or Sound)

- Plant, animal & human
reactions or residual effects

Unusual Sensing

Standard Instrumentation -

Manual or Automatic

Observations & Recording

- o Photographic Records
- o Astronomical Observations
- o Radar Ranging
- o Suitable Transducers
- o Multi-channel Radio
- o Graphic Recorders
- o Magnetic Recorders

- o Visual Observations
- o Interrogation
- o Magnetic Recorders
- o Photographic Records

TABLE 1 - SENSING REQUIREMENTS

	Duration Sec	> 10	1	10 ⁻¹	10 ⁻³	10 ⁻⁶
1. MAGNETIC VECTOR - H FIELD, UNITS IN GAMMAS (1 x 10 ⁻⁵ Oersted)						
3 Components	Ambient	50,000 ± 20	50,000 ± 0.1		50,000 ± 0.01/t	
2 Places	Lower Limit	± 10	± 1	± 1	± 100	± 10 ³
	Upper Limit	± 10 ⁸	± 10 ⁸	± 10 ⁸	± 10 ⁸	± 10 ⁵
Sensors - Magnetometer, Absolute and Relative Measurements Readout Analog, Real Time Cesium - Varian Model V-4938 -					Approximate Cost \$10,900.00 ?	
Magnetometer, Gradient Sensing Readout Analog, Real Time (Three) Internally Constructed,					Approximate Cost \$5,000.00	
						750.00
2. ELECTRIC VECTOR - VOLT/METER						
3 Components	Duration-Sec.	> 10	1	10 ⁻¹		10 ⁻⁶
2 Places	Ambient	± 100				
	Lower Limit	± 100	± 1	± 1		± 0.01
	Upper Limit	± 10,000	± 1,000	± 1,000		± 10
Sensors - Electrostatic Voltmeter, Absolute and Relative Measurements Readout Analog, Real Time To Chart Recorder Comstock & Wescott - Model 12008 -						Approximate Cost \$3,100.00
Electrometer, Relative and Gradient Readout Analog - Real Time To Chart Recorder (Three) Internally Constructed						Approximate Cost \$150.00 Each
						450.00

3. ELECTROMAGNETIC - RADIO - WATTS AND/OR VOLTS/METER

	<u>Duration-Sec.</u>	10^{-3}	10^{-6}	10^{-12}	<u>Secs/Cycle</u>
Polarization	Ambient	City Country	10^{-4} 10^{-6}	10^{-6} 10^{-8}	Volts/Meter Volts/Meter
Direction	Signal		10^{-12}	10^{-12}	Watts (1 μ V/50 Ω)

Sensor - Broadband Spectrum Analyzer Absolute Measurements

Power - Amplitude and Spectral Content .01 to 1,250 Mhz

Readout in Real Time, Time Domain and Frequency, Visual Display and Analog or

Digital Data To Chart or Magnetic Tape Recorder

Hewlett Packard Model 8554L R.F. Section with the 8552A I.F. and 140S-Display System

Approximate Cost \$6,000

Approximate Cost 3,500

Radiometers and Auxiliary Radio Equipment

Readout in Real Time, Visual Display, Analog or Digital To Chart or Magnetic Tape Recorder

4. ELECTROMAGNETIC - IR - WATTS AND SPECTRAL CONTENT

	<u>Duration-Sec</u>	10^{-12}	10^{-13}	10^{-14}
Polarization	Ambient			
Direction	Signal			

Limits Vary As To Location, Day-Night & Local Artificial Heat & Light Conditions

Expected Levels To Be Determined

Sensors - Standard Radiometric or Photographic Techniques; Polarity & Color Sensing, Thermal & Photosensitive Devices

Radiometers - Photometers and Spectrometers

→ Suitable Manufacturing Types and Approximate Cost To Be Determined.

→ Will Be Related To Following Two Items (5) and (6)

Readout: Analog, Digital to Chart or Magnetic Tape Recorder

5. ELECTROMAGNETIC (OPTICAL) - POWER LEVELS AND SPECTRAL CONTENT

<u>Duration-Sec.</u>	<u>2.3×10^{-14}</u>	<u>1.4×10^{-14}</u>	<u>Secs/Cycle</u>
Polarization	Ambient	Day-Night Atmospheric & Local Artificial Lighting Conditions	
Direction	Signal	Expected Levels To Be Determined	
Sensors -	Photographs (Movie Camera - Color)		
	Photo-Optical Tracking - Photographic, Still & Motion Picture - Black-White & Color		
	Polarity & Color Sensing, - Related Spectrum Analysis instrumentation & Readout as Under Item (4)		

6. ELECTROMAGNETIC (UV)

<u>Duration-Sec</u>	<u>1.4×10^{-14}</u>	<u>3×10^{-26}</u>	<u>(Soft X-Ray)</u>
Ambient	Day-Night, Atmospheric & Local Artificial Lighting Conditions		
Signal	Expected Levels To Be Determined		

Sensors - Photo-Optical Tracking - Photosensitive Devices & Photographic Materials, Polarity Sensing Related Spectrum Analysis, & Readout Instrumentation as Under Items (4) and (5)

7. ELECTROMAGNETIC (X-RAY)

<u>(1) Soft X-Ray</u>	<u>(2) Hard X-Ray</u>	<u>(3) Gamma Radiation</u>
Duration	May Be Coherent CW, Periodic or Random Radiation @ 3×10^{-16} - 3×10^{-19}	Secs/Cycle
	or Discrete Particles vs. Time	
Ambient	Day-Night Atmospheric & Local Normal Background	
Signal	Any Levels Above Background, Time Averaged, Steady State or Particles vs. Time	
Sensors -	Gamma Sensitive Photographic Materials - Radiation & Particle Counters, Crystal Scintillators To Measure Photon Flux and Energy	
Readout:	Spectral Content - Time Density Averaging, Analog or Digital Data To Chart or Magnetic Tape Recorders.	

8. GRAVITATION -

Duration Secular
Ambient
Signal

9. ATMOSPHERIC PRESSURE

Duration-sec >10 10⁻¹ 10⁻⁴
Ambient
Signal

10 Nuclear Particle.

10. NATURAL AND RESIDUAL SIGNATURES

Odors
Ground Deformation
Response of Trees and Plants, Animals, Humans,
Vehicle Parts

II. SITE CHARACTERISTICS

Location

Terrain

Time of Day

Weather Conditions (Required for UFO and Ball Lightning)

OR

A Report
of
Converse
Radio
Intercom
Wave Radio
Commercial
Radio
Moderate
Thunder
Light to Near
Thermal Radiation
to Visible Light
Light to Near
Near UV to Far UV
Far UV to Soft X-ray
Soft X-ray to Hard X-ray

EM SPECTRUM CLASS
ARBITRARY STANDARD USAGE BY BANDS IN

BAND	WAVELENGTH- λ $3 \times 10^8 / \text{fcps}$	FREQUENCY-fcps $3 \times 10^8 / \lambda$	Cycles/Second
MP	3×10^{11}	1×10^8	10^{-3}
ELF	1×10^8	1×10^5	3
VLF	1×10^5	1×10^4	3×10^3
LF	1×10^4	1×10^3	3×10^4
MF	1×10^3	1×10^2	3×10^5
HF	1×10^2	1×10^1	3×10^6
VHF	1×10^1	1.0 Meter	3×10^7
UHF	1.0 Meter	1×10^{-1}	3×10^8
SHF	1×10^{-1}	1×10^{-2}	3×10^9
EHF	1×10^{-2}	1×10^{-3}	3×10^{10}
MM	1×10^{-3}	1×10^{-5}	3×10^{11}
INFRARED	1×10^{-5}	1×10^{-6}	3×10^{13}
INFRARED	1×10^{-6}	6.8×10^{-7}	3×10^{14}
VISIBLE	6.8×10^{-7}	4.2×10^{-7}	4.4×10^{14}
ULTRAVIOLET	4.2×10^{-7}	7×10^{-7}	7.1×10^{14}
ULTRAVIOLET	1×10^{-7}	1×10^{-8}	3×10^{15}
X-RAY	1×10^{-8}	1×10^{-9}	3×10^{16}
PARTICLE & COSMIC RAY			3×10^{17}

TABLE 3
LIGHTNING

Prior to Event

$E, \frac{dE}{dt}$ vs. time

Event

$E_{\max.}, H_{\max.}, \text{etc.}$

TABLE 4
OTHER METEOROLOGICAL REQUIREMENTS

DISCREET

1. IS THERE POSSIBLY A ^{FIXED} RATIO OF ORGANIZED TO DISORGANIZED MATTER IN THE COSMIC BACKGROUND EXISTS?

2. IF ORGANIZATION MUST EXIST IN A HOMOGENEOUS ENVIRONMENT IN ORDER TO EXIST, THEN THESE ORGANIZATIONS WILL INDUCE INEQUALITY OF THE RANDOM FIELD

TO OTHER AREAS; THESE ASYMMETRICAL FIELDS OF ENVIRONMENT ABOUT THESE ORGANIZATIONS MAY WELL BE THE BASIS FOR DEFINED FIELD STRUCTURES OR VECTORS WHICH ARE NOT IN THEMSELVES DISCREET QUANTIZED PARTICLES BUT RATHER, LEVELS OF INFLUENCE IN EITHER ISOTROPIC OR PREFERENTIAL DIRECTION, FROM THESE PERTURBATIONS, PROPAGATION STATE IN THE BACKGROUND AT c (OR SOME OTHER DISCREET RELATIVITY)

A theory
The ~~Secret~~ of Infinite ~~ness~~ Velocities

as related to discontinuities of present physical laws
Terrestrial relationships cosmology

1. Past may predict the future - (as means of application)
 - Cyclic phenomena plotted on rectilinear ordinates
for an periodic, linear or other function
 - a. Select condensed time bases - (1E 5,000yr in 5 minutes)
 - etc. correlation of factors -
 - major episodes - war - famine - catastrophe
 - plague - weather - sunspot cycle - comets - eclipses
 - civilizations scientific achievements - U.F.O.
 - physic phenomena - Biblical references

A THEORY OF INFINITE VELOCITIES AS RELATED TO
DISCONTINUITIES IN PRESENT PHYSICAL LAWS

THE PHYSICAL COMPOSITION OF MATTER

10.P.11

INTRODUCTION:

For consideration of the many aspects of our world and ^{material} universe one might enquire as to the basic structure and/or composition of all physical things, what is beyond our present knowledge of the basic atomic ^{structure} and subatomic particles? The question ^{with} follows; as to just how far we may apply ^{the many that} processes of subdivision for things seen to matter or observable in the sense that we can understand them!

It may then be reasonable to assume by deduction that there ~~may~~ indeed be a finite point or plane wherein things may exist (possibly in a transitional state or condition) that may not be purely physical as recognized by our present level or capability of understanding. From this imagined cross-over point, it may also be interesting to set a level of reference for additional deduction or conjecture.

APPLICATIONS
PHYSICAL COMPOSITION
BASIC OF
MATTER

26 AUG 1967

IN CONSIDERATION OF THE MANY ASPECTS OF ^{OUR} PHYSICAL WORLD,
ONE ^{MIGHT} ~~MIGHT~~ CONJECTURE ^{AS TO} UPON THE BASIC STRUCTURE & COMPOSITION
OF THINGS PHYSICAL, ^{BY THE} ~~WHICH~~ OBSERVABLES ^{THE QUESTION} UNDERLIES. ^{IT THEN}
^{THEN FOLLOWS} ~~FOLLOWS TO~~ AS TO JUST HOW FAR DO WE APPLY THE ANALYTICAL
PROCESS OF SUBDIVISION BEFORE THINGS CEASE TO BE MATTER
& PHYSICAL IN THE SENSE THAT WE CAN UNDERSTAND ^{THEN} WITHOUT
CONJECTURING IN THE REALM OF METAPHYSICS, IT ^{MAY} ~~STILL~~ ^{BE} ~~SEEMS~~
REASONABLE TO ~~ASSUME~~ ^{THERE MAY BE} BY DEDUCTION THAT, A FINITE POINT OR ^{POINT}
EXISTS WHEREIN THINGS MAY EXIST (POSSIBLY IN A TRANSITORY CONDITION) ^{THAT}
^{AS REQUIRED AS RELATED TO THE} ~~LEVEL OF~~ ^{LEVEL OF} ~~OR~~ ^{LEVEL OF}
THAT ARE NOT NECESSARILY PURELY PHYSICAL ^{AS WE} ~~UNDERSTAND THEM~~.

FROM SUCH AN IMAGINED CROSS-OVER POINT IT ^{MAY} ~~SEEM~~ ^{ALSO} ~~REASONABLE~~
TO SET A LEVEL OF REFERENCE ^{FOR} ~~FROM THE FOLLOWING~~ DEDUCTIONS &
^{BASIC IDEAS ACCUMULATED FROM STAGES} ~~HERE, THEY ARE~~
SOME OF WHICH ^{AS} ~~ARE~~ PRESENTED ^{HERE}, NOT NECESSARILY IN THEIR A
PARTICULAR ORDER OF PRIORITY BUT AS THEY CAME TO MIND.

1. ALL MATTER, ^{MASS} ~~AND~~ ^{EACH} FUNDAMENTAL PARTICLES ^{IS} ~~ARE~~ ^A ~~COMPOSITE~~
^{OF} ~~SUBSTANTIAL~~ ^{PROTYPE}
^{FROM} ~~THE~~ ^{THE} SAME, ^{BEING} ~~RECEIVED~~ ^{RECEIVED} FROM & SUSPENDED
IN A FINITE, ^{PRESENT} ~~REAL~~ ^{PRESENT}, UNIVERSAL ^{UNIFORM} ~~FIELD~~.
^{PRESENT IN THE} ^{HOMOGENEOUS} ^{(1) BACKGROUND}
2. THE IDENTITY AND CHARACTERISTICS OF ALL MATTER, ^{SUBATOMIC}
^{WITH & WITHOUT MASS} ~~IS~~ ^{IS} DIRECTLY EQUIVALENT TO THEIR PARTICULAR INTERDEPENDENT

RESULTANT → GEOMETRICAL CONFIGURATION & STATE OF EXISTENCE. →

3. THE INTRASTRUCTURAL CONFIGURATIONAL ^{ACTIVE} ~~REACTIVE~~ CAPABILITIES OF EACH
INDIVIDUAL SUBSTANCE, ^{THROUGHOUT THE ENTIRE SPECTRUM OF} ~~MINUTE~~ ^{PARTICULAR}
^{PACKING} ~~REINFORCE~~ ^{FRAMES} ~~IN ITS~~ ^{ITS} PARTICULAR ~~REGIONS~~ ^{OF} TIME & SPACE & ^{RELATIONS} ~~WITH~~ ^{NEIGHBORING} STRUCTURES

PHYSICAL APPLICATIONS
OF BASIC MATTER

24 NOV 68
10/1
(2)

4. THE EXISTANCE OF FORCES & ENERGIES, RESULTS FROM A FUNDAMENTAL
^{ATTENDANT} ^{MATERIAL INTERACTION}
REQUIREMENT THAT ALL THINGS MUST ^{EXIST} IN A STATE OF UNPERTURBED
EQUILIBRIUM.

5. ENERGY MAY BE CONSIDERED AS MASS IN SOLUTION ^{AND THE} ^{SOLVENT}
^{OR} ^{THE SOLUTE OR} ^{IN} ^{OR} ^{SOLVENT}
BEING THE TRANSITORY STATE OF ~~THE~~ FINITE MATTER ^{OR PROTYPE} ^{OF THE SOLUTE}

6. USEFUL APPLICATIONS ^{OR} ^{ALL} ^{OF} ^{MATTER} - FORCES & ENERGIES
^{AND IS} CAN BE ACCOMPLISHED THROUGH 5 BASIC MANIPULATIONS THAT DO NOT
ATTEMPT VIOLATE THE STATE OF UNPERTURBED EQUILIBRIUM.

RADIATION & PARTICLES $\frac{1}{2}$ FINITE MATTER
IN
CONTROLLED ENERGY SYSTEMS

(3)

As we consider the ^{practical} aspects of our physical world, ~~it~~ we
~~seem~~ ^{may logically} ~~logical~~ ^{infer} ~~to~~ conjecture as to the ^{nature of the} infinite composition or
structure of its basic ingredients. The question then follows

INTRODUCTION

~~In a search for inherent order~~

In the ^{more or more and practical} consideration of subatomic

when ^{attempts} one considers

when ^{in an} one attempts to consider the ^{possible} ~~possibility~~ of practical applications
of subatomic substances in useful engines and controlled energy systems,
we might look to the natural resources in our ^{practical} physical world.

RADIATION ENGINES

(4)

~~SUBATOMIC PARTICLES IN ENGINES~~

RADIATION ENGINES & SUBATOMIC PARTICLES & RADIATION ENGINES IN ENGINES

~~CONTROLLED ENERGY SYSTEMS~~ INTRODUCTION

To consider & speculate the possible application of subatomic
we have the engineering community has ^{often} frequently ^{considered} speculated with
the possibility of apply possible

The ~~engineering and~~ Scientific and Engineering community has

the speculative possibility that subatomic substance might
be practically applied to controlled energy system and

among the many considerations ^{just} over the present Scientific
horizon, ~~and~~ the speculative possibility that subatomic
substance may

C. F. Wilson
27 Aug 1968
(A)

Subatomic Particle &
Radiation Engines

Standing ~~foot~~ ^{extrapolation} Over the horizons of modern scientific achievements ~~is~~ the distinct possibility that subatomic particles, radiation and energies can be harnessed and applied to ~~used as~~ prime moving and momentum conversion systems. To ~~bring~~ ^{are to be brought from} such system capabilities beyond pure conjecture we ~~must~~ ^{must} reexamine all and new concepts from a different point of view, ~~and~~ ^{for the} Review and reevaluate known ~~physical~~ ^{physical} factors and possibly couple them with with the "new look".

During ~~the~~ ^{while considering} ~~consideration~~ of the many aspects of our physical world we ~~might~~ ^{have learned much and} conjecture as to the basic structure and composition of ~~these~~ ^{all} things physical. The question has been asked as to how far we might apply the ~~analytical~~ ^{proposers} of analytical ~~possibilities~~ ^{analytical} before things cease to be physical in ~~essence~~ ^{to become the physical} without conjecturing in the realm of metaphysics. ~~It is~~ ^{reasonable} to assume, by deduction, ⁽¹⁾ that there may be a point or plane where things ~~can~~ ^{can} exist that are not purely physical in our sensory system. ~~Further, that~~ ⁽²⁾ that at this point substance a things may exist in a transitory state without mass from which all energy, mass, matter and physical forces are derived and observed.

RADIATION & SUBATOMIC PARTICLES
IN
CONTROLLED ENERGY SYSTEMS

W.S.W.

(2)

INTRODUCTION

ingredients

When one considers the many aspects of our practical physical world, it seems only logical to conjecture as to the infinity ^{INGREDIENTS} ~~imposed~~ fundamental structure or composition ^{of its basic constituents} of physical things. The question then follows as to just how far ^{may} we apply the analytical ~~process~~ process of analytical division before things seem to be physical in the sense that we can understand. Without conjecturing in the realm of metaphysics, it still seems reasonable to assume by deduction that ^{there} may be a finite point or plane wherein things may exist that are not purely physical ^{in the more accepted sense} ~~as we are presently~~ as sensed within our present capabilities of understanding that such things may exist ~~possibly~~ ^{possibly} in a transitory state ~~without having~~ ^{as a} having neither mass or substance with substance but without ~~and~~ without mass from which ^{energy} mass, matter, and physical force are derived and observed.

10 ^{Two} basic postulates:
THREE

I The nature and identity of any substance, ~~particle of matter~~ is directly equivalent to its particular state of existence and resultant interdependent geometrical configuration and position in space and time. which ~~is further~~ ^{FROM 1973} ~~is further~~ ^{STAY} ~~is further~~ ^{APPLIES TO}

1. all matter, mass and each fundamental particle is a composite of the same PROXY received from and suspended in a real and finite homogeneous background that exists as a Universal Saturate in space and time

2. The intra-structural configuration, active and/or reactive capabilities of all substance, throughout the entire spectrum of organized radiation, particle, mass & matter is dependent upon its proximity to, ^{OR INTERACTION WITH} neighboring structures and/or its position in a particular ^{frame of reference in} ~~reference frame~~ ^{reference frame} of time and space.

II The existence of all forces and energies ^{and/or} substance interactions results from a fundamental requirement that "all things must and do exist in a state of Universal Equilibrium".

1. Energy may be considered as "man in a transitional state in solution with the homogeneous Universal Saturate";
2. all fundamental ~~is~~ initiating forces emerge from the "finite balance between Universal Equilibrium and the transitional state of the Universal Saturate".

III The orderly control, direction and/or application of all substances of matter and force or energy may be accomplished by means those methods that do not violate the natural state of Universal Equilibrium & the Unity of Time & Space.

1. Space & time are ^{absolute} immutable separate entities ^{which} equate to unity ^{from which our real time & periodicity may be referenced & related.}

2. It appears that ^{relationships} $T_a = \sqrt{c^2 + t^2}$ might be a valid assumption ^{where} $T_a =$ ABSOLUTE TIME IN SPACE & $c =$ VELOCITY OF LIGHT & $t =$ OBSERVED REAL TIME AS RELATED TO C

3. Absolute distance and velocity are related to T_a & S_a ^{as} $D_{TS} \neq V_{TS}$ THROUGH THEIR GEOMETRICAL MEAN ^{as the factor} $\sqrt{2}$ WHERE $T_a = 1$ $S_a = 1$ & $D_{TS} = \sqrt{T_a^2 + S_a^2} = \sqrt{1^2 + 1^2} = \sqrt{2}$

4. There are 3 classes of Distance, time, and velocity & distance

(1) Absolute	RELATIVISTIC	and	MEASURED (EARTH ORBIT)
SPACE DISTANCE	$\sqrt{T_a^2 + T_m}$	REAL TIME	MEASURED
SPACE TIME	$\sqrt{T_a^2 + V_m}$	REAL VELOCITY	
SPACE DISTANCE	$\sqrt{D_a^2 + D_m}$	REAL DISTANCE	

IF: ABSOLUTE TIME (T_a) = unity (1)

ABSOLUTE SPACE (S_a) = unity (1)

THEN ~~THE~~ ELAPSED ABSOLUTE TIME $T_{ae} = \frac{1}{1 - t_r}$

WHERE t_r = RELATIVE TIME OR $\sqrt{1 + t_m \times C_x^2}$

WHERE t_m = REAL TIME MEASUREMENT

C_x = TIME FOR LIGHT TO TRAVEL FROM POINTS A \rightarrow B
IN SPACIAL DISTANCE A \leftrightarrow B

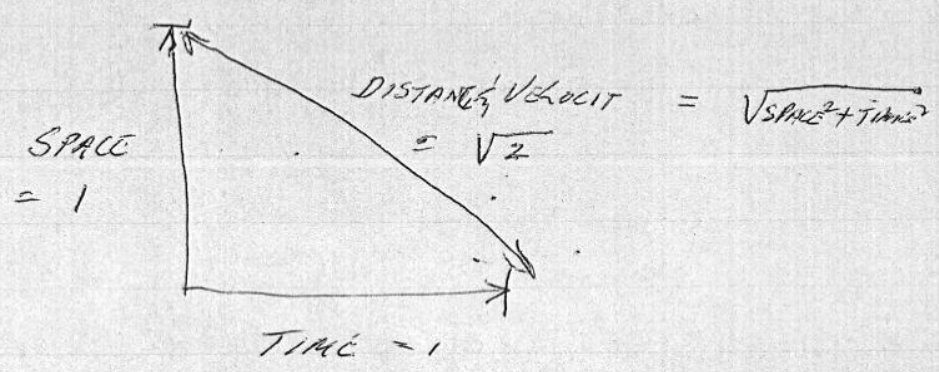
THEREFORE $T_{ae} = \frac{1}{1 - \sqrt{1 + t_m \times C_x^2}} + 1$ $+ \frac{1}{c} s = \text{VELOCITY}$

AND DISTANCE IN SPACE = $D_{SA} = \frac{1}{1 - V_r}$

WHERE V_r = RELATIVE VELOCITY OR $\sqrt{1 + V_m \times C_{xv}^2}$

WHERE V_m = VELOCITY MEASURED IN REAL TIME

C_{xv} = SPACIAL DISTANCE TRAVELED BY LIGHT AT TIME t



9
A. All matter, mass and each fundamental particle is:
1. in a composite of the same protyle received
from and suspended in a finite and real and finite
homogeneous background ^{that is} ~~which~~ exists as a
Universal Saturate in space and time.

7
B-2. The nature and identity of ^{any} ~~each~~ substance is
directly equivalent to its particular state of existence
and resultant interdependent geometrical configuration
and position in space and time.

↑
C. The intra-structural configuration, active and reactive capabilities
of all substances, throughout the entire spectrum of organized
radiation, particles, mass & matter, is dependant upon its position
in a particular referent frame of time and space and its proximity
to neighboring structures.

D. The existence of force, energy, ^{substance} ~~material~~ interactions in substances
results from a fundamental requirement that "all things
must and do exist in a state of Universal Equilibrium"

E. Energy may be ^{considered} the solute of mass in solution with
a ^{in homogeneous} ~~the solvent of~~ universal saturate. ^{in a transitory state as a solute} ~~in a transitory state~~
^{state of transition} ~~state~~
^{transitory state} ~~state~~

F. ^{all fundamental} ~~Basic~~ initiating forces emerge from the ^{basic requirement of} Universal Equilibrium

IV absolute time and space are immutables separate entities from which our real times and periods ^{between} of events may be referenced ~~by~~ $\sqrt{t_x^2 + t_a^2}$

$$t_A = \sqrt{t_r^2 + t_x^2} \quad \text{or} \quad t_r = \frac{1}{\sqrt{t_x^2 + t_a^2}} \quad \gamma = \frac{1}{1 - \sqrt{c^2} t_r^2}$$

$$t_A = \sqrt{c^2 + t_r^2} \quad t_a = \sqrt{c^2 \times t_r^2}$$

$$t_a = \sqrt{t_r^2 \times c^2}$$

$$T_a = \frac{1}{1 - t_r}$$

$$\text{SPACE} = \frac{1}{1 - t_a^2}$$

$$t_r = \sqrt{1 + t_r^2 \times c^2}$$

T_{AB} $C \times$ THAT TIME IT TAKES LIGHT TO TRAVEL FROM POINT A \rightarrow B OCCURRED DURING THE TRAVEL OF LIGHT IN THAT SPACIAL DISTANCE ^{between} FROM A \rightarrow B

are the
 F. force and motion the mixture from energy
 The symmetric relationship between Universal Equilibrium and
 the dimensional state of the Universal Absolute.

The Construction, ^{of matter} of all matter, mass, particles, radiation, energy, force
may, be ^{considered} deduced from the following ~~preliminary~~ deduction

1. All matter, mass and sub-fundamental particles in a
composite of the same ^{received} ~~property~~ from and suspended
in a finite and real homogenous background in the
~~system~~ ^{system} as a universal saturate in space and time.
2. The nature of ^{all} matter etc.

THEORETICAL PHYSICS

31 DECEMBER 1968

MDAC-WD SANTA MONICA

MEMO

TO: JOE BROWN

FROM: PAUL WILSON

SUBJECT: PHYSICAL PROPERTIES OF MAGNETIC & GRAVITY FIELDS

DISTRIBUTION: D. B. HARMON, W. P. WILSON SR.

As a result of certain recent observations on the sub-quanta particles and their possible interrelationships, it is conjectured that:

1. All gravitational fields result from subsets of or are derived from magnetic fields.
2. Mathematical relationships can be derived to rigorously prove or disprove the conjecture.
3. Suitable physical experiments can be constructed to verify the mathematical predictions.

W. Paul Wilson Jr.

31 December 1968

PARTICLE - RADIATION INTERACTION
EXPERIMENTS

10/29/68
W.P.W

AS AN OUTGROWTH OF RECENT THEORETICAL DISCUSSIONS CONCERNING THE BASIC COMPOSITION & CONFIGURATION OF THE ELECTRON CERTAIN CONJECTURES WERE MADE & QUESTIONS RAISED: SPECIFICALLY:

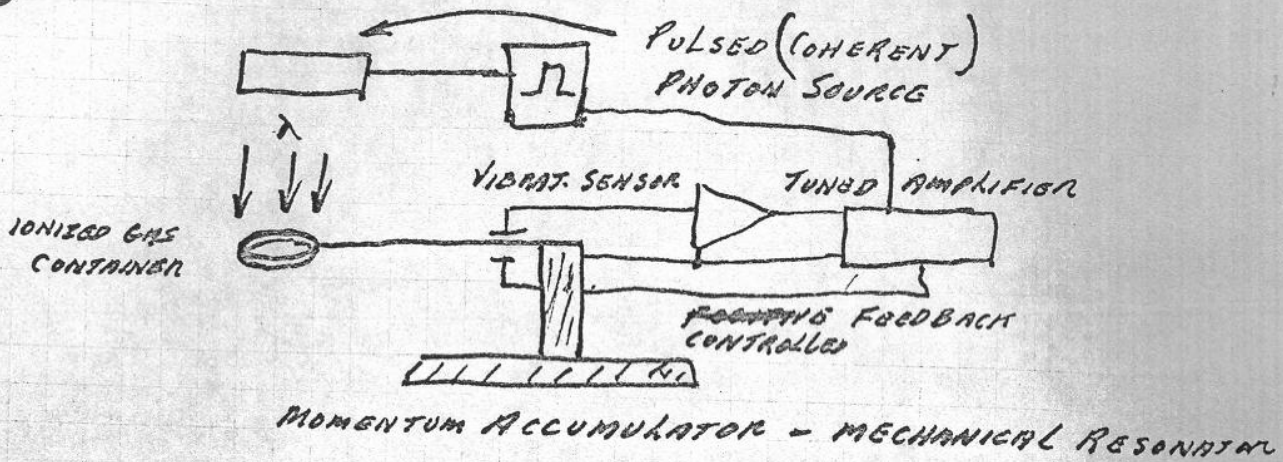
1. IF GRAVITONS ARE INITIATED IN THE ELECTRONS COULD THEIR PRODUCTION SOMEHOW BE AMPLIFIED, BY ORDERS OF MAGNITUDE, IN THE PREFERRED DIRECTIONS?
2. IS THERE A POSSIBILITY THAT PREVIOUSLY UNOBSERVED SIDE EFFECTS MAY RESULT FROM SUBJECTING ELECTRONS TO CONTROLLED ^{BOMBARDMENT} WITH BEAMS OF COHERENT, DENSE & ENERGETIC PHOTON RADIATION?
3. CAN SIMPLE & USEFUL EXPERIMENTS BE CONSTRUCTED TO EXAMINE THESE POSSIBILITIES?

EXPERIMENTAL APPROACH:

1. CONSIDER PROPERTIES OF ELECTRONS
2. DEVISE METHODS OF CONFINEMENT, POLARIZATION & MEANS TO OBSERVE INTERACTIONS
3. CONSIDER RADIATION SOURCES, ENERGY & POWER LEVELS
4. PROVIDE MEANS TO OBSERVE, MEASURE & RECORD ALL ^{APPLIED (INDIVIDUAL &} ~~RESULTS~~ ^{COMBINED)} POWER, ENERGY &/OR RADIATION SOURCES & TIME RELATIONSHIPS. (1)

SIMPLE EXPERIMENT NO. 1

10/29/68
W.P.W.



1. BOMBARD SIMPLE IONIZED GAS CONTAINER (NEON TUBE) WITH PERIODS OF PHOTON PULSE BURSTS. REP. RATE TIMED TO $\frac{1}{2}$ BY NATURAL VIBRATIONAL FREQUENCY OF SUPPORTING TORSION CANTILEVER.
2. PROVIDE MEANS TO APPLY STATIC, ^{AND TIME VARIANT} ELECTRIC $\frac{1}{2}$ / OR MAGNETIC FIELDS THROUGH AND ABOUT VARIOUS AXIS OF TARGET.
3. ASCERTAIN THAT PHOTON RADIATION IS THE ONLY COUPLE IN THE POSITIVE FEEDBACK LOOP. ^{ANY} ALL MECHANICAL VIBRATION SHOULD BE INITIATED & SUSTAINED BY PHOTON PULSE BURSTS.

~~PREFACE~~ PREFACE

DURING RECENT DISCUSSIONS WITH VARIOUS PERSONS AS TO THE POSSIBILITY OF (PRESENTLY UNKNOWN) STANDING WAVE PATTERNS OF FORCE OR ENERGY POSSIBLY RELATED TO BUT NOT NECESSARILY COMPOSED OF OBSERVABLE MAGNETIC QUANTUM FIELDS ON THE EARTH'S SURFACE, IT CAME TO LIGHT THAT CERTAIN

GERMAN SCIENTISTS HAVE DOCUMENTED RESEARCH IN THIS AREA.

(ENGLISH TRANSLATIONS OF THE PAPERS IS NOW BEING COMPLETED.)

PREMISE

TENTATIVE INFORMATION INDICATES THAT CERTAIN FORCE FIELDS MAY EXIST ON ^{NEARLY} SYMMETRICAL ^{OR [QUADRILATERAL]} RECTANGULAR COORDINATES. THE DIMENSIONS & POSITION ^{& NORMAL TO} OF WHICH ARE DEPENDANT UPON ^{THE} GEOGRAPHIC LATITUDE & LONGITUDE POSITIONS.

IN THE SOUTHERN CALIF. AREA, THE "INTO THE EARTH" & "OUT OF THE EARTH" CENTRAL FORCE FIELD POINTS ARE ON ^{APPROX.} SQUARE CONFIGURATIONS OF

^{APPROX.} 65 FT. POINT TO POINT DIMENSIONS. THEY ARE SYMMETRICAL WITH

^{RESPECT} ~~FIELD~~ ^{TO POSITION} BUT VARY IN ^{DIMENSIONS} LENGTH & ^{ARE} WIDTH AS THEY ^{ARE} ^{LOCATED} MORE NORTHERLY OR SOUTHERLY, ABOVE OR BELOW THE

EQUATOR. (AS THE EARTH'S POLES ARE APPROACHED, THE PATTERNS BECOME MORE OF A TRAPEZOID WITH PARALLEL NORTH & SOUTH SIDES)

FIELD OBSERVATIONS PHENOMENA

PHYSICAL EVIDENCE OF THIS, HAS NOT BEEN OBSERVED BY THIS REPORTER. ~~HOWEVER,~~ WHILE ~~THINKING ABOUT THE~~ PROBABILITY, ^{OF THE EXISTENCE} ~~OF SUCH~~ ^{THAT} FORCE OR ENERGY FIELDS ~~EXISTING IN THE FOLLOWING~~ WAS OBSERVED:

^{WAS ALSO ENTERTAINED} THE THOUGHT, THAT NATURAL PHYSICAL OCCURANCES MIGHT BE OBSERVED "COINCIDENTAL WITH ^{ANOMALIES} OR AS A RESULT OF" ANY SUCH ~~FORCE FIELDS~~ ^{PARCELS OF} ~~IN~~ ^{FLAT}

DURING THE COURSE OF EXAMINING ~~CERTAIN~~ ^{CERTAIN} LAND AREAS IN THE YUCA VALLEY, CALIF. (HIGH DESERT AREA) THE ^{APPEARANCE} ~~REGULAR~~ ^{SOMEWHAT} ~~FIELD~~ ^{SOMEWHAT} REGULARLY LOCATED ^{APPEARANCE OF CERTAIN} MOUNT HILLS WAS NOTICED.

A LARGE BLACK ANT SEEMS TO BE ONE OF SEVERAL SPECIES OF HARVEST ANTS TO BE FOUND IN THE AREA. THIS PARTICULAR ANT IS CONTINUOUSLY COLLECTING DARK COLORED WEED SEED WITH OVAL HEAD AND A TAIL TWISTED IN TO A SPIRAL CONFIGURATION. THE ANT AFTER

HILL ARE DISTIN FIRST TAKING THE SEEDS INTO THEIR HOLE LATER BRING THEM TO THE SURFACE & DEPOSIT THEM IN A DISTINCTIVE, SHALLOW, INVERTED CONE SHAPED, PATTERN SURROUNDING THEIR HILL. AS A RESULT OF THIS PRACTICE, THEIR LOCATION IS EASILY OBSERVABLE FROM A DISTANCE. IT FIRST APPEARED THAT THE PARTICULAR COLONIES OCCURRING ALONG

SOMEWHAT SYMMETRICAL LINEAR COORDINATES. THEREFORE A PRELIMINARY EXAMINATION TO DETERMINE THIS WAS CONDUCTED IN A LARGE FLAT ACRES ADJACENT TO A HILLY AREA AS FOLLOWS ^{ON} NEAR THE GIANT ROCK AIRPORT ^{GROUND}

1. ANT HILL NO 1 WAS LOCATED & MARKED WITH A VERTICAL STICK MARKER
2. ANT HILL NO 2 WAS LOCATED & MARKED AS ABOVE
3. A MAGNETIC COMPASS BEARING WAS TAKEN ALONG A PROJECTED LINE OF THE TWO MARKERS & FOUND TO BE N. MAG. 20 DEG. E. APPROX. 500 YARDS DISTANCE
4. AN IMAGINARY PROJECTION, ON THE SAME BEARING WAS LOCATED.
5. HILLS NO 3 - 4 - 5 - 6 & 7 WERE FOUND ^{& MARKED} ALONG THIS LINE SPACED AT MULTIPLES OF APPROX. 20 PAGES.
6. TWO OF THE ANT HILLS WERE NOT OF THE SAME SPECIES ONE WAS A SMALLER BLACK ANT & THE OTHER A RED ANT
7. ADDITIONAL COLONIES WERE LOCATED ON LATERAL PROJECTIONS (EASTERLY) OF APPROX. 20 PAGE MULTIPLES ALONG A
8. HILLS NO 8 - 9 - 10 - 11 - 12 WERE LOCATED ON SIMILAR BEARING OF N. MAG. 20° E APPROX. 40 PAGES E. OF FIRST OBSERVATION
9. PRELIMINARY INVESTIGATION TENDS TO INDICATE THAT THE ANT COLONY LOCATIONS MAY BE POSSIBLY BE BASED ON MORE THAN COINCIDENCE
10. OBSERVATIONS WERE INTERRUPTED AND WILL BE CONTINUED AT A LATER DATE

W. P. Wilson

July 29, 1968

(X)

↑ (X) + 42P →

(X) ← 22P

PD
↓
62P

N
↑

42

↑

NMAG 355W

(X) ← 24P →

(X) ← 14P →

N
↑

108

↑
32

PD
70P
↓

(X)

(X) ← 18P →

WHITE STONE DR.

↓

(X) 45P →

30P

↑

23

↓

(X) 46P →

(X) 22P →

↑

21

22

AT. MAG 345° W

↑ NM 350W

↑ NMAG. 355 W

(X) 46 →

(X) 26 P →

ORNL BUTLER
ROAD

NMAG 345° W

S STONE ROAD

28 August 1968
W. P. Wilson, Jr.

SUGGESTED STANDARD FORMAT
FOR TAPE INTERVIEWS

TITLE: Interview of Mr. Subject (Code Name if Appropriate)
as related to an (Observation - Contact, etc.) of/or with a (UFO
Aerial Phenomenon - Flying Saucer, etc.)

PREAMBLE: (To establish Who, What, Where, When, Why, and Limitations)

1. This is a (magnetic or other) recording of an interview being conducted in (City County State) Date and Time
 2. The interview is being conducted by and in the presence of Mr. etc. and Mr. etc. the person now speaking. Mr. _____ will act as moderator.
 3. The sole purpose of this interview is to ^{GATHER} collect information that may be of scientific interest, or value. All ~~resulting~~ information contained herein is to be considered confidential and proprietary and shall not be revealed to other persons for any reason except as agreed to by and with the consent of ~~the participants.~~ ^{AUTHORIZED AGENTS OF MDAC-WO} PERSONS
HOW PARTICIP
 4. (If appropriate) For purposes of security and to insure right of privacy the true names of the principles and/or observers, will not be used but (They, He, She, etc) will be referred to and addressed as (Smith, Jones, Etc.)
 5. (For Minors or Juveniles), Prior permission for interview should have been obtained from parent or guardian).
- Q. Address Subject - What is your age? And Occupation?
- A. Answer _____
- Q. Is this interview being conducted with the knowledge and consent of your parent or guardian? Answer.

Introduction

- Q. 1. Address Subject - What is your age and occupation?
- A. _____
- Q. 2. Do you understand that the information to be discussed during this interview will relate only to observations made by you (and other persons if any) and will not include any ideas or inventions of a proprietary nature?
- A. _____
- Q. 3. To the best of your knowledge and belief are the incidents and or observations to be discussed during this interview true and factual occurrences?

A. _____

Q. 4. Now, Address Subject - It is our (my) understanding that at some time in the past you (saw, heard, or were involved with) something unusual?

A. _____

Q. 5. To the best of your recollection, what was the date, time and place of this occurrence?

A. _____

Q. 6. Statement - Now, Address Subject will you tell us, in your own words, just what it was that you saw (heard etc.)?

NOTES:

1. Allow uninterrupted narration for suitable period, make notes and question subject between periods.
2. Close a particular session or end of tape with time notation and future action if there is to be any.
3. Date and identify all taped material and prepare for safekeeping.

W.P.W.

PLASMA AND UNIVERSAL GRAVITATION

G is dimensionally charge/mass and is $2.58 \cdot 10^4$ e.s.u. per gram. That it may actually be electrostatic charge per gram thus offers itself as an explanation of gravity. But this naive interpretation has been avoided because of the formidable problems incurred by the apparently complete nonpolarity of gravity and the absence of a satisfactory mechanism for the accumulation of the required amount of charge on one body, e.g, $1.54 \cdot 10^{24}$ e.s.u. for the earth and $5.16 \cdot 10^{29}$ e.s.u. for the sun. On the other hand there are several reasons to believe that gravity is actually of electrical and magnetic origin. Let us summarize several of these reasons:

(1) Experimental evidence shows that the earth is being continually and uniformly bombarded by cosmic radiation at a rate evidently in excess of 10^{15} cosmic-ray particles per second. Moreover, the "primaries" of cosmic radiation are apparently almost entirely positive ions. (9). As a matter of fact our magnetic field is such as to permit penetration by charges only of $e/m \approx 10^{14}$ e.s.u./gram or less. Therefore electrons would need to have relativistic masses of around $3 \cdot 10^3 m_0$ to penetrate the earth's magnetic field. While this is well within the energy range of cosmic radiation, at least many times more positives than negatives should be and evidently are able to penetrate into the Earth's atmosphere. But at a minimum of 10^{15} elementary positive charges per second or about 10^6 e.s.u. per second for the whole earth the charge on the earth would increase at a rate of at least 10^{13} e.s.u. per year.

(2) The magnetic moment of the earth has the value required by a circulating charge distribution corresponding to the charge $G \frac{1}{2} M_{\oplus}$ distributed approximately uniformly throughout the earth(i), i.e.,

$$\mu_{\oplus} = e_{\oplus} h_{\oplus} / 2 M_{\oplus} c \quad (iii.35)$$

where e_{\oplus} is $G \frac{1}{2} M_{\oplus}$, μ_{\oplus} the earth's magnetic moment, h_{\oplus} the "mechanical moment" of the earth and c the velocity of light. This relationship was first noticed by P.M.S. Blackett(1a) and applies also to the sun and other stars.

(3) In reference(1) the author presented a general unification concept which seems to show that the same fundamental laws apply in celestial as in atomic and molecular (and probably also nuclear) systems. Moreover it was there shown that gravity is intimately related to the radiation from the central body. The most important correlation bearing out this intimate relation to atomic systems is the observed coupling between orbital and spin states brought out in reference(1).

(4) It is possible to take a large "sample" of the matter on the earth, namely that comprising the atmosphere, or $5.27 \cdot 10^{21}$ grams, and show that it contains, within experimental error, the required electrical charge, namely about $1.36 \cdot 10^{18}$ e.s.u. Thus, if we treat the atmosphere as a concentric-sphere, the condenser

with the base of the atmosphere or the lithosphere as the inner sphere, the charge q on the atmosphere is found to be

$$q = CV = r_1 r_2 / (r_1 - r_2) \int_{r_1}^{r_2} (dV/dr) dr \approx 4.4 \cdot 10^{17} (dV/dr) \quad (\text{iii.36})$$

Experimentally (dV/dr) amounts to about 0.6 to 3.17 volts/cm cm. (positive vertically upward so that q is positive) near the earth's surface. The average value is required to be 3.1 volts/cm in order that $G^{1/2} M = q$ which is in excellent accord with the observed atmospheric potential gradient.

(5) There is a tremendous accretion process going on in the solar system that amounts evidently to about 10^{15} grams of micro-meteorites on the earth each year (Whipple)(9). Assuming a ratio of more than one thousand to one for the gaseous material ($H, He, CO_2, H_2O,$ etc.) compared with solids in the accretion process as indicated by relative abundance data, there may be about $3 \cdot 10^8$ grams/sec total accretion on the earth. This is, at least within an order of magnitude, the amount of accretion necessary to maintain a constant $e/m(G^{1/2})$ or on the earth against the observed cosmic radiation accumulation of charge.

(6) If the earth's mass increase due to accretion were $3 \cdot 10^8$ grams/sec., one might expect the sun's accretion to amount to $3 \cdot 10^8 \cdot 4\pi r_{\odot}^2 / 4\pi r_{\oplus}^2 \approx 10^{18}$ grams/sec. assuming that the earth merely intercepts that portion of the (probably) spherically distributed total mass flux to the sun corresponding to the cross-sectional area of the earth. There is an approximate check on this total flux in the conditions existing in the chromosphere of the sun. This may be shown as follows:

The electron density at the top of the sun's chromosphere is about $2 \cdot 10^{11} \text{ cm}^{-3}$ which is therefore also approximately the positive charge density. If matter were undergoing effectively "free fall" into the sun, its velocity would be $(GM/r_{\odot})^{1/2} = 4 \cdot 10^7 \text{ cm/sec.}$. This velocity corresponds, through the relation $\frac{1}{2} m v^2 = \frac{3}{2} k T$, to a temperature of about $2 \cdot 10^7 \text{ }^\circ\text{K}$ for a gas of average molecular weight unity. This agrees approximately with the temperature of the solar corona as evidenced by the appearance of charged atoms, e.g., iron, chromium, nickel, with charges of +13 to +16 in it. Hence the accretion on the sun may be as much as $n_0 m_H v (4\pi r_{\oplus}^2) = 2 \cdot 10^{11} \cdot 1.7 \cdot 10^{-24} \cdot 4.5 \cdot 10^7 \cdot 4\pi \cdot (7 \cdot 10^{10})^2 \approx 10^{18} \text{ g/sec.}$ in agreement with the above earth-sampling result.

It is of interest that this kinetic energy of accretion is $\frac{1}{2} m v^2 = \frac{1}{2} \cdot 10^{18} \cdot 2 \cdot 10^{15} = 10^{33} \text{ erg/sec.}$ which is about the known solar constant, namely $2 \cdot 10^{33} \text{ erg/sec.}$ Apparently one thus has a likely explanation for the solar constant that need not include, or is at least approximately of the same relative importance as, the $H \rightarrow He$ reaction via the carbon-nitrogen cycle that is supposed to be taking place in the core of the sun.

(7) In stars, galactic nuclei (and a postulated supergalactic center) the average kinetic energy of any body should be approximately the negative of the gravitational energy GM^2/\bar{a} where \bar{a} is the mean distance from any element of mass to the center of the system. Therefore

$$\bar{T} \approx GM^2/N \cdot k \cdot \bar{a} \quad (\text{iii.37})$$

From this assumption the following are approximate values of the quantities in equation iii.37 for three bodies of great interest to us (based on an average atomic weight of 0.5).

Body	M(grams)	N	\bar{a} (cm)	\bar{T} (°K)
sun	$2 \cdot 10^{33}$	$2 \cdot 10^{57}$	$4 \cdot 10^{10}$	$\sim 2 \cdot 10^7$
effective galactic nucleus	$\sim 3 \cdot 10^{43}$	$\sim 10^{67}$	$\sim 10^{11}$	$\sim 10^{11}$
effective supergalactic nucleus	$\sim 10^{56}$	$\sim 10^{80}$	$\sim 10^{12} - 10^{13}$	$\sim 10^{16} - 10^{17}$

Based on the above facts together with the quasi-lattice model of plasma outlined above, let us now present the following "plasma model" of gravitation:

Celestial bodies are "positively" charge particles existing as (positive) lattices meshed in tremendous multi-electron lattices (or "cryscapades") in which the circulating electron lattices exist between and among the positive ions, i.e., in interplanetary, interstellar and intergalactic space, exactly as electrons in metals and plasma exist in the free space between the positive-ion lattice.

The charging of celestial bodies positively is easily understood and computed in terms (1) of the ion-cut-off characteristics of the powerful magnetic fields of celestial bodies and (2) of the binding energy of plasma for positive ions. First consider the selective absorption of an excess of positive ions by celestial bodies on the one hand and an excess of electrons by interplanetary, interstellar and intergalactic space on the other.

In order to understand why more positives than electrons are able to penetrate the magnetic field of bodies such as the sun and the earth one need simply realize that the cut-off energy is of the order of a billion electron volts even for the earth and, of course, greater for the sun and other luminous stars. To have such large energies, positive ions need to have relativistic masses actually not much greater than their rest masses, however, velocities always at least approaching closely the velocity of light. But it would be necessary for electrons to have relativistic masses more than 10^3 times greater than their rest mass in order to penetrate the magnetic fields even of planets to say nothing of stars and galaxies. It is instructive to consider the radii of circular orbits of nuclei and electrons moving as "satellites" of the earth and sun in or near the ecliptic plane. From the equation

$$M_v^2/r = e v H_{\perp}/c \tag{iii.38}$$

and realizing that the component of magnetic field H_{\perp} perpendicular to the velocity vector falls off as the cube of the distance, one obtains

$$r/r_0 = (e H_0 r_0 / M c^2 B)^{1/2} \tag{iii.39}$$

where the zero subscript designates the value at the surface of the body in question and $B = v/c$. Equation iii.39 gives for protons and other completely-stripped ions $r/r_0 \approx 10 B^{-1/2}$ for the earth, and $r/r_0 \approx 10^3 B^{-1/2}$ for the sun. But for electrons $r/r_0 \approx 400 B^{-1/2}$ for the earth, and $r/r_0 \approx 4 \cdot 10^4 B^{-1/2}$ for the sun. These are therefore the closest distances of

approach for ions and electrons of external origin. Note that the

earth's magnetic field at 60 earth radii (the moon-earth distance) about balances the sun's magnetic field at one AU (the earth-sun distance). This means that penetrating positive particles of $0.8 < \beta < 1.0$ originating outside the earth-moon system would orbit finally about the earth in an orbit inside the moon's orbit, but electrons in this range of energies would be so far out from the earth that they would be governed strictly by the sun's magnetic field. Likewise protons originating outside the solar system and finally orbiting around the sun at $0.8 < \beta < 1.0$ would orbit the sun "inside" the sun's "asteroid" system but electrons would orbit only "outside" the asteroid-ring system. These conditions seem to define the limits of the earth and the sun as nuclei placing the minor planets in a different category than the major planets. That is, the major planets in this respect would be little "sisters" to the sun whereas the minor planets would be "daughters".

Now for electron-positron pair formation the photon energy is 10^6 e.v. . This corresponds to a temperature of about 10^{10} °K.

Therefore the galactic nucleus should be able to "emit" large quantities of "electrons-positron" pairs, in fact even more than photons, because the spectral displacement law (the Wein law) would have the wave length of maximum intensity for emission from the galactic center at "less" than the "Compton wave length" for this electron-positron pair. By decay and rearrangement the main radiation from the center of our galaxy might therefore be expected to be simply protons and electrons or H-atoms of initial kinetic energy about 10^{-6} ergs per particle. These would have slowed down, by gravitational attraction to the galactic center, to about 10^7 cm/sec. at $3 \cdot 10^{22}$ cm (30,000 l.y.) from the center of radiation. This is approximately the observed velocity of hydrogen in our region of interstellar space. Therefore it seems reasonable to assume that the observed hydrogen in interstellar space is really predominantly that emitted as "soft cosmic radiation" from the galactic center. Moreover, from the high-energy "tail" of the Stephan-Boltzmann radiation from the galactic center one should expect to find in our region of space hydrogen atoms or ions (soft cosmic rays) of velocity near the velocity of light, i.e., with energies perhaps 10^3 to 10^4 times greater than the average of the Stephan-Boltzmann spectral distribution radiated from the galactic center.

The existence of a supergalaxy now a quite definite reality, would lead one to look for a "supergalactic" nucleus of effective diameter comparable to the diameter of the supergalaxy's satellites, namely the galaxies, or 10^{23} to 10^{25} cm. The supergalaxy would be the final one because in the system-within-the-system concept any system is in general, i.e., within a factor of about 10, about 10^2 times greater in diameter than its satellites. But at 10^{23} cm the "red shifts" go to zero, hence all radiation either from the supergalactic nucleus or one of its satellites not intercepted by a primary, secondary, tertiary, etc., satellite would be returned, by space-curvature, to the gigantic nucleus. Now at the tremendous temperature of the supergalactic nucleus ($\sim 10^{17}$ °K) the peak of the radiation distribution would have an energy $h\nu$ of about 10^{13} e.v. with an upper limit radiation, corresponding again to the high-frequency tail of the Stephan-Boltzmann distribution, around

10^{17} e.v. This is approximately the observed upper-limit energy of cosmic radiation and this model for cosmic radiation is therefore consistent with observations and predicts that the source of the cosmic rays of highest energy is the supergalactic nucleus which is emitting simply in accord with the well-established Stephan-Boltzmann radiation law.

Next, applying the concept of the plasma let us compute the charge on a celestial body. A plasma has an "energy well" of depth given (for an overall uncharged plasma) by equation iii.33. This means that the plasma can "absorb positive ions" until the increase in energy due to repulsion, i.e., the energy $CV^2/2$ of the charged "condenser" ($q = CV$), exactly balances the energy of the plasma providing one sprays the plasma condenser with positive charge. (Actually cosmic radiation is doing just this as far as the earth and presumably all other bodies are concerned). The earth as a plasma (it is a good conductor and therefore metallic, or a plasma, as far as the macroscopic earth is concerned) should therefore be able to absorb positive charge until the energy increase caused by this charge is

$$CV^2/2 = q^2/2C = N \cdot |E_i| \quad (\text{iii.40})$$

and the charge is

$$q = (2C \cdot N \cdot |E_i|)^{1/2} \quad (\text{iii.41})$$

For a chemical (or solid) plasma of the nature of the earth $|E_i|$ amounts to around 10^{-11} ergs per positive ion. Also assuming an average atomic weight of 30, $N_{\oplus} \approx 10^{50}$. Furthermore, $C_{\oplus} = r_{\oplus} = 6.4 \cdot 10^8$ cm. Therefore $q_{\oplus} = (2 \cdot 6 \cdot 10^8 \cdot 10^{50} \cdot 10^{-11})^{1/2} = 10^{24}$ e.s.u. This agrees almost precisely with $G^{1/2} M_{\oplus}$ and definitely, it would seem, identifies $G^{1/2}$ with charge per unit mass. Note also that for the earth

$$|E_i| \approx GM_{\oplus}^2 / 2a \cdot N;$$

the condition $NRT \approx GM^2/2a$ give somewhat (possibly 3 times) too large a temperature evidently because the binding energy is largely chemical.

One may likewise compute the (positive) charge on the sun from equation iii.41, i.e., from the equation

$$CV^2/2 = GM^2/2a = q^2/2C = q^2/2a$$

or

$$q = G^{1/2} M \quad (\text{iii.42})$$

However, one finds that $|E_i|_{\odot}$ must be about 500 e.v. for the sun. This is consistent with the composition of the sun and the fact that practically all of the orbital electrons of the atoms up to about $Z = 13$ to 15 should have been stripped at the thermal environment of the sun, and therefore are plasma electrons. For example, one needs less than 2 per cent of the sun to be atoms of atomic number 15 or greater to account for this "plasma" energy.

It is important to realize in this model that net universal

attraction despite an excess of positive charge on a body is associated with the "energy well" of the plasma and ideal, metallic (or plasmatic) polarization, i.e., an effectively infinite dielectric constant. In fact the increased energy $cv^2/2$ is exactly balanced by the decreased energy due to the interaction of the charge q with the negative charge of interplanetary electrons bonding the celestial particle in the celestial lattice. Indeed, owing to excellent conduction in the plasma each particle-on-a-particle is held to the system, despite the local positive excess by the familiar "image force" with a strength determined simply by the binding energy of elementary ions for the plasma, as determined by the "energy well".

UNIVERSAL PLASMA DEVELOPMENT

As noted above the supergalactic nucleus should emit at a maximum intensity in the energy range of about 10^{13} e.v. per photon. At this frequency, which is above the Compton wave length for neutrons, the photons should decay in their (relativistic) half-life cycle to matter itself, i.e., possibly first to neutrons (if the photon is not identically a neutron to start with), α particles, etc., and the electrons all probably initially, as they leave the nucleus, in charge balance. An electron excess then becomes trapped in the space between the supergalactic nucleus and its satellites by the magnetic fields of the galaxies, leaving therefore an excess of negative charge in this space and an equal positive excess, owing to the greater penetration of the positives, in all of the galaxies combined. Under conditions where the positives and negatives can recombine to neutral atoms in the free space between the galaxies the "neutrals" can then accrete into the galaxies without being hindered by magnetic fields. Evidently neutral accretion must take place universally at a fixed ratio to the charge accretion in order to maintain the gravitational constant. The penetrating positive excess thus adds charge to the galaxies leaving an equal amount of excess negative charge in the space between the galaxies and supergalactic nucleus, providing the "chemical" binding energy of the galaxy to its positive supergalactic nucleus. This same process is repeated between a galactic nucleus and "its" satellites; by emission followed by decay to charged particles, a positive excess of which is able to penetrate the galactic satellites, the constellations, galactic clusters and the stars of the galaxy also become positively charged. Moreover, the excess negative charge remaining behind, owing to the inability of all but a relatively few of them compared with the positives to penetrate the satellites, add to the "negative-excess" intergalactic charge. The hard cosmic rays of the primary process each produce, of course, a large number of high energy, positive and negative secondaries. Thus these secondary charges again become separated to some extent (about one part in 10^{18}) within the galaxies by the tremendous dynamo-action of the rotating magnetic fields of the stars and clusters of stars of the galaxy, and the greater penetrating power of the high-energy "tail" of the positives of this softer cosmic radiation. One should realize that this process repeats itself again between the stars and their planets by soft cosmic radiation from the star itself, and again between the planets and their satellites by cosmic-ray "star" formation inside the

system. This latter process is the predominant one and occurs in all systems. That is, cosmic-ray "star" (or explosion) processes occurring inside any given system will be subject to the same dynamo-action of the rotating magnetic moment of the bodies of the system as between the supergalaxy and the galaxy described above, irrespective of the order or size of the system. This dynamo-action thus serves to produce a "positive excess" on all massive bodies and a "negative excess" throughout all space, extragalactic, intergalactic, interstellar and interplanetary.

CHEMICAL BINDING IN PLASMA

A remarkable feature of the plasma interpreted by the quasi-lattice model is that it provides a means, under high internal temperatures and high density, for realizing "chemical-binding" energies far in excess of that in the strongest chemical bonds in our terrestrial environment, e.g., as in CO , N_2 , diamond, platinum, etc. For instance, it was indicated that the "chemical" or plasma binding energy in the sun may be about 500 e.v. per atom. This concept is simply that when the nuclei of a plasma are sufficiently close together, and the temperature high enough to remove by ionization many or all of the electrons of atoms that are ordinary core electrons comprising the positive-lattice ions at low temperatures, the chemical-binding energy then becomes comparable to $\sum_{i=1}^z I_i$, where z is the total number of electrons per atom removed by ionization and moving in the quasi-lattice of the plasma, and I_i is the ionization potential of the i^{th} electron.

This seemingly quite plausible property of plasma thus offers a ~~simple~~ simple explanation for the ~~high~~ high-density dwarf stars. That is, if a body were comprised largely of high atomic weight nuclei, e.g., ~~of~~ atoms of 16 electrons or more, and had an internal temperature of say 10^8 , about 16 electrons per positive ion would be plasma electrons, and the binding energy would then be tremendously greater than in a plasma with only one or two electrons per positive ion. At such a large binding energy the density would be comparably large.

This feature of the quasi-lattice model of the plasma also offers a plausible explanation of the tremendous binding energy of nuclei if one also postulates a new realm of elementary particles, e.g., of size as much smaller than a nucleus as the stars, constellations, and clusters of stars are smaller than a galaxy. A photon might then be regarded as a plasma comprising a tremendous number of more elementary particles (e.g., Frenkel's ~~quasi-~~ "N-particles") (2) with a "positive excess" of $4.77 \cdot 10^{-10}$ e.s.u. per galaxy, and a neutron as a plasma with no charge excess. Realizing that the ~~proton~~ proton with its large positive excess is a stable plasma, one also realizes that the combination of two such plasma one with maximum possible positive excess and the other with no positive excess, e.g., the proton and the neutron, would combine to form a plasma of a still deeper "energy well" simply because it is more massive. The tremendous log of new, strange particles that are known to comprise atomic nuclei is strongly suggestive of extremely minute, "nuclear galaxies" with characteristic

minute galactic clusters, globular clusters, constellations, stars and planets held together in extremely tight, high temperature plasma.

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$$-E_L = (30Z^2/d)(1 - 0.8/dZ^{4/3})$$

(iii.33)