



JET PROPULSION LABORATORY California Institute of Technology • 4800 Oak Grove Drive, Pasadena, California 91103

Mail Stop 264-738
June 21, 1979

Russell Targ
Stanford Research Institute
Menlo Park, CA 94025

Dear Sir:

In reading your book, "Mind-Reach," I was struck by the concept of the remote-viewing experiments involving Jupiter and Mercury.

For the next month or so, there is another unique opportunity: The first spacecraft visit ever to the planet Saturn will start this coming August: Pioneer 11 will fly by the planet on Sept. 1.

If you try such a remote-viewing experiment, I would recommend the following:

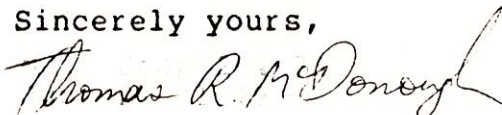
1. Concentrate on phenomena at or above the visible clouds, since the spacecraft cannot verify claims made about things happening below the clouds.
2. What are the visible rings made of? What do they look like up close?
3. Ask for information on the magnetic field, plasma, gases, dust, energetic particles, and any other phenomena outside Saturn, extending to a distance of the order of 100 times the diameter of the visible rings of the planet.
4. Ask for descriptions of the many moons of Saturn, especially of its only large moon, Titan, which is the only satellite in the solar system that has a thick atmosphere. (An example of what would have been a very impressive prediction: If someone had predicted that Jupiter's satellite Io had seven active volcanoes.)
5. Ask if there are any rings of dust, gas, or rocks around Saturn besides the visible rings, especially at much larger distances from the planet.

I would be willing to evaluate the accuracy of such remote

viewing. If you do such an experiment, I could serve as an independent witness if I received transcripts or tapes of the viewers' testimony before Sept. 1.

JPL PROPULSION LABORATORY

Sincerely yours,



Dr. Thomas R. McDonough
Lecturer in Engineering (CIT)
Astrophysical Consultant (JPL)
Phone (213) 795-0147

100-111-1319
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TMCD:sd
cc: Harold E. Puthoff

1. The first part of the experiment is to view the clouds from a distance of about 100 miles. This is done by using a telescope with a diameter of about 10 inches. The clouds are viewed through a filter which allows only the light from the clouds to pass through. The clouds are viewed for about 10 minutes. The results of the experiment are as follows:

2. The clouds are seen to be very bright and to have a very irregular shape. They are seen to be very bright and to have a very irregular shape. They are seen to be very bright and to have a very irregular shape. They are seen to be very bright and to have a very irregular shape.

3. The clouds are seen to be very bright and to have a very irregular shape. They are seen to be very bright and to have a very irregular shape. They are seen to be very bright and to have a very irregular shape. They are seen to be very bright and to have a very irregular shape.

4. The clouds are seen to be very bright and to have a very irregular shape. They are seen to be very bright and to have a very irregular shape. They are seen to be very bright and to have a very irregular shape. They are seen to be very bright and to have a very irregular shape.

5. The clouds are seen to be very bright and to have a very irregular shape. They are seen to be very bright and to have a very irregular shape. They are seen to be very bright and to have a very irregular shape. They are seen to be very bright and to have a very irregular shape.

6. The clouds are seen to be very bright and to have a very irregular shape. They are seen to be very bright and to have a very irregular shape. They are seen to be very bright and to have a very irregular shape. They are seen to be very bright and to have a very irregular shape.

7. The clouds are seen to be very bright and to have a very irregular shape. They are seen to be very bright and to have a very irregular shape. They are seen to be very bright and to have a very irregular shape. They are seen to be very bright and to have a very irregular shape.

8. The clouds are seen to be very bright and to have a very irregular shape. They are seen to be very bright and to have a very irregular shape. They are seen to be very bright and to have a very irregular shape. They are seen to be very bright and to have a very irregular shape.

9. The clouds are seen to be very bright and to have a very irregular shape. They are seen to be very bright and to have a very irregular shape. They are seen to be very bright and to have a very irregular shape. They are seen to be very bright and to have a very irregular shape.

*Martin
1979*

It should also be noted that in 1976, Toth had written an article concerning the possible use of radiation devices against the U.S. Embassy in Moscow. Therefore, the Soviets may have had a score to settle with Toth. This charge was echoed by Robert Beck in 1978; he claimed that Soviet technicians also have transmitted extreme low frequency electromagnetic signals, capable of producing mood alterations in humans, to North America. If this is true, it would represent a perversion of Kholodov's historic work.

The Mitogenic Rays

In 1979, I received a report which purported to be a summary of the document given to Toth by Petukhov. It paid tribute to A. G. Gurvich (1945) who studied plant roots, claiming to find that mitogenic rays, emitted by dividing cells, were transmitted through the root, stimulating other cells to divide. If another plant was growing nearby, cell division in that plant was also stimulated, because the mitogenic rays had the ability to extend beyond the root itself. He proposed that mitogenic radiation resembled a chain reaction; a mitogenic ray striking a cell could stimulate cell division and/or enable that cell to emit a radiation.

Since Gurvich's time, technology has advanced to the point where the mitogenic rays could be measured by

photomultiplier tubes -- extremely sensitive devices which detect tiny units of light (or photons) through an amplification process (or multiplier). Mitogenic radiation, it was claimed, ranged from about nineteen hundred to three thousand angstroms (a unit of length equal to one hundred-millionth of a centimeter used in discussing light waves).

Experiments were conducted with a psychic sensitive with reputed PK ability. The tests attempted to study mitogenic rays. When the sensitive was relaxed, the photomultiplier tube detected very little ultraviolet radiation. But when he began to concentrate on manifesting PK by influencing one other person, the rays sharply increased. The report conjectured, "Ultraviolet radiation may serve as a trigger mechanism for a general improvement in the bioenergetic reactions of another organism." The report continued:

It is not excluded that there may be forms of radiation as yet unknown, the clarification of whose physical nature may be achieved only in the course of further research. The solution might lie outside of traditional atomic and molecular radiation.

The report cited a monograph by N. I. Kobozev (1971) which hypothesized the existence of "superlight elementary particles." Kobozev claimed to have demonstrated that these particles would have to be infinitesimally smaller than an electron. The report concluded:

It is just these particles that could be the source of the ultraviolet radiation so necessary for the Gurvich mitogenic effect; particles with a mass from 4 times 10^{-4} to 6 times 10^{-4} ...that the electrons give off ultraviolet..., covering the entire range of mitogenic radiation and, consequently, perhaps its source. In any case, the analysis carried out makes one consider adopting the particles as the source of mitogenic radiation and on this basis studying the Gurvich effect more closely.

Visitors to the USSR in 1977 had told me that Edward Naumov was searching for a "supralight particle" responsible

for psi and mentioned Petukhov as one of his collaborators. However, if this report was indeed the document which caused Toth so much trouble, it was hardly worth the effort because the experiment it describes is only one step toward the discovery of the conjectured "psi particle."

In the meantime, other documents were sent to me listing some of the laboratories in which one or more researchers supposedly are attempting to identify the "psi particle." The centers cited were:

1. The Adjunct Laboratory of Medical and Biological problems (Moscow).
2. The Institute of Problems of Transmission of Information (Moscow)
3. The Institute of Reflexology (Moscow).
4. The Interdepartmental Commission for the Coordination of Work on the Biophysical Effect (Moscow).
5. Special Department No. 8, Institute of Automation and Electricity, Siberian Academy of Sciences (moved from Novosibirsk to Moscow in 1969).
6. Department of Physics, State Engineering College (Moscow).
7. The Institute of Psychiatry and Neurology (Kharkov).
8. Laboratory of Biological Cybernetics, Department of Physiology, Leningrad University (Leningrad).

My conversations with scientific workers who have emigrated from the USSR suggest that this list is accurate. If so, and

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APPENDIX A

THE ZAHORIS

A writer in the *Quarterly Review* for 1822 (p. 373) states that "the faculty of using the divining rod is evidently the same as that possessed by the Spanish Zahoris, though the latter do not employ a hazel twig." The *Spectator*, in an article on the rod (the 14th of October 1882), also refers to the Zahoris in the same casual way, as if every one knew all about them. On inquiry no one could give any information beyond a reference to the meaning of the word as given in Spanish dictionaries. Thus, in Lopes's *Spanish Dictionary* the word "Zahori" is explained as follows: "A vulgar impostor pretending to see things, although hidden in the bowels of the earth, if not covered with blue cloth." Again, "Zahoria" is said to be "The art of seeing as above. The performer must be born on Good Friday." Neuman and Baretta, in their Spanish dictionary, use similar words, and the *Dictionary of the Royal Spanish Academy* has a similar description, ending, "Lynceus homo subterranea videns." The word "Zahori" is really from the Arabic, meaning "clear," "enlightened"; it was, in fact, equivalent to the term "clairvoyant," as that word is now used. The same root occurs in Hebrew, and is the origin of the title Zohar, the most famous book of the Kabbalists.

It seemed, therefore, to be a matter of historical interest to ascertain what was known concerning these Zahoris. The earliest account of them comes to us from Mexico in the year 1557. It is contained in a folio volume entitled *Phisica Speculatio*, published at Mexico in 1557 and written by one Alphonsus (Gutierrez) of Vera Cruz. This work was reprinted at Salamanca in 1559. In his discourse on the Soul (*De Anima*, lib. ii, speculatio ii, pp. 300-301 or pp. 376-377 of the Salamanca edition), Alphonsus writes as follows:

"SPECULATION II OF ENCHANTERS, SALUTATORS,¹ AND OF THE PEOPLE VULGARLY CALLED ZAHORIS.

There is no one who denies that there may be such an arrangement in a man's eyes, that he may be enabled to see at a great

¹ The word *saluator* means in low Latin a "pointer out." The index finger was called *digitus saluatorius*, not only from its being used for familiar salutation, but also for pointing out.

distance, to which another man's eyes cannot reach. In the same way there may be such an arrangement as to enable a man to see an object through some diaphanous medium, whilst other eyes are incapable of discerning the shape of the object through the same medium. But I cannot conceive that any one's sight can be so constructed that he can see an object behind a wall or any opaque substance; for sight is the effect either of outward transmission, [*i. e.*, from the eyes] as some maintain, or of inward reception, as the majority declare. It is not clear how the shape of anything can reach the eye, when it is hidden in the earth, and behind something opaque and not diaphanous; for how would it pierce through the earth or penetrate the stone? For such shape would necessarily be absorbed on coming in contact with an opaque body, and could not transmit, because it is not a diaphanous body. Wherefore such shape could not reach the eye, neither could the object itself be seen. And I do not see how they [the Zahoris] can perceive (as they say) abscesses or humours in the internal organs of a man, (their sight not being impeded by the body or clothes); nevertheless they themselves assert that they can, and in the same way, on entering a temple where dead bodies lie, that they can clearly perceive the internal organs of the corpses, if they cast their eyes down. Nevertheless I do not give full credence to their assertions. For these things may be illusions wrought of the devil. Nevertheless I do not condemn them: for I have known men otherwise upright, who have declared they see these things. I confess I do not know what cause can produce such natural power; for it is not the same as that alleged by enchanters and salutators; but is quite different, for the Zahoris say the object is made visible by natural means, by radiating its shape to the eye; if so, it is necessary that the medium through which it passes should be diaphanous; otherwise the shape does not become visible. All philosophers say that air and water are diaphanous mediums, and all things partake of their nature; but the earth and opaque bodies are not of that kind."

Some years later a famous Jesuit of Louvain, Martin del Rio, published his great work *Disquisitionum Magicarum* in three folio volumes. In the first volume (pp. 11-12) of this work, del Rio refers to the Zahoris (he calls them *Zahuris*), and the following translation gives the principal statements he makes:

"A race of men in Spain are known who are called *Zahuris*; we may name them Lynxes; when I was staying at Madrid in the year 1575, such a boy was to be seen there. They relate that these people see things that are hidden in the inward bowels of the earth, veins of water and treasures of metals, and corpses placed within sarcophagi. This thing is most fully received and well known. Not only Pindar, Tzetzes, and other poets have thought this possible, but philosophers also, some of whom ascribe this power to a melancholy humour.¹

¹ [Melancholy here means madness; as Milton says, "Moonstruck melancholy, moping madness."]

"... I think they know veins of water by the vapours exhaled from those places morning and evening. They know veins of metal from the grass, of whatever kind, that usually grows there. Treasures and corpses I would consider to be indicated by demons. . . . They are accustomed to restrict this faculty of seeing to certain days, the third and sixth day of the week, which is a token of a secret pact. Besides, the redness of the eyes, which is particularly to be observed in Zahuris, would rather injure than assist clearness of sight."

It is interesting to note the prevalent idea of that period, and long afterwards, that demons have the principal hand in the discovery of hidden treasure, otherwise del Rio's conjectures indicate shrewd observation on his part. The "redness of the eyes" is a curious trait.

Another early reference to the Zahoris is to be found in a work by Juan Eusebio Nieremberg, entitled *Curiosa y Oculta Filosofia* (3rd edition, Madrid 1643). Chapter LXXVI of this work is devoted to the power of the Zahoris and the following is a translation of the chief portion (pp. 284-285):

"Less is heard of the sight of the modern Zahoris, though it cannot be taken as certain. Celio Rodiginio favours their cause, judging that there may be a natural means of seeing through large opaque bodies. Another attributes what they say they see to the effect of a melancholy humour. This would be a good explanation if facts did not follow their imagination or sight; but springs are found where they point them out, metal where they say they see it, and the dead with all their marks which they perceive, so that it must be attributed to some other cause than melancholy.

But knowledge of where water is to be found underground may be acquired without much difficulty, without its being necessary for the sight to pierce the earth. It was the ancient office of the Aquilegus,¹ whose art was the knowledge of where water was to be found, at what depth, and of what quality it was. Marcellus wrote of these things among the Romans, and is quoted by Cassiodorus. In the time of the King Theodoric a very celebrated Aquilegus came from Africa, whom Theodoric affectionately recommended to Apronianus that he might give him a suitable salary. The mode of discovering the water was by the presence of certain herbs, briars, reeds and other green trees, by certain species of mosquitoes, and light vapours which arose from the spot, and by other means which they took, such as placing dry wool in certain parts at night, well covered, to see if it would be found damp. Sweet and salutary waters are qualified by the south and east wind, and the heavy and less salutary fall with the north and west wind. The same thing may be urged concerning the knowledge of mines of metal, for there may be in the same way natural signs of them, and certain herbs which signify their presence.

As to the assertion that the Zahoris can see the buried dead

¹ [Aquilegus in Latin was one skilled in seeking out water.]

and certain particular marks upon them, Alphonso of Vera Cruz, in the second book of his *Anima*, and Father Delrio, on the Medea of Seneca and in the first book of his *Magia*, attribute this to evil arts; and I can see no grounds for opposing them, the more so that the power of the Zahoris is limited to certain days, such as Tuesdays and Fridays, which to me is a suspicious circumstance; also the redness and inflammation of the eyes usually found among these people seems to prove that they rather blind their sight than sharpen it.

The most interesting part in this quotation is Nierenberg's reference to an ancient cult of water-finders, or *aquilegi*, as he calls them. The famous Jesuit, Father Kircher, also refers to the method employed by the *aquilegi* (as he terms him) in water-finding.

Another Spanish writer, Feyjoo y Montenegro, published a paper entitled *Vara Divinatoria, y Zahories*.¹ This paper is principally concerned with the discussion of the well-known case of Jacques Aymar, whose story was then attracting universal attention. In section VII the Zahoris are referred to, and the author treats them with scepticism, remarking that the multitude is generally credulous, and among all people men of critical faculty and sound judgment are few. He continues:

"The name Zahoris is applied to a class of men of whom it is said that their vision penetrates opaque bodies, thus causing to appear whatsoever may be hidden away fathoms deep below the surface of the earth.² Perhaps we have inherited them from the Moors, since the word *Zahori* seems Arabic.

It cannot be advanced that this virtue is either natural or supernatural; consequently it must be condemned as either feigned

¹ *Theatro Critico Universal* (1728), ix. 85-86.

² ["In the past century," one writer says, "it is declared that there were in Spain certain men who saw what was underground to a depth of 20 pike handles (picas). Many philosophers failed not to discover (as they thought) reasons for persuading people that this might happen quite naturally." He then states that the *Mercurie françois* [sic] of the year 1728, published an account of a Portuguese lady (named Pedegacha). "She declared she saw what was in the earth to a depth of thirty to forty fathoms, but as regards the human body, she could not see into it if clothed, the clothing preventing her vision. But the body being uncovered, she was able to observe all the interior parts, even the abscesses or any other defect there might be, as well in the humours or soft parts as in the solid." It may be that this fable had its origin, not in Portugal, but in France. But this author does not give credence to the existence of the Zahoris, justifying himself mainly for his refusal of assent to my testimony, since having cited my work, he terminates thus: "The testimony of this Benedictine, being that of a Spaniard, is of great weight to give assurance of the falsity of this opinion." See *Mercurie de France* (September 1725), pp. 2121-2125; (June 1728), pp. 1175-1177; *Mémoire instructif pour un voyageur* (1738), i. 114, 120; — Romier, *Introduction aux observations sur la physique* (1772), ii. 225-7.]

or as superstitious. It is not *natural*, since light does not penetrate into the depth of opaque bodies. . . . As little can it be alleged that the talent or power of the Zahoris is *supernatural*. In the first place, it is not credible that it has God as its special author, since it is a virtue whose only use is to serve greed. It is not announced that the Zahoris disinter treasures to furnish assistance to the poor, or to make war on infidels. In the second place, because neither in the sacred writings nor in ecclesiastical history do we read that God has granted this virtue as a permanent habit to any of His many illustrious servants. How then can it be believed that, while refusing it to all these His most intimate friends, He has reserved it for men in no way remarkable by their merits? In the third place, supernatural graces are not limited to any particular nation, and of Zahoris, they are said to exist only in Spain.

Among the vulgar there is the belief that God dispenses this grace only to those who are born on a Good Friday, without considering that there should be an infinity of Zahoris, since many there are who are born on that day. Others limit the power to the circumstances of being born at the particular moment at which the Passion is being chanted. Even with this restriction it would follow that there should be in the whole extent of Spain from 700 to 800 Zahoris, since this total, more or less, results from the supposition that about the same number of men are born every day and hour of the year, and that Spain (including Majorca and excluding Portugal) possesses seven and a half millions of persons, which is the population determined by Senor Don Geronimo de Urtariz in his excellent work, *Theory and Practice of Commerce and of Sailing*. Consequently, on this computation there would not be a province of Spain which had not four or five dozens of Zahoris. Where are they, that we may see them? Nor can it be said that those who pretend to this grace hide it, since God does not concede virtues that they may be of no use.

There remains then but to say that this virtue is *superstitious*, and that those who exercise it have a compact, either expressed or implied, with the devil. In truth, the work of extracting gold from the depths of the earth is more of a nature to be attributed to diabolical influence than to the Divine assistance, since an abundance of that precious metal rather promotes vice than favours virtue. Such, indeed, appears to have been the thought of the ancients when they pretended that Pluto, the infernal divinity, was the first discoverer of mines of gold and silver.

The author then goes on to say that if the Zahoris really do exist, they are either wizards or rogues, and he prefers to think the latter, as the former would involve a diabolical compact, a far greater crime than being a mere rogue.

This extract has been quoted at some length, as it gives an interesting picture of the habits of thought of a learned Spaniard 120 years ago. It is evident that the writer had no personal knowledge of the Zahoris, his information about them appearing to be derived from traditional stories coming from a preceding century.

During the present century there are only casual references to the Zahoris, and this race of pretended seers, some of whom possibly may have had supernormal faculties, has long died out, even the very meaning of the word being known to comparatively few.¹

¹ In addition to the literature cited see Baltasar Gracian, *El Criticon* (1653), pp. 124-43; G. C. Le Gendre, *Traité de l'Opinion* (1735), i. 491, 500-501; E. D. Hauber, *Bibliotheca Acta et Scripta Magica* (1739-45), xi. 747-68, xii. 816-821, xxii. 659.

DOWSING

We have had a Vice-President of Avenue, New York, and with other able dowsing exploits Saratoga Springs able to obtain all the matter; but it we print certain of

The first letter is "Regarding the parcel Adams Well, because acres at a sheriff's sale for a song, and one afternoon Mr Titus property he knew conscious of having us enter of gas I did not call information, except of our present spirit. After he went I too that in any way could which because it was land we owned had

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STANFORD UNIVERSITY

STANFORD, CALIFORNIA 94305

DEPARTMENT OF MATERIALS SCIENCE AND ENGINEERING

December 19, 1979

Mr. Ingo Swann
Building 44
Stanford Research Institute

Dear Ingo:

Here is a copy of our paper for you to read and think about. It has been rejected a second time by Nature (without reasonable cause) and so I will rewrite it for some other journal. In the meantime, I would like to begin a set of experiments with you wherein the goal is to get the device to function from a remote location.

We have a Faraday cage in the laboratory about 15 feet from the device so this remote location should be adequate for an initial study. I know it is possible to have it work from this location because I have achieved it once myself. Thus, I expect that you will be able to do it in an excellent fashion. After you have digested the paper, we can discuss the proposed experiment and develop a mutually acceptable protocol for its conduct.

Sincere best wishes,

Bill

William A. Tiller
Professor

WAT/mp
Encl.

A High Gain Biological Radiation Detector

by

William A. Tiller, E. M. Young and D. N. Modlin

A. Introduction

A short time ago, in an elegant psychokinesis (PK) experiment, Schmidt⁽¹⁾ found evidence for a direct interaction between the human mind and external quantum events. More recently, Balanovski and Taylor⁽²⁾ investigated several alleged paranormal phenomena in order to establish whether current understanding of electromagnetism was sufficient to explain the occurrences. Their conclusions were in the negative; electromagnetism was found not to give an adequate explanation of the effects studied. At this stage it would seem prudent to ascribe such effects as these to a radiation of unknown origin which might be simply labeled "a biological radiation."

Although macroscopic PK effects have been observed⁽³⁾, it is the microscopic domain experiments, involving very small amounts of energy transfer, that are being pursued most effectively at the moment. In particular, experiments of the high gain variety, each characterized by a simple physical system with an inherently large response to a very small disturbance, hold the greatest promise for understanding in this area⁽⁴⁾. The purpose of this

paper is to describe one such high gain system of the microscopic domain variety that we have found effective for detecting the emission of biological energy (B.E.) from humans. The present system employs a gas discharge technique that grew out of our studies on corona discharge photography⁽⁵⁻⁷⁾.

B. Detector Design

The basic device, based upon a poised gas discharge principle much like a geiger counter, has a sandwich-like shape with the gas isolated between two parallel planar dielectric surfaces separated by 10^{-3} M, as illustrated schematically in Fig. 1. Figure 2 presents a photograph of the assembled device which is $\sim 10^{-1}$ M from edge to edge and $\sim 2 \times 10^{-2}$ M thick.

Gold electrodes $\sim 3 \times 10^{-2}$ M in diameter were vacuum sputtered onto the outsides of the dielectric surfaces to a thickness of $\sim 450 \text{ \AA}$, thus allowing about 70% transmission to daylight but remaining nearly invisible in a darkened room while one observes the glow from the gas discharge. Tinned copper wire (#22) provides electrical contact with the electrodes, attached around their periphery by a mixture of a resinous adhesive and copper paint for both mechanical support and electrical continuity.

Quartz, high-lead glass, crown glass and soda-lime glass plates $\sim 2 \times 10^{-3}$ M thick have all been utilized as dielectrics. They all produced similar but slightly varying results because of variations in their electrical and mechanical properties. The dielectric surfaces were sealed to the phenolic frame structure by means of flat gum rubber gaskets just inside a bolting square of nylon hardware. The gap spacer section of phenolic contains both an input and an exit port, each terminated by a closure valve, for both

changing and isolating the gas initially charged at atmospheric pressure. A number of different gases have been used with varying results and the anomalous effects under study have been observed with such common gases as nitrogen and air.

The detector is powered by a finely regulated precision high voltage system capable of delivering an essentially undistorted sinusoidal voltage between $0 - 10^4$ volts RMS over the frequency range $10^2 - 10^4$ Hz. However, frequencies between roughly $10^1 - 10^5$ Hz were explored during the process of discovering a viable operating range. The power supply feeds one of the two gold electrodes while the other electrode is maintained at ground potential. The power supply arrangement is ^{also} illustrated in Fig. 1 (inside dashed rectangle).

In perspective, it should be pointed out that the detector resembles an oversized version of a basic plasma discharge "cell" and has many features in common with one of the cells in a conventional A.C. plasma display panel⁽⁸⁾.

C. Experimental Results

Early experiments showed that when a subject brought their palm or finger(s) within $\sim 5 \times 10^{-2}$ M of the grounded electrode, an intermittent and then often a brief sustained discharge developed in the gas even though the applied voltage V_A , was less than the breakdown voltage, V_{BD} , by several hundred volts ($V_A \sim 0.85 - 0.9 V_{BD}$). When the hand was removed, the discharge activity died away. It was also observed that the magnitude of V_A/V_{BD} producing these anomalous effects varied with frequency with the minimum value occurring around 500 Hz. Of course, because the hand was brought up to the grounded electrode, no voltage was applied to the palm or fingers.

(a) Pulse Counter Observations

One means of quantifying the foregoing observation was to place the system in a "counting" mode using the setup presented in Fig. 1 (ignoring the oscilloscope). With such a system, any current pulse larger than a present value is recorded as a single count. The minimum detectable pulse has a 5 nanosecond width at the 140 mV level of the pulse. The counter is set to register only positive pulses. Several revealing experiments have been carried out under this format: (1) Repetitive sequences with one operator; (2) Sequences with several operators; (3) Effect of subject intention; (4) Effect of shielding and perturbation sources. We shall consider these in turn.

(1) The standard procedure was to enclose a five-minute test period, when the subject had both his hands adjacent to the detector (WBH) parallel to and a few inches away from the electrode surfaces and was intentionally focusing his attention on the detector, with five-minute periods when the subject had removed his hands from top and bottom of the detector (WOH), broke his attention from the cell and had stepped away from the detector by several feet. Table I presents typical data gathered with subject A.

We note first that the "with both hands" (WBH) case produced significantly more counts than did the "without hands" (WOH) case. The WBH case gave similar results to the single hand case mentioned above. Secondly, we note that the detector often exhibits both an initial inertia effect and a "run-on" effect; i.e., there may be no enhanced discharge activity for the first few minutes of the WBH period and, after the five-minute WBH segment,

the enhanced discharge level may not decay back to the background level for an additional several minutes, even though the hands have been removed. Finally, from the thousands of completed experiments of this type with many different subjects, we have noted both an "acclimation" and a "fatigue" effect. Here, the total count number of consecutive experimental runs climbs as a subject becomes less anxious about and more acclimated to the experimental conditions. However, this increase is somewhat short-lived as the subject becomes either fatigued or bored and the total count number begins to drop again. The duration of this cycle can be as short as three consecutive experimental runs but usually occurs over five or more runs if subject rest periods are taken between runs. To give some appreciation for the variability in the results, Fig. 3 presents a histogram of the number of occurrences N^* versus the ratio of WBH counts/WOH counts. Dashed profiles denote 251 runs by subject A while blank profiles denote 60 runs by 11 other subjects. In this data, if the WOH counts were zero, the value was set at unity for calculation purposes.

(2) Table II illustrates typical data gathered on the same day from three different subjects, all of whom independently produced the enhanced discharge activity in the detector. The protocol was the same as for (1). In general, we have found nearly every subject tested thus far (~ 40) has been able to produce some amount of enhanced discharge in the detector. Further, the WBH/WOH ratio has ranged from ~ 2:1 to 10^5 :1 while averaging about 2×10^4 :1.

(3) Very early in these studies it became apparent that a subject's mental concentration on the detector during an experiment measurably affects their

performance. In general, the more "attuned" the subject, the more vigorous was the response. To test this effect, a single variation was introduced into the protocol. During the entire WBH counting period, the subject withdrew his mental concentration from the detector and mentally performed a simple arithmetic addition table; i.e., $2 + 2 = 4$, $4 + 4 = 8$, ... $51 + 51 = 102$, ...etc. Table III presents an especially successful example of this experiment where the mental withdrawal segment was sandwiched between two normal WBH segments. The evidence clearly indicates that some degree of focused mental intention from the subject on the detector is an essential protocol component for achieving the enhanced counting activity. On other occasions, depending on the mental state of the subject, the mental withdrawal effect is not so striking.

(4) Many conventional tests were performed with the detector to see if we could ascertain the nature of the B.E. giving rise to the enhanced counting activity. A grounded fine-mesh copper screen box was constructed to fit completely around the detector and serve as a small Faraday cage. This had no apparent effect on the response of the detector during experiments with the normal protocol. In all cases, the detector was first completely enclosed in plastic before the shield was fitted in place in order to prevent electrical arcing. Thus, both humidity factors and electromagnetic energies in the low frequency through radio frequency range were shielded.

Next, the detector was exposed to infrared light (at levels commensurate with that of normal body metabolic heat), to incandescent and fluorescent white light sources (15 watts centered 3 inches from either electrode) and

to ultraviolet light (continuous to 2500 Å⁰ from a 4 watt source centered 1 inch from either electrode). In addition, a medium-strength radiation source (C_S¹³⁷, 10μ Cu) centered ~ 2 x 10⁻² M from the ground electrode delivering ~ 0.8 mR/hr and 350 C/M into the gas, failed to produce any enhanced discharge activity. Once again, nothing within this segment of the electromagnetic spectrum had any effect on the detector.

Next, an artificial finger and palm-shaped dielectric charged to potentials as high as several kilovolts D.C. had no effect when brought to within an inch of the ground electrode surface. Likewise, neither a small permanent magnet (~ 50 gauss) nor a 60 Hz electromagnet of the same strength had any effect. When various thin electrically grounded metal foils (Al, Sn, Cu, Pb) or magnetic shielding materials were placed adjacent to the grounded side of the cell and a single hand brought up to within an inch or so of the metal sheet, which extended well beyond the edges of the cell, the detector still registered an enhanced counting rate (see Table I).

Finally, as another check on the heat radiating possibilities of the human hand, 1/8" thick IR glass filters of both the heat absorbing and the heat transmitting variety were fitted tightly in place adjacent to the detector's ground electrode. A single hand of the subject was then brought to ~ 1" from the surface and again the enhanced counting activity was observed.

(b) Oscilloscope Observations

A 400 MHz single-beam real time storage oscilloscope was employed in the circuit of Fig. 1 to display the current versus time characteristics of the individual microdischarges. A typical trace for the electron avalanche

current is presented in Fig. 4. These single avalanches had peak currents from 0.25 to almost 10 amps and typically 12 nanosecond duration. The lower limit on sensitivity was set by the triggering threshold of the scope, which was $\sim 0.1 - 0.4$ amps.

With a high triggering threshold, the electrical current generated in a WBH avalanche was generally larger than that generated in a WOH avalanche by factors of $\sim 2 - 10$. However, with a low triggering threshold and data taken using scope pictures with a high speed film, the situation is a little different. When exposures were made for both situations (WOH and WBH) such that the same number of counts are registered on the counter in each case, the photographic results appear to be the same; i.e., the average discharge profile appeared to be the same for both situations. Of course, for the WBH case, the exposure time was considerably less than for the WOH case. A large microavalanche probably creates a train of average microavalanches which register predominantly on the film and wash out the initiator. The stop and start nature and the higher trigger threshold of the charge storage scope favor the recording of the large exceptional microavalanches compared to the average. The foregoing experiments seem to indicate that the enhanced counting rate largely reflects a greater number of microavalanches rather than a larger average microavalanche for the WBH case compared to the WOH case.

D. Discussion

The typical current pulse of Fig. 4 is triggered from an initial microavalanche or parallel set of microavalanches. From the pulse times involved, one presumes that only electron transit times of the gap are possible, as