

WHEN
WHO
WHAT
WHERE
WHY

OBSERVABLES
EVENT DOCUMENTATION

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. Acoustical 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) - Measurable 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: ~~Sturges~~ A 830

From: W.P. Wilson Jr A 833

Subject: FIELD DATA ACQUISITION REQUIREMENTS

~~Field Data~~

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WHY?

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 fuel safe considerations.

* Following the UFO sensing requirements, the ^{requirements for} sensing ball lightning and various other meteorological phenomena are developed.

17 JAN 1970

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VFO Targets

A basic analysis of VFO reporting 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:

→ Magnet, 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 ^{background} background and may be within range of the sensor for long periods to short time intervals. The short duration would most probably be associated with a close range fly-by. For this reason, it ^{may be} would seem that the shorter the times might produce the strongest signals.

For example, a fly-by at 10,000 ^{feet} feet per sec. could ~~produce~~ 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 ~~under these~~ for these conditions would provide significant information. Therefore, a 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 operations.

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 SENSE 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. H. 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-13P1349-68-5080.

BASIC REQUIREMENTS
FIELD DATA ACQUISITION

(1) MOBILE-READY ACCESS, MANNED

(2) PORTABLE-REMOTELY INSTALLED, SELF-SUSTAINING

AREAS OF OBSERVATION

- Earth Sciences
- Atmospheric
- Cosmology

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

Ultrasound

- 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.

- Location

- Time

- Magnitude

Cosmic & Atmospheric Events

Physical - Solid Objects, etc.

Coherent Radiation

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

Unusual Sensing

- Plant, animal & human
reactions or residual effects

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 I - SENSING REQUIREMENTS

1. MAGNETIC VECTOR - H FIELD, UNITS IN GAMMAS (1×10^{-5} Oersted)

	<u>Duration Sec</u>	<u>> 10</u>	<u>1</u>	<u>10^{-1}</u>	<u>10^{-3}</u>	<u>10^{-6}</u>
3 Components	Ambient	50,000 ± 20	50,000 ± 0.1		50,000 ± 0.01/±	
2 Places	Lower Limit	± 10	± 1	± 1	± 100	± 10 ³
	Upper Limit	± 10 ⁶	± 10 ⁶	± 10 ⁶	± 10 ⁶	± 10 ⁵

Sensors - Magnetometer, Absolute and Relative Measurements

Readout Analog, Real Time

Cosium - Varian Model V-4938 -

Approximate Cost ^{\$10,900.00} ~~\$5,000.00~~

Magnetometer, Gradient Sensing

Readout Analog, Real Time

(Three) Internally Constructed,

- Approximate Cost \$250.00 Each

750.00

2. ELECTRIC VECTOR - VOLT/METER

	<u>Duration-Sec.</u>	<u>> 10</u>	<u>1</u>	<u>10^{-1}</u>	<u>10^{-6}</u>
3 Components	Ambient	± 100			
2 Places	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

Constock & 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	10^{-2}	10^{-4}	10^{-6}	Volts/Meter
		Country	10^{-4}	10^{-6}	10^{-8}	Volts/Meter
Direction	Signal		10^{-12}	10^{-12}	10^{-12}	Watts (1 HV/50R)

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

Radiometers and Auxiliary Radio Equipment

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

Approximate Cost 3,500

4. ELECTROMAGNETIC - IR - WATTS AND SPECTRAL CONTENT

	<u>Duration-Sec</u>		10^{-12}	10^{-13}	10^{-14}	
Polarization	Ambient	Limits Vary As To Location, Day-Night & Local Artificial Heat & Light Conditions				
Direction	Signal	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 ^{cap} Particle

10. NATURAL AND RESIDUAL SIGNATURES

Odors

Ground Deformation

Response of Trees and Plants, Animals, Humans,

Vehicle Parts

11. SITE CHARACTERISTICS

Location

Terrain

Time of Day

Weather Conditions (Required for UFO and Ball Lightning)

WINDSPEED
WINDDIRECTION
WINDGUST
WINDGUSTDIRECTION
WINDGUSTSPEED
WINDGUSTDIRECTION
WINDGUSTSPEED

Wavelength
Power
Frequency
Polarization
Direction
Duration
Intensity
Color
Temperature
Humidity
Pressure
Altitude
Latitude
Longitude
Time
Date
Observer
Location
Weather
Conditions
Remarks

EM SPECTRUM CLASS

ARBITRARY STANDARD USAGE BY BANDS IN

BAND	WAVELENGTH- λ $3 \times 10^8 / \text{fcps}$		FREQUENCY- fcps $3 \times 10^8 / \lambda$		1	
	Meters		Cycles/Second			
MP	3×10^{11}	1×10^8	10^{-3}	3	1	
ELF	1×10^8	1×10^5	3	3×10^3	3.	
VLF	4	1×10^5	1×10^4	3×10^3	3×10^4	3.
LF	5	1×10^4	1×10^3	3×10^4	3×10^5	3.
MF	6	1×10^3	1×10^2	3×10^5	3×10^6	3.
HF	7	1×10^2	1×10^1	3×10^6	3×10^7	3.
VHF	8	1×10^1	1.0 Meter	3×10^7	3×10^8	3.
UHF	9	1.0 Meter	1×10^{-1}	3×10^8	3×10^9	3.
SHF	10	1×10^{-1}	1×10^{-2}	3×10^9	3×10^{10}	3.
EHF	11	1×10^{-2}	1×10^{-3}	3×10^{10}	3×10^{11}	3.
MM	12	1×10^{-3}	1×10^{-5}	3×10^{11}	3×10^{13}	3.
INFRARED		1×10^{-5}	1×10^{-6}	3×10^{13}	3×10^{14}	3.
INFRARED		1×10^{-6}	6.8×10^{-7}	3×10^{14}	4.4×10^{14}	3.
VISIBLE		6.8×10^{-7}	4.2×10^{-7}	4.4×10^{14}	7.1×10^{14}	2.
ULTRAVIOLET		4.2×10^{-7}	7×10^{-7}	7.1×10^{14}	3×10^{15}	1.
ULTRAVIOLET		1×10^{-7}	1×10^{-8}	3×10^{15}	3×10^{16}	3.
X-RAY		1×10^{-8}	1×10^{-9}	3×10^{16}	3×10^{17}	3.
PARTICLE & COSMIC RAY						

TABLE 3

LIGHTNING

Prior to Event

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

Event

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

TABLE 4

OTHER METEOROLOGICAL REQUIREMENTS

1. IS THERE POSSIBILITY OF ^{DISCREET} QUANTIZED RATIO
 OF ORGANIZED TO DISORGANIZED MATTER? ^{COSMIC} ^{ANTIGRAVITY ENDS?}

2. IF ORGANIZATION MUST EXIST IN A HOMOGENEOUS ENVIRONMENT
^{FIELD} ^{IN ORDER TO EXIST} THEN THESE ORGANIZATIONS WILL INHERIT ^{INHERITANCE?} INEQUALITY
 TO OTHER AREAS. THESE ASYMMETRICAL FIELDS OF ENVIRONMENT
 ABOUT THESE ORGANIZATIONS WILL BE THE BASIS FOR
 DEFINING FIELDS STRUCTURES OR VECTORS WHICH ARE NOT
 IN THEMSELVES DISCREET QUANTIZED PARTICLES BUT
 RATHER, LEVELS OF INFLUENCE IN EITHER 13 DIMENSIONS OR
 4 DIMENSIONS ^(COMBINATIONS OF) ^{OR} ^{OR}
 3 DIMENSIONS ^{DIRECTION} VECTORS. FROM THESE PERMEATIONS, ^{LEVELS OF} ^{OR}
 STATE IN THE MEDIUM AT C (OR SOME DISCREET RELATIVES!)

A Theory
The Secret of Infinite Mass Velocities
as related to discontinuities of present physical laws
to present relationships cosmology

1. Past may predict the future - (as means of application)
 - cyclic phenomena plotted on rotational ordinates
for cyclical, linear or other functions
 - a select condensed time base - (1: 5,000 yr in 5 minutes)
etc. correlation of factors -
 - Major episodes - ice-age - famine - catastrophic
plagues - weather - sunspot cycle - comets - eclipses
civilization - scientific achievement - U.F.O.
 - physical phenomena - Biblical references

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

THE PHYSICAL COMPOSITION
OF MATTER

10. P. 1

INTRODUCTION

For consideration of the many aspects of our ^{material} world and
1 however one may be ^{convinced} as to the basic structure
and/or composition of all physical things, what is beyond
our present knowledge of the basic atoms and subatomic
particles? The question ^{is} follows; as to just how
far we may apply ^{the} process of Subdivision. Are things
ever too 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 transient, state or condition)
that may not be purely physical as recognized by our
present level or capability of understanding. From this
imagined core or point, it may also be ^{reasonable} to
set a level of reference for additional deduction or
conjecture.

IN CONSIDERATION OF THE MANY ASPECTS OF^{OUR} PHYSICAL WORLD,
ONE MUST CONSIDER^{AS TO} WHAT THE BASIC STRUCTURE & COMPOSITION
OF THINGS PHYSICAL, ~~AND THEIR~~ ^{THE} ~~THEIR~~ ^{THEIR} SUBSTANCES^{THEIR}.
~~THESE~~ ^{THESE} ~~FOLLOW~~ ^{FOLLOW} 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^{IT} WITHOUT
CONJECTURE IN THE REAM OF METAPHYSICS, IT^{IS} STILL ~~SEEM~~ ^{IS} ~~REASONABLE~~ ^{REASONABLE} TO ~~ASSUME~~ ^{ASSUME} BY DEDUCTION THAT, A FINITE POINT IN
SPACE WHEREIN THINGS MAY EXIST (POSSIBLY IN AN INFINITE CONTINUUM)
THAT HAS NOT NECESSARILY PHYSICAL ASPECT, UNDER STANDING^{IT}.

FROM SUCH AN IMPROVED CROSS-OVER POINT IT MAY SEEM PROPER
TO SET A LEVEL OF REFERENCE FROM THE FOLLOWING DEDUCTIONS &
SOME OF WHICH ARE PRESENTED HERE, NOT NECESSARILY IN THEIR
PARTICULAR ORDER OF PRIORITY BUT AS THEY CAME TO MIND.

1. ALL MATTER, ^{AND} FUNDAMENTAL PARTICLES IS A COMPOSITE
OF ~~SMALLER~~ ^{PROTOS} PARTS^{PROTOS} RECEIVED FROM A SUBSTANCE
IN A FINITE, ~~AND~~ ^{PRESENT IN THE} ~~REAL~~ ^{UNIVERSAL} CONTACT.
~~THESE~~ ^{HOMOGENEOUS (OR HOMOGENEOUS)} ~~PROTOS~~ ^{ARE} ~~THE~~ ^{THE} ~~SMALL~~ ^{SMALL} ~~PROTOS~~ ^{PROTOS}
2. THE IDENTITY AND CHARACTER OF ALL MATTER & SUBSTANTIAL
PARTICLES IS DIRECTLY EQUIVOCAL TO THEIR PARTICULAR INTERACTIONS
^{WITH & WITHOUT MASS}

RESULT → GLOBAL CONFIGURATION & STATE OF EXISTENCE.

1. THE INTRASTRUCTURAL CONFIGURATION^{ACTIVE} DEPENDS ON THE QUALITIES OF EACH
INDIVIDUAL SUBSTANCE, IS DEPENDENT UPON ITS RELATIONSHIP TO THE
SUBSTANCE WITH WHICH IT IS INTERACTING.
IN ITS INTERACTIONS OF TIME & SPACE, ^{IT IS} ~~IT IS~~ ^{IT IS} ~~IT IS~~

PHYSICAL APPLICATIONS
OF BASIC MATTER

9. THE EXISTENCE OF FREE ENERGIES, RESULTS FROM THE REQUIREMENT THAT ALL THINGS MUST EXIST IN A STATE OF EQUILIBRIUM.
10. ENERGY MAY BE CONSIDERED AS MASS IN SOLUTION ^{THE SOLUTE IS} AND ^{THE} ^{SOLVENT} OR AS BEING THE TRANSITORY STATE OF ~~THE~~ ^{THE} ~~FREE~~ ^{ALL} ~~PARTICLE~~ ^{PROTYPE} ~~OF~~ ^{THE} ~~SOLVENT~~
11. USEFUL APPLICATIONS OF ^{ALL} ~~PROTYPE~~ ^{THE} ~~SOLVENT~~ ^{PROTYPE} ~~OF~~ ^{THE} ~~SOLVENT~~ CAN BE ACCOMPLISHED THROUGH BASIC MANIPULATION THAT DO NOT ATTEMPT TO ALTER THE STATE OF THERMODYNAMIC EQUILIBRIUM.

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

(3)

As we consider the ^{practical} ~~many~~ aspects of our physical world, it is ^{not} ~~not~~ ^{very} ~~not~~ ^{surprising} ~~not~~ ^{to} ~~not~~ ^{be} ~~not~~ ^{convinced} ~~not~~ ^{of} ~~not~~ ^{the} ~~not~~ ^{importance} ~~not~~ ^{of} ~~not~~ ^{the} ~~not~~ ^{structure} ~~not~~ ^{of} ~~not~~ ^{its} ~~not~~ ^{basic} ~~not~~ ^{ingredients}. The question then follows

INTRODUCTION

~~for a scientific introduction to~~

In the ~~consideration~~ ^{study} of subatomic ~~particles~~ ^{and not practical}

we ~~do not~~ ^{do not} ~~consider~~ ^{consider}

when we attempt to consider the ~~possibility~~ ^{possibility} of practical application of subatomic substances in ~~useful~~ ^{useful} ~~energy~~ ^{energy} ~~systems~~ ^{systems}, we might look to the ~~actual~~ ^{actual} ~~resources~~ ^{resources} ~~in~~ ⁱⁿ ~~our~~ ^{our} ~~physical~~ ^{physical} ~~world~~ ^{world}.

SCIENTIFIC ENGINES?

~~SCIENTIFIC ENGINES?~~

(4)

RADIATION ENGINES & SUBATOMIC PARTICLES & RADIATION ENGINES
ENGINES

~~CONSIDER ENERGY SYSTEMS~~
INTRODUCTION

To consider and evaluate the possible application of subatomic
particles the engineering community has frequently speculated with
the possibility of applying power

The engineering and scientific and engineering community has

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

among the many considerations just on the present scientific
horizon, the speculative possibility that subatomic
substances may

Subatomic Particle &

W. V. Wilson
27 Aug 1968
(A)

Radiation Engineer

Attending ^{the} ~~foot~~ ^{development} Over the horizon of modern scientific
achievements ~~is~~ ^{is} the distinct possibility that subatomic
particle, radiation and energy can be harnessed and
applied to ~~the~~ ^{used to} prime moving and momentum conversion
systems. To ~~try~~ ^{use} such system capabilities beyond pure
conjecture we ~~must~~ ^{need to} reexamine old and new concepts
from a different point of view ^{and to bring to} known and reevaluate
known ~~physical~~ ^{physical} factors and possibly supplement with
with the "new tools".

During the ^{whole universe} ~~the~~ ^{whole universe} consideration of the many aspects of our physical
world we ~~might~~ ^{might} ~~conjecture~~ ^{conjecture} as to the basic structure
and composition of ^{all} ~~these~~ ^{all} things ~~physical~~. The question has
been asked as to how far we might apply the ~~analytical~~ ^{processes}
of ~~analytical~~ ^{analytical} ~~processes~~ ^{of} ~~physics~~ ^{physics} before things cease to be ~~physical in nature~~.
Without conjecturing on the nature of metaphysical ^{reasonable}
to assume, by ~~deduction~~ ^{deduction}, that there may be a point or plane wherein
things ~~may~~ ^{exist} exist that are not purely physical in our common ^{mean from}
faith, ~~but~~ ^{and that} at this point substances or things may exist in a
transitory state without mass from which all energy, mass, matter
and physical force are derived and observed.

RADIATION & SUBATOMIC PARTICLES
IN
CONTROLLED ENERGY SYSTEMS

W.S.W.

(2)

INTRODUCTION

incomplete

When one considers the many aspects of our practical physical world, it seems only logical to conjecture as to the infinite ^{incomplete} ~~infinite~~ fundamental structure or composition of physical things. The question then follows as to just how far ~~we~~ we apply the analytical ~~process~~ process of analytical division before things cease 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 ^{should} be a finite point or plane wherein things may exist that are not purely physical ^{in the case of light energy} ~~as we are presently so concerned~~ within our present capabilities of comprehending. What such things may exist ~~possibly~~ ^{possibly} in a transitory state ^{without having} ~~having~~ ^{has} ~~no~~ ^{no} ~~substance~~ ^{substance} but without ^{mass} ~~with~~ ^{mass} ~~without~~ ^{without} mass from which ^{many} ~~many~~ ^{many} ~~many~~ matter, and physical forms are derived and observed.

Our physical existence is controlled 10 P. 11
to four basic postulates

I The nature and identity of any substance ^{is} ~~is~~ matter
is directly equivalent to its particular state of existence
and resultant interdependent geometrical configuration
and position in space and time. which ~~is~~ further ^{defined} ~~by~~ ^{as follows:}

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

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

II The existence of all forces and energies ^{and} 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, mass in a transitional state in
solution with the homogeneous Universal Substrate;
2. All fundamental ~~to~~ initiating forces emerge from the
"finite balance between Universal Equilibrium and
the transitional state of the Universal Substrate".

III The orderly control, direction and 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. ^{absolute} Space & ^{absolute} time are inseparable entities ^{with} unity from which our real time ^{parameters} & space may be referenced; ^{relative} relative.

2. It appears that $T_a = \sqrt{c^2 + V^2} / c$ might be a solid component where T_a = absolute time in space & c = velocity of light
 T_r = observed real time as related to c

3. Absolute distance and velocity are related to T_a & S_a
 $D_{15} = V_{15} T_a$ TRIGONOMETRIC MEAN & the factor $\sqrt{2}$
where $T_a = 1$ $S_a = 1$ $\therefore D_{15} = \sqrt{1^2 + 1^2} = \sqrt{2}$

4. There are 3 classes of distance, time, and velocity; ^{relative} relative.

(1) Absolute	Relative and ^{relative} Real	^{relative} Real
Space ^{TIME} FORMER	$\sqrt{1^2 + 1^2}$	REAL TIME FORMER
Same ^{velocity} TIME	$\sqrt{1^2 + 1^2}$	REAL VELOCITY
SPACE DISTANCE	$\sqrt{1^2 + 1^2}$	REAL DISTANCE

(3)

IF: Absolute Time (T_a) = unity (1)

Absolute Space (S_a) = unity (1)

THEN WHEN EITHER Absolute Time $T_{a2} = \frac{1}{1 - \frac{v^2}{c^2}}$

WHERE t_r = RELATIVE TIME OR $\sqrt{1 + \frac{v^2}{c^2}}$

WHERE t_m = REAL TIME MEASUREMENT

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

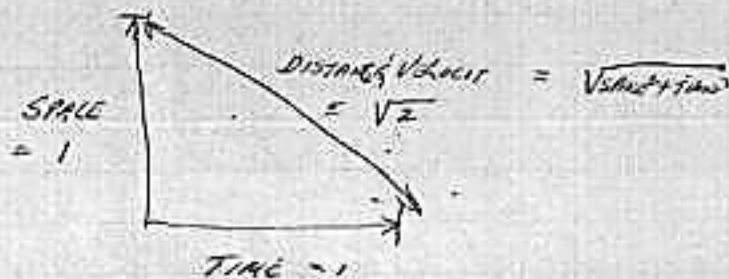
THEN THE $T_{a2} = \frac{1}{1 - \frac{v^2}{c^2}}$ + 1 $\frac{v}{c} = \text{Velocity}$

AND DISTANCE IN "SPACE" = $D_{s1} = \frac{1}{1 - \frac{v^2}{c^2}}$

WHERE V_r = RELATIVE VELOCITY OR $\sqrt{1 + \frac{v^2}{c^2}}$

WHERE V_m = VELOCITY MEASURED IN REAL TIME

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



A. All matter, mass and such fundamental particles
 1. is a composite of the same particle received
 from and suspended in a fundamental real and finite
 homogeneous background ^{that of} which exists as a
 Universal detour in space and time.

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

C. The intrastuctural configuration, active and reactive capability,
 of all substances, throughout the entire spectrum of organized
 relation, particles, mass & matter, is dependant upon its position
 in a particular respect frame of time and space and ^{its} property
 to neighboring structures.

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

E. Energy may be ^{considered} as the ^{state of} motion of mass in ^{and transition state as a state} relation with
^{in homogeneous} ^{state of transition} ^{throughly state}
 a universal detour in ^{homogeneous} ^{state of transition} ^{throughly state}

F. ^{all fundamental} Being interesting from source from ^{like requirement of} The Universal Equilibrium

IV Absolute Time and space are uncountable separate later
 from which our real time and ^{spatial} space may
 be referred to by $\sqrt{v^2 + c^2}$

$$t_A = \sqrt{v_A^2 + c^2} \quad \text{or } t_r = \frac{1}{\sqrt{v^2 + c^2}} \quad \gamma = \frac{1}{1 - v^2/c^2}$$

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

$$t_a = \sqrt{v_A^2 + c^2} \times c^2$$

$$T_a = \frac{1}{1 - v^2/c^2}$$

Space = $\frac{1}{1 - v^2/c^2}$

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

$\frac{1}{\sqrt{1 - v^2/c^2}}$ ^{occurs in the time of light} ~~is that time~~ ^{it takes light to travel from point A to B}
 IN THAT SPACIAL DISTANCE FROM A TO B

Mr. Thomson etc. of the Thomson's formula
 Thomson's formula is not universal equation and
 it does not give any information about the motion of particles
 and matter ^{and matter}
 in the

The Construction ^{of matter} of all matter, mass, particles, radiation, except for
maybe ^{consider} ~~deduced~~ from the following ~~prostate~~ deduction

1. All matter, mass and sub-fundamental particles are
composite of the same ^{reagent} γ form and suspended
in a finite and real homogeneous background ~~with~~
~~effecting~~ ~~as~~ a universal saturate in space and time.
2. The nature of ^{all} matter etc.

Name

For: See below

From: Paul Wilson

Subject: PHYSICAL FOUNDATIONS OF QUANTUM ELECTRODYNAMICS

Author(s): D.A. HUGHES, W.P. WILSON, JR.

As a result of certain recent observations on nearly neutral particles and their possible interactions, it is conjectured that:

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

W.P. Wilson, Jr.

31 December 1968

10/29/68
W.P.H.

PARTICLE - RADIATION INTERACTION EXPERIMENTS

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

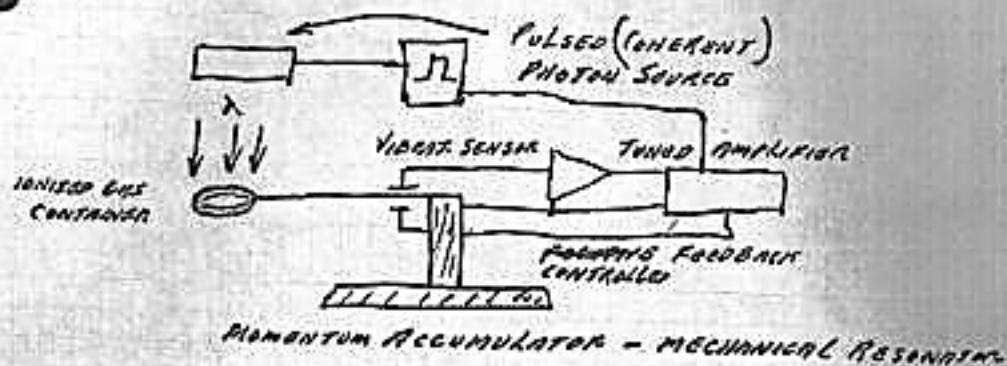
1. IF GRAVITONS ARE INITIATED IN THE ELECTRONS COULD THEIR PRODUCTION SOMEHOW BE AMPLIFIED, BY ORDERS OF MAGNITUDE, IN THE PREFERRED DIRECTIONS?
2. IS THERE A POSSIBILITY THAT PREVIOUSLY UNOBSERVED SIDE EFFECTS MAY RESULT FROM SUBJECTING ELECTRONS TO CONTROLLED ^{BOMBARDMENT} WITH BEAMS OF COHERENT, DENSE & HIGH ENERGY 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 & AND MEANS TO OBSERVE INTERACTIONS
3. CONSIDER RADIATION SOURCES, ENERGY & POWER LEVELS
4. PROVIDE MEANS TO OBSERVE, MEASURE & RECORD ALL ^{APPLIED (MAXIMUM & MINIMUM) POSITIVE} ~~NEGATIVE~~ COMBINED) POWER, ENERGY & FOR RADIATION SOURCES & TIME RELATIONSHIPS. (1)

SIMPLE EXPERIMENT NO. 1

10/29/65
W.P.W.



1. BOMBARD SIMPLE IONIZED GAS CONTAINER (NEUTRAL) WITH BURSTS OF PHOTON PULSE BURSTS, REP. RATE TUNED TO ξ BY NATURAL VIBRATIONAL FREQUENCY OF SUPPORTING TORSION CANTILEVER.
2. PROVIDE MEANS TO APPLY STATIC, ^{AND TIME VARIANT} ELECTRIC ξ / 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.

~~PAPER~~ PROPOSAL

DURING RECENT DISCUSSIONS WITH VARIOUS PERSONS AS TO THE POSSIBILITY OF (PRESENTLY UNKNOWN) STANDING WAVE PATTERNS OF FORCE OR ENERGY

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 A ^{NEARLY} SYMMETRICAL ^{OR EQUILATERAL} RECTANGULAR COORDINATES. THE DIMENSIONS & POSITION OF WHICH ARE DEPENDANT UPON THE GEOGRAPHIC LATITUDE & LONGITUDE POSITIONS.

IN THE SOUTHWEST 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~~ ^{RESPECT} TO POSITION BUT VARY IN ^{DIMENSIONS} ~~LENGTH~~ ^{AS THEY} ~~LOCATED~~ ^{ARE} 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

~~PHYSICAL EVIDENCE~~ ^{PHYSICAL EVIDENCE} OF THIS HAS NOT BEEN OBSERVED BY THIS REPORTER. ~~HOWEVER~~ ^{CONSIDERING THE} ~~WHILE~~ ^{IF SUCH} ~~THE~~ ^{PROBABILITY} ~~THAT~~ ^{OF SUCH} FORCE OR ENERGY FIELDS ~~EXIST~~ ^{MAY EXIST,}

^{WAS ALSO ENTERTAINED} THE THOUGHT THAT NATURAL PHYSICAL OCCURANCES MIGHT BE OBSERVED "COINCIDENTAL WITH ^{AS} ~~CONSEQUENCE~~ OR AS A RESULT OF ANY SUCH ^{ANYWAYS -} ~~FIELDS~~ ^{IN}

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

A LARGE BLACK SEEDS TO B ONE OF A SPECIES OF HARVESTING
 THE PARTICULAR SPECIES OF ANT SEEMS TO BE ONE OF SEVERAL TO
 BE FOUND IN THE AREA. THIS ANT ^{PARTICULAR ANT} IS CONTINUOUSLY COLLECTING
 DARK COLORED WOOD SEED, FRAGMENTS SMALLER THAN THOSE
 FOUND IN THE AREA. THESE SEEDS ARE TWISTED IN TO A SPIRAL ^{CYLINDRICAL} CONFIGURATION. ^{THE ANT AFTER}

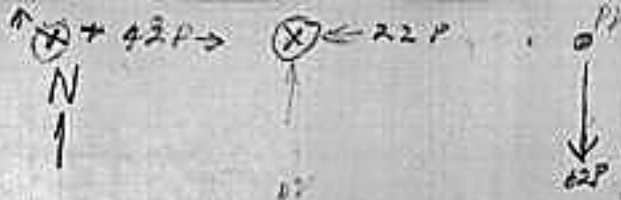
HILL ARE DISTINCTLY FIRST TAKING THE SEEDS INTO THEIR NESTS LATER BRING
 THEM TO THE SURFACE; DEPOSIT THEM IN A DISTINCTIVE, SHALLOW, INVERTED
 CONE SHAPED PATTERN SURROUNDING THEIR HILL. AS A RESULT OF THIS
 PRACTICE, THEIR NEST LOCATIONS ARE OBSERVABLE FROM A DISTANCE.
 IT FIRST APPEARED THAT ~~THE~~ PARTICULAR COLONIES OCCURRING ALONG
 SOMEWHAT SYMMETRICAL LINEAR COORDINATES. THEREFORE A PRELIMINARY

EXAMINATION TO DETERMINE THIS WAS CONDUCTED, IN A LARGE FLAT
 ACROSS AN ADJACENT TO A HILLY AREA AS FOLLOWS ^{ON THE GREAT ROCK} ^{PLANT GROWING}

1. Hill No. 1 was located; marked with a vertical stick ^{MARKER}
2. 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, IN THE SAME BEARING WAS LOCATED.
5. HILLS NO 3 - 4 - 5 - 6 & 7 WERE FOUND ALONG THIS LINE
 SPACED AT MULTIPLES OF APPROX. 20 PACES.
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
 OF APPROX. 20 PACE MULTIPLES ^{ALONG}
8. HILLS NO 8 - 9 - 10 - 11 - 12 WERE LOCATED AT SIMILAR BEARING
 OF N. MAG. 20 DEG. APPROX. 40 PACES E. OF FIRST OBSERVATION
9. PRELIMINARY INVESTIGATION TENDS TO INDICATE THAT THE ANT COLONY
 LOCATIONS MAY BE SUITABLY BE BASED ON MARKS TAKEN CONSECUTIVELY
10. OBSERVATIONS WERE INTERRUPTED AND WILL BE CONTINUED AT
 A LATER DATE

W.P. Wilson
 July 29, 1968

(X)



108

(X)



(X) 45P →



23



(X) 46P →



21

↑ N. 35° W

(X) 46 →

(X) ← 29P

(X) 19P →



(X) ← 18P



30P



(X) 22P →



22

↑ N. 35° W

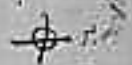
(X) 26 P →



WHITE STONE CR.

N. 35° W

DRIVE BUTLER
X MARK



N. 35° W

5 STONE ROAD

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 collect information that may be of scientific interest or value. ^{GATHER} 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. _{ADMITTED RESULTS OF FDAC-40}
 4. (If appropriate) For purposes of security and to insure right of privacy the true names of the principals 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.

FIELD AND UNIVERSAL GRAVITATION

It is dimensionally charge/mass and is $2.58 \cdot 10^7$ e.s.u. per gram. That it may actually be electrostatic charge per gram then 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., $1.57 \cdot 10^{27}$ e.s.u. for the earth and $5.26 \cdot 10^{27}$ 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 sq. second. Moreover, the "primaries" of cosmic radiation are apparently almost entirely positive ions. (2) As a matter of fact our magnetic field is such as to permit penetration by charges only of $e/m \leq 10^{14}$ 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.

(3) The magnetic moment of the earth has the value required by a circulating charge distribution corresponding to the charge G^2/M_0 distributed approximately uniformly throughout the earth (1), i.e.,

$$\mu_0 = e c R_0 / 2 M_0 c \quad (iii.35)$$

where μ_0 is G^2/M_0 , μ_0 the earth's magnetic moment, R_0 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 $1.36 \cdot 10^{13}$ 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

$$q = CV = \epsilon_1 \epsilon_2 / (\epsilon_1 - \epsilon_2) \int_{r_1}^{r_2} (dV/dr) dr \approx 4.4 \cdot 10^{12} (dV/dr) \quad (111.36)$$

Experimentally (dV/dr) amounts to about 0.6 to 3.17 volts/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 $(dV/dr) = q$ 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^{12} grams of micrometeorites on the earth each year (Whipple)(7). Assuming a ratio of more than one thousand to one for the gaseous material ($H, H_2, CO_2, H_2O,$ 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 $\epsilon_1 m_e (G/r_2)$ 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 $2 \cdot 10^8 \cdot (r_{sun}/r_{earth})^2 \approx 10^{11}$ 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 $2 \cdot 10^{16}$ cc which is therefore also approximately the positive charge density. If matter were undergoing effectively "free fall" into the sun, its velocity would be $(GM/r_0)^{1/2} = 4 \cdot 10^8$ cm/sec. This velocity corresponds, through the relation $\frac{1}{2} m v^2 = \frac{3}{2} kT$ to a temperature of about $2 \cdot 10^7$ °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 $10^{11} m v (4\pi r_0^2) = 2 \cdot 10^{11} \cdot 1.7 \cdot 10^{-27} \cdot 4.5 \cdot 10^{27} \cdot (7 \cdot 10^{10})^2 \approx 10^{11}$ g/sec. in agreement with the above earth-sampling result.

It is of interest that this kinetic energy of accretion is $\frac{1}{2} m v^2 = \frac{1}{2} \cdot 10^{11} \cdot 2 \cdot 10^8 = 10^{19}$ ergs/sec. which is about the known solar constant, namely $2 \cdot 10^{19}$ ergs/cm²/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/\bar{a} where \bar{a} is the mean distance from any element of mass to the center of the system. Therefore

$$\bar{T} \approx GM^2/N \cdot k \cdot \bar{a} \quad (111.37)$$

From this assumption the following are approximate values of the quantities in equation 111.37 for three bodies of great interest to us (based on an average atomic weight of 0.3).

Body	M (grams)	N	$\frac{M}{N}$	$\frac{M}{N}$
sun	$2 \cdot 10^{33}$	$2 \cdot 10^{57}$	10^{-24}	10^{-24}
effective galactic nucleus	$\sim 2 \cdot 10^{42}$	$\sim 10^{57}$	$\sim 10^{-15}$	$\sim 10^{-15}$
effective supergalactic nucleus	$\sim 10^{46}$	$\sim 10^{57}$	$\sim 10^{-11}$	$\sim 10^{-11}$

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 "crysoapades") 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 lattices.

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 10^9 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

$$Mv^2/r = e v H_{\perp} / c \quad (111.38)$$

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

$$r/r_0 = (e H_0 r_0 / M c^2 B)^{1/2} \quad (111.39)$$

where the zero subscript designates the value at the surface of the body in question and $B = v/c$. Equation 111.39 gives for protons and other completely-stripped ions $r/r_0 \approx 10 B^{-1/2}$ for the earth, and $r/r_0 \approx 10^2 B^{-1/2}$ 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 $10^8 < E < 10^9$ 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 $10^8 < R < 10^9$ 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 10^7 °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 10^7 ergs per particle. These would have slowed down, by gravitational attraction to the galactic center, to about 10^3 cm/sec. at $3 \cdot 10^4$ pc. (30,000 ly) 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^{22} to 10^{24} 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 10^3 times greater in diameter than its satellites. But at 10^{22} 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 ($\sim 10^{11}$ °K) the peak of the radiation distribution would have an energy $h\nu$ of about 10^{12} e.v. with an upper limit radiation, corresponding again to the high-frequency tail of the Stephan-Boltzmann distribution, around

10^{11} 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.35. This means that the plasma can "absorb positive ions" until the increase in energy due to repulsion, i.e., the energy $qV/2$ of the charged "condenser" ($V = CV$), 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

$$CV^2/2 = q^2/2C = N \cdot |E_2| \quad (\text{iii.40})$$

and the charge is

$$q = (2C \cdot N \cdot |E_2|)^{1/2} \quad (\text{iii.41})$$

For a chemical (or solid) plasma of the nature of the earth $|E_2|$ amounts to around 10^{11} ergs per positive ion. Also assuming an average atomic weight of 30, $N_0 \approx 10^{23}$. Furthermore, $C_{\text{pl}} = r_0 = 2.0 \cdot 10^{-17}$ cm. Therefore $q_0 = (2 \cdot 0 \cdot 10^{17} \cdot 10^{23} \cdot 10^{11})^{1/2} = 10^{24}$ e.s.u. This agrees almost precisely with $G^{1/2} \cdot M_{\text{e}}$ and definitely, it would seem, identified $G^{1/2}$ with charge per unit mass. Note also that for the earth

$$|E_2| \approx GM^2/2\pi \cdot N_0$$

the condition $NkT \approx GM^2/2\pi$ 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

$$CV^2/2 = GM^2/2\pi = q^2/2C = q^2/2\pi$$

or

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

However, one finds that $|E_2|_0$ 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 plasmatric) polarization, i.e., an effectively infinite dielectric constant. In fact the increased energy $qv^2/2$ is exactly balanced by the decreased energy due to the interaction of the charge q with the negative charge of interplanetary electrons bounding 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^{11}) 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, N₂, 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 ~~very~~ simple explanation for the ~~many~~ 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-particles~~ "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 ~~same~~ 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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$$-E_L = (30Z^2/d)(1 - 0.3/dZ^{1/2}) \quad (iii.33)$$