Effects of UFOs Upon People

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A summary of the present paper was given at a UFO symposium in 1986 entitled *Bridging The Gap*. Sponsored by the Mutual UFO Network, it was held on October 11–12 at the Tuolumne County Fairgrounds, Sonora, California. Available time allowed only a discussion of the thesis, essential UFO sightings, major technical points, and the conclusions. Similar abbreviated material was covered at the 24th *Annual National UFO Conference, UFOs Over America: 40 Years And Counting*, at the Burbank Hilton Hotel, Burbank, California, June 12–14, 1987. The full text as reproduced here was first published in *UFOs 1947-1987, The 40-Year Search For An Explanation*. Hilary Evans with John Spencer, Editors for the British UFO Research Association, Fortean Times, London, 1987.

INTRODUCTION

A vast reservoir of technical data on UFOs lies in the published reports of witnesses. And it can be tapped by the careful study of details in single, well-documented events or in the composite from many similar cases. Validity of the data is assured when the reports contain technical information that could not possibly have been known to the witnesses. Ironically, testimony from simple, ordinary folk can therefore be the most valuable. It is essential to focus attention upon the phenomenon reported rather than the identity of the witness or other diversionary issues. When a UFO produces some observable effect in our environment, it should be amenable to scientific analysis; that is, it should have a scientific explanation. Thus, competent investigation of UFO cases will usually disclose the exact mechanism that produces the observed effect, or at least identify one that might be responsible.

All observed effects of UFOs, except purely mechanical processes and artifacts, carry implications of electromagnetic and gravitational fields in their vicinity.[1] Technical studies of individual effects can establish limits to the parameters of those fields. So detailed studies of the wide range of effects should lead to a significant understanding of the UFO field. Limitations deduced from one effect may well be different from those of another, and still another. By overlaying these various constraints, specific parameters of the UFO fields should become progressively more apparent.

Previous studies by the author and others have converged upon microwave radiation from UFOs as a candidate cause of many of their effects. So a general discussion here can lay a foundation for understanding what microwaves are, how they are described, and, in succeeding sections, how they can interact with people to produce a variety of responses. Microwave radiation is that portion of the electromagnetic spectrum that lies in the frequency range of

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UFO involvement: As might be expected from such a background, his approach to the UFO phenomenon has been consistently pragmatic: "Civilizations presently unknown to mankind may exist in some extra-dimensional sense from which UFOs penetrate into our realm of existence; however, they fully partake of our physical reality while they are under our observation. As they certainly interact with the physical environment, details of such interaction should be studied from a scientific point of view. Explanations should not be sought in the realms of religion, psychology, biology, paranormal, or the occult, though these are valid lines of inquiry as corollaries to UFO sightings." He has been MUFON's Director of Research since 1975.

Publications: *Ufology, New Insights From Science and Common Sense* (1973) is not only an expression of the above position, but is widely respected as one of the most constructive contributions to the scientific UFO literature. This has been supplemented by numerous articles in *MUFON UFO Journal* and elsewhere.

300,000,000,000 to 1,000,000,000 cycles per second — abbreviated to 300,000 MHz (megacycles) to 1,000 MHz. Corresponding wavelengths are 10 to 0.1 cm. The specific frequency in a given event should be known. Next, the manner of delivery is important, whether continuous or pulsed, and if pulsed, at what repetition rate and what pulse width. It is easily seen that a strong but very short pulse followed by a relatively long interval before the next would deliver only a small amount of power. Thus one speaks of peak powers, average powers, and duty cycles. It need not be difficult to visualize a description of pulsed microwaves. Consider microwaves of 1,000 MHz being pulsed at 100 Hz having a peak power of 300 milliwatts per square centimeter ($mW/cm1^2$) etc. but an average power of only 2 mW/cm^2. A further concept to be encountered is that of *threshold*, namely the lowest power level at which any given effect takes place.

Physical effects of UFOs upon people can hardly receive a comprehensive treatment in a brief section, still less those responses which appear to be psychological and even parapsychological. They have not been touched upon here, but there is a mass of data that should be examined, particularly since the possibility exists that they may actually be only physical responses to radiation.

SIGHT

Almost everything known about UFOs is derived from direct, visual observation of unfamiliar things in the sky, or, occasionally, on the ground. In addition, many witnesses have reported strange creatures associated with UFOs and involuntary visits aboard the craft, but as these aspects are covered elsewhere, they are ignored here.

HEARING

1. Bullets

Several witnesses have responded to an approaching UFO in the manner of the Old West, that is, by drawing a bead and firing with a rifle or pistol. The bullets have been heard to strike metallic surfaces and whine off in ricochets.[2] Also, the landing of nearby UFOs has been heard as a thud such as would be expected from a not-so-gentle setdown of a ponderous machine.[3] While these sounds offer no clues to the UFO fields, they suggest that the objects under study are not imaginary, vaporous, holograms, ball lightning, or earthquake lights.

A survey of close encounter cases by the author classified five distinct types of sounds emanating from UFOs.[4] They were:

VIOLENT	(roar, explosion)
LOW PITCH	(hum, buzz)
RUSH OF AIR	(whoosh, swish)
HIGH PITCH	(shrill, whistle)
SIGNALS	(beeps, pulses)

2. Violent

Very early in the morning of September 30, 1980, near Sale, Southern Australia, George Blackwell awoke to a whistling sound. It came from a wingless craft 8 m. across that displayed colored lights as it spun. It flew slowly at low altitude, finally settling to the ground near a large water tank. The witness approached to within 15 m. when the whistling sound became very loud. Then he heard an awful bang, accompanied by a blast of air and heat as the object took off vertically and flew away.[5, 8]

A highway patrolman saw a strange object sitting on the ground in the San Joaquin Valley of California. It was early morning on a wintry day. Suddenly, the object became surrounded by a mist. Then a brilliant glow appeared as the object rose off the ground. A few seconds later, he heard an explosion as the UFO departed. The sound was clearly a shock wave from the UFO as the time delay was appropriate for the distance and the speed of sound.

Explanation

Shock waves appear to be generated only at take-off. While sitting on the ground, the propulsion system is presumed to be turned off; that is, no external field surrounds the UFO. Power would then be required to initiate the field. The sudden appearance of mist in the San Joaquin case is a vital detail. That region in California is noted for very dense, ground fogs resulting from ground cooling due to radiant heat loss to the cosmos during long winter nights and high humidity near sloughs and swamps. Water vapor adjacent to the UFO could have been condensed by a reduction either in temperature or pressure. Because the phenomenon was accompanied by a shock wave, a change in temperature alone can be ruled out. The newly generated field must have exerted an outward force on the atmosphere, thereby reducing the pressure close to the surface. A very small pressure change, indeed, would suffice to cross the dew point and condense water vapor from saturated air at 100% humidity. Such condensation can sometimes be observed in the low-pressure zone above airplane wings. Again microwaves emanating from UFOs are suspected because, at certain wavelengths, they are resonantly absorbed by water molecules with an accompanying transfer of momentum, that is, a force. Resonances are at wavelengths of 0.17 cm. with four stronger ones below 0.1 cm. Continuation of the process of pushing the air out of the way is the likely reason that UFOs can fly faster than the speed of sound without creating sonic booms.[6]

3. Tones

The most prevalent types of sounds are either low or high pitch. Words used by witnesses often succinctly and specifically denote the pitch. For example, the former might be approximated by a hummingbird, the latter likened to the squeal between stations on old-fashioned AM radios. Two revealing cases have recently come to light after being hidden for decades:

At 4:00 a.m. on July 25, 1957, several workers were taking a break at the Daye Steel Plant in Huangshi City, Peoples Republic of China. Upon hearing a humming sound, they noticed a bright spot in the clear night sky that was increasing in apparent size. As it came closer, it was seen as a circular plate giving off a dazzling white light and leaving a white trail. During a two- to three-minute observation, it flew over the frightened observers at 1000 m., producing a whistling sound that was louder than a jet. As the object approached the witnesses, the low pitch changed to high pitch; no mention was made of any intermediate tones.[7]

The next example, collected by the CIA in southern Belgian Congo in 1952, remained secret until released in 1983 under a lawsuit pursuant to the Freedom of Information Act. Two fiery objects glided in sweeping curves over uranium mines. They were seen in several perspectives as disks, ovals, and thin lines. During 10 to 12 minutes of observation, they emitted hissing and buzzing sounds. Commander Pierre at a small airfield jumped into a fighter plane and took off in pursuit. He was able to get within 150 m. of the objects that were disk-shaped, aluminum, 12 to 15 m. in diameter, with a rim of fire. They were emitting a whistling sound that could easily be heard over the airplane engine. Note that the sound changed from low pitch to high pitch as the witness approached the objects, without mention of intermediate tones.[8] In both cases, the range closed, with movement of the *object* in China and of the *witness* in the Congo.

Explanation

It has long been recognized that people can hear electromagnetic radiation in the microwave region, such as radar and microwave radiation from UFOs was suspected as the cause of humming sounds. Relatively little was known about this phenomenon 15 years ago, but it had been well established that the aural response was caused by short bursts of energy corresponding to pulsation of the microwave source. In some uncertain manner, the pulses stimulated the organ in the inner ear that sends signals to the brain. The tonal value perceived by experimental subjects corresponded to the pulse rage of the source. Also, the location of the source was usually thought to be behind the head as the direct response of microwave bypassed the time delay of ordinary, slow-moving sound waves reaching the more remote ear. This process, known as binaural audition, is one of several clues to recognizing the direction from which sounds originate. Vigorous research during the 1970s brought this highly complex phenomenon into sharp focus.[9] But for the present purpose, many details must be omitted so some statements are

subject to various technical restrictions that are not mentioned. Generally speaking, it has been shown experimentally that people are able to hear pulsed microwaves from 200 to 3,000 MHz with peak power densities of 300 mW/cm^2 and average power densities as low as 0.4 mW/cm^2 with pulse widths of 1 to 100 microseconds (*m*sec). As the shape of the response curve is a steep-sided mesa, the range of pulse width is probably about 10 to 40 µsec. In terms of average power density, the threshold is approximately 120 *m*W/cm^2. Therefore, very low-intensity, microwave radiation pulsed at 50 to 100 cycles per second would be "heard" and aptly described as humming. Experiments with animals showed that cats were 20 to 30% more sensitive than people, but one dog tested was 5 times more sensitive. That result may explain why agitated dogs are the first indication of many UFO events.

An entirely different mechanism, known as the thermoplastic process, appears to be responsible for the high pitch sounds. Absorption of energy in biological tissue produces an extremely small increase in temperature. Due to thermal expansion of the tissue, a corresponding increase in pressure is produced that then propagates through the medium as a sound wave. A microwave pulse impinging upon the head thereby creates a pressure wave that propagates through the skin, muscle, bone, and brain tissue and reverberates inside the cranium. These vibrations are carried by bone conduction to register as sound in the auditory nerve. Microprobes have been surgically implanted in the auditory nerves of animals to measure the frequencies of pulses stimulated by this mechanism. It has been found that *the frequency depends only upon the size of the head and the acoustical properties of brain tissue.* An extremely intricate, theoretical analysis by Dr. James C. Lin accurately duplicates the experimental data for guinea pigs and cats.[10] For example, the calculated frequency for cats ranged from 30 to 40 kHz, whereas the measured value was 38 kHz. The measured value for cats is within their normal hearing range, up to 60 kHz, but well beyond the limit of human hearing at 20 kHz. The calculated threshold for cats was 589 mW/cm^2 for a head radius of 3 cm. For a man with a head radius of 7 cm., the calculated frequency range from 10 to 15 kHz based upon theoretical models expected to yield upper and lower limits. The calculated threshold for man, 2183 mW/cm^2, is extremely high compared to safety limits in the U.S. for short-term exposure of only 10 mW/cm^2. Anyone hearing a shrill whistle from a UFO would be in serious danger.

Thus, experiment and theory show that the pitch perceived from impinging microwave pulses result from two distinctly different mechanisms. At weak intensities and pulse rates in the low audio range, the pulses directly stimulate the inner ear and are interpreted as humming sounds. For very intensive radiation pulses, pressure waves reverberate inside the head creating the impression of high pitch whistles. No known mechanism produces tones of intermediate frequencies. Thus, the sounds stimulated by microwave radiation from UFOs would be discontinuously dependent upon the distance to the UFO.[11]

SMELL

The idea that UFOs might produce some unique odors originally carried a touch of humor. But they really do! An early survey of the literature turned up 18 cases where witnesses noticed peculiar odors and attempted to describe them. Comparisons with sulphur dioxide, as in rotten eggs, were the most numerous. Other descriptions referred to benzene and its derivatives. Finally, a number of descriptions almost certainly identified ozone.

Explanation

Irradiation of various gases with microwaves produces a wide variety of gas atoms and free radicals, the required components for chemical reactions. In air, nitric oxide is produced. The efficiency of this reaction is greatly enhanced when the radiation is pulsed. Ethane and methane are decomposed, but benzene is stable in the radiation. In other words, a pulsed source of microwaves in air can generate nitric oxide and, in subsequent reactions, the benzene family that has been detected near UFOs. As benzene is not decomposed by the field, any formed would tend to accumulate to detectable concentrations. These concentrations need not be great considering the extreme sensitivity of the olfactory sense. Oxidation of sulphur by microwaves has been accomplished in the laboratory, namely conversion of sulphur dioxide to sulphur trioxide. Similar oxidation of sulphur, contaminating the atmosphere from automobiles and other sources, into sulphur dioxide could well account for the most commonly reported sulphurous odors.

There is a curious relationship between this aspect of UFOs and the controversial subject of ball lightning. Many of the same odors have been reported in association with small balls of light at close range. Electrical discharges in the atmosphere change energy states of various atoms and numerous chemical compounds are formed. Nitrogen is elevated to a metastable state having several interesting properties. It produces a soft, white glow that continues for some time after the discharge terminates. Such excited nitrogen is called "activated" because it readily combines with other atoms, whereas ordinary nitrogen gas does not. It combines with hydrogen to form ammonia (NH_3) and with oxygen to form nitric oxide (NO). Below about 150ºC it reacts with other atmospheric gases to form nitrobenzene ($C_6H_5NO_2$), an oily substance having a strong odor like bitter almonds. Also produced by electrical discharges in air is the highly reactive ozone (O_3) that can be detected around sparking electrical machinery.

As an aside, it is observed that the slow decay of activated nitrogen giving off a white glow is probably the cause of white, luminous trails so often seen behind UFOs as they traverse the sky. Activated nitrogen may also cause the slowly decaying clouds that are sometimes left at landing sites when UFOs take off.

It is clear that odors reported in UFO events are precisely those that would be expected from chemical reactions in the atmosphere triggered by electrical discharges or microwave radiation. Very few witnesses were cognizant of the technical details so their testimony can be taken at face value. The presence of microwaves seems assured, but unfortunately the data do not allow any quantitative deductions.[12]

TASTE

Three hunters in the Ocala National Forest of Florida were looking for a lost deerhound at 9:00 p.m. on December 14, 1975. They spotted a hemispherical object 8 m. high with 5 "legs" about 4.5 m. long. Emitting a bright blue-white light, it hovered over a power line then moved away as the witness approached to within about 200 m. During the half-hour observation, their CB radio failed, a humming sound was heard, a strange odor hung in the air, and "…they had a *funny metallic taste* in their mouths."

A Canadian case on October 23, 1967, involving 17 witnesses and 5 objects seems to be significant although the details were poorly described. A real estate salesman approached to within 200 m. of objects that had landed in a vacant lot. "Everything he ate tasted the same and there was a *taste of copper or metal in his mouth*." The objects flew away over some power lines that lighted up and the salesman's car and the steel flagpole at the show house were later found to be magnetized.

Explanation

Recalling these and other such reports, the author's curiosity was raised by a casual remark of a friend. She had undergone a treatment of electrolysis for hair removal. When the electrode was placed on the cheek, she experienced a taste sensation "like eating tinfoil" that lasted about 15 minutes after the treatment. The implication was obvious. Some electrical or magnetic effect produced the same sensation in an electrolysis patient as in a UFO witness! A professional electrologist furnished some details. Low-voltage electricity is applied to a hair root at 13.56 MHz or with direct current. In her experience, the taste occurred only when using DC. It is most prominent during an "after treatment" on the lower portion of the face using, as a cathode, a freely rotating conducting cylinder covered with damp gauze. The author reluctantly submitted to such treatment and decisively experienced the phenomenon as the device rolled over the cheeks, lips, chin, and especially the jaws. The taste is hard to describe and the word "metallic" came to mind but seemed inadequate. There was a tingling component and a strange bitterness. The location on the tongue was the lower edge of the front half where the tongue contacts the teeth.[13]

Technical information on this subject is hard to find, but a comprehensive survey article may be available in some medical libraries.[14] The phenomenon has been known since the pioneering work in electricity. It was discovered when two dissimilar metals were applied to the tongue, creating a primitive battery. Test subjects over the years have always had difficulty describing the taste. Much research has developed a wealth of detail about the phenomenon. While individual responses vary considerably, the threshold for detection is a current of about 100 microamperes. The taste increases with stronger currents. Its onset is immediate but it decays very slowly. The sensation is evoked by direct current pulses as slow as 0.5 per second that is perceived as continuous. Alternating

current is also effective but not above 1,000 Hz. While the cause has not been unequivocally established, it appears to be a combination of direct action of electricity on the taste cells and normal chemical effects of products of electrical breakdown of saliva.

A fundamental theorem of electromagnetism is that a magnetic field, while changing intensity, will induce an electric field that in turn drives a current in a conductor. So the current causing metallic taste could arise from a transient magnetic field alternating at less than 1,000 sec^{-1} or one being turned on and off in that range. But the human body is almost as effective an antenna as a copper wire of the same length. So short blasts of electromagnetic energy could also produce eddy currents of sufficient strength to stimulate the taste. In any even, the essential requirements are a current of at least 100 microamp that may be DC or pulsing up to 1,000 sec^{-1}. By examining other pertinent data from UFO sightings, one might be able to establish which of these two mechanisms is involved.

REVIEW OF MAGNETIC EFFECTS

Magnetic fields associated with UFOs have produced a wide variety of effects strongly suggesting a static or slowly changing field. They have *induced permanent magnetism* in ferrous objects such as signs and flagpoles. Many wristwatches have been *stopped* during a UFO sighting then later found by a jeweler to be magnetized. Such residual magnetism could have been produced only by static fields or ones changing intensity very slowly; rapidly pulsing fields, on the other hand, would erase magnetism. That technique is used to erase magnetic tapes and to "degauss" ships. The author has duplicated most types of radio interference from UFOs with static, magnetic fields.[15] The most sensitive components of transistor radios are coils in tuned radio-frequency and intermediate-frequency circuits. The magnetic field modifies the physical property of their ferrite cores. The circuits are thereby detuned from the selected station. Reception begins to fade at about 350 gauss and is entirely blocked at about 800 gauss. Such fields are moderately strong, being typical for bar magnets. Continued increases in field strength will shift the tuning to the next station of higher frequency. A radio can be tuned across the whole dial in that manner. Radios originally set at stations in the upper end of the dial will be driven completely beyond the AM band, where they can receive navigational signals in Morse code.

Slowly pulsing magnetic fields around UFOs have been suspected to cause agitation or *spinning of compasses*. Intuition suggests that sustained rotation of a compass can be produced by a weak magnetic field only if it is pulsed at a rate approximating the natural resonant frequency of the compass. That point was verified in experiments by the author in which spin rates of liquid-filled compasses were sustained from 6 to 20 rpm depending upon the strength of the applied magnetic impulses. Overly strong impulses threw the compass into wild agitation. On February 2, 1973, Captain Peter Telling was piloting a commercial flight in Australia. At first fearing a fire in his starboard engine, he spotted an intense bluish-white light 7–14 m. in diameter at a distance of 10 m. It paced the airplane for 20 to 25 seconds. His automatic direction finder, gyrocompass, and *magnetic compass* all went haywire and spun at 12 rpm.[16] The pulse rate of the magnetic field was thus measured to be as slow as 12 rpm = 0.2 sec^{-1}, or one pulse every 5 seconds.

Actually, the magnetic fields from UFOs have been precisely measured with scientific instruments in the field![17] French aerospace scientist, Dr. Claude Poher, former head of GEPAN, studied the relationship between UFO sightings and major disturbances of the earth's magnetic field. France maintains a series of research stations monitoring atmospheric conditions, nuclear explosions, and the three components of the geomagnetic field. They are generally located in remote areas to minimize electromagnetic interference. During the fall of 1954 when UFO sightings were unusually frequent, fifteen events were found in which the exact location and time of the sighting corresponded with a major disturbance of the magnetic field at the research station. While moderately strong fields are measured in gauss, very weak fields are measured in gammas, the ration being 1 gamma = 10^{-5} gauss. Maximum disturbances in the vertical component of the field ranged from about 5 gamma to about 80 gamma for distances of 24 to 100 km. The geomagnetic field in France is about 0.454 gauss with a declination of 10 degrees west and a dip of 60 degrees downward toward the north. Hence, the vertical component would normally be (0.454) sin 60 = 0.393 gauss = 39.300 gamma. The measurements are thus seen to be extremely sensitive, namely on the order of 1 part in 1,000. Five experimental data points clustering around 5 gamma at 85 km. are taken as a baseline. As magnetic fields diminish from their source inversely as the third power of the distance, Poher's data allow the calculation of

the source strength, or magnetic moment, of the UFO. It is found to be 7.7 x 10^{11} amp meter^2! That figure is phenomenally high compared to current research on super-fields and the hint of advanced technology from unearthly sources is inescapable. The magnetic field strength at any distance from UFOs can also be calculated from the scientific measurements. It would be 425 gauss at a distance of 130 m. from a UFO, a typical range at which electromagnetic effects are observed and consistent with the experimental data on radios.

From the foregoing review of magnetic effects, it appears that magnetic fields from UFOs are static or pulse very slowly. It is, therefore, unlikely that they could produce significant currents in the body because such induction is proportional to the rate of change of the field strength. The rate of change of a static field is, of course, nil.

In contrast, direct evidence indicates that pulsed microwaves are a strong candidate. In 1958, a four-year, comprehensive medical survey of the physiological effects of radar was completed at Lockheed Corporation. Many employees were routinely exposed to low-intensity radiation during final tests of aircraft radar. Their medical histories were compared with those of employees who had not been exposed. Despite various minor symptoms, no pathological changes were observed for occasional exposures up to 13.1 mW/cm^2 in the S- and X-bands having frequencies of 1,500–5,200 and 5,200–11,00 sec^{-1} respectively. Almost 6% of 335 people exposed to the S-band field experienced a "buzzing or pulsing sensation," a phenomenon with which the reader is already familiar. "Less than 1%…" presumably meaning three individuals, experienced "sparking between dental fillings or a *peculiar* metallic taste."[18] (My emphasis.) There seems little doubt that pulsed microwaves are perfectly capable of stimulating the taste, particularly at power densities greater than 13.1 mW/cm^2.

FEELING

In almost every instance of short range observations of UFOs, witnesses have experienced a sensation of heat. The intensity may vary from a mild warmth to a frightening and painful burn. Frequently the witness retains a semi-permanent record of such encounters in the form of a sunburn or even blisters. The burns are generally limited to areas that are directly exposed to the UFO.

Explanation

If a UFO is encased in a brilliant plasma, it will radiate energy in a broad band of frequencies or wavelengths. Extending well beyond the visible spectrum, the flux of energy will include longer and shorter wavelengths in the infrared and ultraviolet regions. Infrared radiation is the mechanism by which heat is transmitted at a distance. If, on the other hand, the UFO is not covered with a plasma and a metallic surface is visible, it can still radiate substantial intensities of infrared due to the elevated temperature, particularly if it is self-luminous, glowing in a soft orange color like the heating elements of an electric stove. The radiant energy transmitted per unit area and unit time may be expressed as millicalories per square cm. per second (mcal/cm^2 sec) and compared to energy received from the sun. The solar irradiation constant, the energy striking an area perpendicular to the rays, amounts to 32.3 mcal/cm^2 sec. So the rate of heat input to a witness can be roughly estimated from the description of the experience or more accurately if the witness were asked for a direct comparison. Assuming isotropic emission from the UFO, one can calculate the total energy emitted by the UFO in that bandwidth. But that is not the whole story.

1. "Sunburned" Skin

Manuel Amparano, a policeman in Kerman, California, observed a bright object in the sky during the night. It emitted a blue flash then departed straight upward in seconds. Upon returning to the station, he was found to be sunburned as red as a lobster. The effect faded in four hours. The burn was only on the portion of his body directly exposed to the UFO. *His long-sleeve uniform afforded no protection*, but he was completely shielded by the door of the patrol car.[19]

In Baden, Pennsylvania, on August 13, 1965, a middle-aged man saw a disc in the night sky fly in front of the moon. It was estimated to be 100 m. in diameter at a distance of 700 m. Its orange lights weakened as it became a very intense blue for three seconds. Shortly afterward, a shock wave was felt. Within 20 minutes, his eyes became painful and he gradually lost his vision for a few days. Oddly, his entire body was sunburned as if by "ultraviolet."[20]

Explanation

Obviously, ultraviolet could not have produced the sunburn because it could not have penetrated the clothing! The same applies to the California policeman. Microwaves, however, could penetrate clothing and burn the skin but be reflected by a car door. Early experiments by the U.S. Navy explored the heating sensation of microwaves. Energy from 10 cm. waves and longer penetrates deeply and is dispersed throughout the body. Hence, only a small fraction is absorbed at the surface where biological heat sensors are located. But shorter wavelengths are preferentially absorbed in the skin and are thus more effective in stimulating the sensation of heat and causing burns. They are almost as effective as infrared! The experiments showed that the threshold for feeling warmth from microwaves of 1 cm. in an exposure of a few seconds was about 2 mcal/cm^2 sec.[21] In other words, people can feel the warmth from 1 cm. microwaves at less than one-tenth the energy flux from the sun. Burns would naturally be caused by much higher intensities.

2. Hot Objects

David Winter experienced a typical automobile failure while driving home in British Columbia at 2:15 a.m. on December 13, 1967. It was a clear, cold night with the temperature about 20–25°F. He pulled off the road to look under the hood for the source of trouble. Only then did he notice an object hovering about 15 m. above the ground about 100 m. away. It was shaped like a dome, flat on the bottom, displaying red and green lights with what appeared to be portholes emitting light. The surface looked like wire-brushed steel. He noted that his battery felt warm. Becoming apprehensive, he then got back into the car while watching the object drift closer in a gentle rocking motion. He became frightened upon discovering that his hair felt warm. Later he said "…and the copper ring on my left ring finger got rather warm and unpleasant so I decided to take that off too. And I noticed my watch getting a little… I have a metal watch band here and it got warm..." Also, "A metal button and metal fly in my pants and they got hot." During a second inspection of the car, he retrieved a flashlight from a toolbox and noticed that its metal frame became hot but the lens remained cold. Metallic parts of the car had become hot but the tires felt as cold as the air.

Explanation

Observe the contrasts between the items that were heated versus those that were not. Nonconducting materials (rubber and glass) remained at ambient temperature whereas electrical conductors (steel, copper, and silver) became hot. The watchband may have been gold but its material was not stated. Warmth of the battery was caused by heating of the battery acid, a conducting medium.[22] Undoubtedly, a high-frequency electromagnetic field was inducing eddy currents in the conductors that produced resistance heating. Differences in the temperatures of the rings would be expected due to the different electrical resistivities of copper and silver and their individual dimensions.[23]

3. Electrical Shock

In the late 40s and early 50s, most UFO sightings were high-altitude flybys unless it was that witnesses were more reluctant to confess to close encounters and investigators to report them. It was not until the 1954 flap in France that witnesses in substantial numbers reported UFOs at very short ranges and an accompanying feeling of tingling or electrical shock. Then in 1958 near Lima, Peru, a UFO descended and hovered near a truck, bus, and car. Passengers in all three vehicles felt an electrical shock at the same time that their engines failed. NICAP was the first organization to take a particular interest in such electromagnetic effects and to publish an extensive record of the events.[24]

Explanation

Radar systems operating at microwave frequencies have become so powerful that the hazard of electrical shock to workmen has become serious. Special protective clothing has been developed that covers the entire body, head, face, hands, and feet. Made of metalized nylon, it reflects electromagnetic energy away from the wearer. A special

feature assures electrical continuity across the seams. A surface layer of neoprene prevents closing a circuit between two objects at different electrical potentials that might be touched at the same time by a workman.[25]

Human-like creatures seen in association with UFOs are invariably described as wearing skin-tight, one-piece uniforms covering the whole body including the feet. They are notably without buttons, zippers, pockets, discontinuities, and seams. One witness peering into the goggles of a UFOnaut observed a fine, wire-mesh screen that would effectively shield the eyes against microwaves. UFOnauts are apparently taking the same precautions that we are in the presence of intense microwave fields. In such environments near UFOs, unprotected witnesses would be expected to feel the induced currents in the skin as a tingling sensation or an electrical shock.

BY-PASSING THE PHYSICAL SENSES

Some physical effects are visited upon the witness although they are not immediately registered by the ordinary senses.

A. Paralysis

At the time of an engine failure in the presence of a UFO, the witness may be surprised to discover that he is unable to move. A specially graphic example was the experience of a farmer in Saskatchewan. He climbed down from a swather to investigate a 3 m., silver-colored, dome-shaped object that was hovering close to the ground and spinning in deep grass. Upon backing away and remounting the machine, he noticed four more similar objects spaced out along a nearby slough. The first object then rose up to about 60 m., followed by the second, then the third, and so on. During these maneuvers, he was paralyzed. In a taped interview, he later said, "I sat there like I was froze, I couldn't move nothing." Further elaboration was telling and clear:

> I didn't have the strength to move anything on it (the farm machine). See, it's a hydrostatic drive, automatic like a car, steering also. I couldn't move anything, all I had to do was push the lever or turn the steering wheel, but I couldn't. I felt like I was hypnotized or paralyzed, I had no strength. I tried to move that lever but I couldn't. Just a touch of your finger — it will move. Nothing seemed to work right, I was scared, I've been scared before, but nothing like this. I wanted this hand on the gear shift and this one on the steering wheel and you think I could move it? I couldn't budge it.[26]

Explanation

Of primary concern here are the fundamental properties of motor control nerves. In some ways they resemble electrical wires but the similarity cannot be carried very far. A central core of protoplasmic material, a moderately good conductor, is surrounded by a sheath or membrane of a fatty substance that is a moderately good insulator. Orders to outlying muscles, sent by the central nervous system, travel along these fibers as a wave of electrical potential. The travelling pulse, known as an action potential, always has the same intensity in a particular fiber. At any point along the fiber, it is either present or it is not. It never shows up only partially or at a potential different from the norm. Energy for transmission of this signal derives from the fiber itself, not from driving force at the input end. The sheath is interrupted at intervals of about 1 mm., called Ranvier nodes, and the transmission energy is supplied by the passage of certain ions through the membranes in these short segments. The width of the pulse is about 1 millisecond and it travels at various speeds, depending upon the size of the fiber, typically about 10 m/second. Measurements of electrical potentials inside the sheath show that a fiber at rest is about 0.07 volts negative compared to the external solution. An action potential travelling down the fiber has a positive amplitude of about 0.10 to 0.12 volts. Therefore, at the moment the action potential occupies a position in the fiber, its interior experiences a momentary swing that is about 0.04 volts positive compared to the outside.

Experimental electrodes implanted in the fiber at any location can trigger the standard pulse by impressing a potential difference across the membrane of about 0.02 volts or greater. Pulses then travel outward in both directions along the fiber, although they would normally travel in only one direction. After the pulse has passed through one segment of the fiber, a finite time is required for that segment to return to normal. During the recovery period, it is completely incapable of transmitting another pulse. For about one millisecond, the fiber cannot be stimulated at all.

For roughly another millisecond, it can but only by a stimulus stronger than usual. If a stimulus below the threshold of 0.02 volts followed by another within about 2 millsec, then the second one may evoke a response even though it too is weaker than the threshold. The first stimulus opens the gates, so to speak, for the next one.

If microwave radiation were capable of providing the requisite stimulus, then action potentials would be induced. It has been found, in fact, that microwaves can create the necessary electrical tension across the membrane. By inserting miniature electrodes into nerve fibers, the potential difference between the inside and the outside can be measured. Irradiation by microwaves induces potentials that are typically in the millivolt range, but are sometimes as high as 0.10 volt, five times stronger than the threshold value of 0.02 volt. As action potentials triggered by this mechanism would be identical in every respect to those that are sent by the central nervous system, there would be no way that receptors could detect them to be fraudulent. Muscular responses would be absolutely dictated by such artificially produced signals. A muscle contraction persists for about 500 millisec before relaxing. So a series of pulses impacting a muscle at a faster rate would produce an indefinitely sustained contraction. As all skeletal muscles occur in opposing pairs, their indiscriminate and simultaneous contraction would freeze them in rigid opposition, that is, paralyze the body.

Any legitimate action potential from the central nervous system, representing some intended muscular behavior, would be annihilated upon collision with the extraneous signal travelling in the wrong direction. Thus, action potentials triggered by microwaves interfere with volitional control. Partial loss of motor control would be produced by slower pulses of microwaves, a reported UFO effect.[27] Because of health hazards, humans have not been intentionally exposed to high-intensity microwave fields so there is no experimental verification of the above analysis. However, motor disruption and partial paralysis by microwaves have been experimentally observed in chickens, pigeons, sea gulls, and small animals.[28]

2. Radiation Injuries

An Ohio farmer and his wife were watching TV one night in November 1958 when the set acted up and went black. Then a strange light from the window caused them to look outside and discover a large object some 6 m. in diameter hovering over their backyard. The husband went outside to investigate. He remained still (paralyzed?) as the object moved directly over him. Immediately he felt ill and within 48 hours was dead, "…his insides fried as though by the heat of a microwave oven."[29]

A similar exposure of lesser severity may have been the cause of major health problems in the extremely well documented Cash-Landrum case near Houston on December 29, 1980. It has probably been investigated more thoroughly than any other case and much has been written about it.[30] In the briefest possible summary, two principal witnesses were dazzled by a diamond-shaped object hovering low over a highway. Around it at some distance were a large number of helicopters of recognizable types. Exposure to the bright light, heat, and other radiation lasted 5 to 10 minutes. Both victims suffered severe burns, glisters, loss of hair, internal injuries, and at least 18 other symptoms.

Explanation

The investigators, including medical professionals and other physicians who cared for the patients over an extended period, fully recognized that the above injuries were caused by radiation of a broad spectrum including X-rays, microwaves, infrared, and ultraviolet. They also emphasize that the object described by the witnesses was simply not identifiable by them, nothing more. Also, the presence of helicopters raised the question of whether the object might have been an experimental aircraft of the United States Air Force. The main points here are that (1) infrared and probably short microwaves produced the burns, (2) internal injuries were probably caused by the heating effect of the more penetrating, longer microwaves, and (3) loss of hair was due to the well-known effect of ionizing X-rays with probably contributions from microwaves. An atmospheric plasma produces a strong component of X-rays by the deceleration of electrons colliding with molecules and ions in the highly agitated, ionized gas. This process, known as Bremsstrahlung, also generates a broad spectrum of photons having lesser energies and correspondingly longer wavelengths in accord with the reported injuries in the Cash-Landrum case.

WEIGHING THE EVIDENCE

It has been shown from scientific sources that microwaves from UFOs could account for most physiological responses of witnesses, except for such mundane matters as visual observation and hearing bullets ricochet. For the senses of hearing, smell, taste, and feel, the formerly puzzling effects were traced to specific mechanisms that are capable of producing them. Some interactions between microwaves and the sensory organs appear to be mysterious, may be unknown to the general public or even experts in other fields, but are well-established facts. In addition, much information was found to describe the interactions quantitatively. It should be helpful at this point to assemble that data in Table 1 and analyze the various constraints imposed by the sensory physiology.

Scanning down the column of thresholds in Table 1 highlights the extreme sensitivity for hearing a humming sound at 0.012 mW/cm^2. It is little wonder that this response frequently causes the witness to look around for the source and discover an object in the sky if he were not previously alerted by the family pet. The humming sound is so consistently reported that the corresponding field parameters are considered to be typical. So a pulse rate of about 50 to 100 cycles per second is implied in accordance with the frequency of audio tones described as humming. That rate is well below the limit of 1,000 sec^{-1} required for inducing metallic taste. In order for microwaves to be heard, they must be between 200 and 3,000 MHz and have pulse widths between 1 and 100 microsec but probably between 10 to 40 microsec.

The feeling of heat begins in the upper frequency ranges at 2 $mcal/cm^2sec$. But direct comparison with the other thresholds requires a conversion into compatible units leading to the equivalent value of 8,37 mW/cm^2sec.[31] As this threshold for feeling heat is about 700 times higher than that for hearing, it is no surprise that the sensation of heating is restricted to short-range cases, whereas a UFO at a considerable distance can be heard. As pointed out previously, the threshold for high-pitch sound, being some 22,000 times greater than for the hum, would endanger the observer. No further evidence allowing determination of thresholds could be found.

As to the frequency of the radiation, there is a pattern of consistency. Whereas hearing requires frequencies of 200 to 3,000 MHz, paralysis implied approximately 3,000 while internal injuries require less than 3,000. All frequencies are capable of producing high-pitch sounds, metallic taste, odors, heating of conductors, and electrical shock. These effects, therefore, could all be generated within the frequency limits imposed by the humming sound. On the other hand, something unique appears to be happening when shock waves are generated because they require frequencies greater than 60,000 MHz to couple with the molecules in the atmosphere. A clue may be afforded by the blue flash that was reported in two cases above, but this question is unresolved.

TABLE 1 – Summary of infrared electromagnetic parameters.

		ELECTROMAGNETIC FIELD				
PHYSICAL SENSES		Microwave ?	Threshold (mW/cm^2)	Frequency (MHz)	Pulse Rate (sec^{-1})	Pulse Width (microsec)
Sight		No	–	–	–	–
Hearing:	Bullets	No	–	–	–	–
	Shockwaves	Yes	?	>60,000	?	?
	Low Pitch	Yes	0.012	200-3000	50-100	1–100
	High Pitch	Yes	2183	Any	Any	Any
Smell		Yes	?	Any	Enhances	Any
Taste	100 mAmp	Yes	<13.1	Any	<1.000	Any
Feel:	Heat	Yes	8.37	30,000	Any	Any
	Hot Objects	Yes	?	Any	Any	Any
	Elec. Shock	Yes	?	Any	Any	Any
BYPASSING PHYSICAL SENSES						
Paralysis		Yes	?	≈3,000	>500 Enhc.	Any
Injuries:	Burns	Yes	?	30,000	Any	Any
	Internal	Yes	?	<3,000	Any	Any
	Hair Loss	No	–	–	–	–

Summary of infrared electromagnetic parameters

CONCLUSIONS

Careful study of UFO case histories can reveal considerable detail on the sensory responses of witnesses. Furthermore, a parallel survey of scientific literature in a variety of subjects will sometimes disclose specific mechanisms that may be responsible for the reported effects. Finally, experimental data in the literature or obtained by the investigator can provide quantitative information about the physiological responses and the parameters of UFO fields. It has been found that most UFO effects on people can be attributed to a complex field consisting of two components, namely:

1. An electromagnetic field in the microwave region having
    a) frequency in the range of 200 to 3,000 MHz,
    b) pulse repetition rate of 50 to 100 sec^{-1}, and
    c) pulse width of 1 to 100, more likely 10 to 40 microsec.

    The onset of physiological responses begins with a humming sensation at an average power density of 0.4 mW/cm^2 but field intensities many thousand times greater may be experienced.
2. A magnetic field that varies intensity slightly about every two seconds. The intensity at the witness is on the order of 1,000 gauss for close encounters.

An extensive series of laboratory and field experiments could reduce the range of uncertainties in the field parameters, and eventually lead to a full understanding of UFO propulsion systems.

Reports of UFOs emphasize two major points: Firstly, they hover in the sky with no indication of a familiar propulsion system such as propellers, jets, or rockets. No momentum is transferred to the atmosphere and there is a notable absence of violent and noisy downwash. The objects appear to defy gravity. The other point is their strange manner of flitting about. Observers are frequently startled by a sudden acceleration far exceeding normal experience, also by instantaneous stops and right-angle turns at high speed. Not only do UFOs appear to be anti-gravitational, they behave as though they had no inertia.

In the General Theory of Relativity, Dr. Albert Einstein postulated the Principle of Equivalence. It states that the property of matter, called mass, is the same whether responding to gravitational forces or to accelerations. For the mathematically inclined reader, that means that the small "m" in the universal gravitational equation ($F = GmM/r^2$) is identical to the small "m" in the inertial equation ($F = ma$). That identity has been demonstrated in satellite experiments to a precision of 1 part in 10^{14}. So what does that mean? If a method should be developed to nullify the effect of gravity, it would automatically and necessarily nullify inertia! A hovering UFO that directly defeats gravity would have an inherent ability to fly without the familiar restrictions of inertia.

It is remarkable indeed that witnesses in all countries, languages, and educational levels from scholars to primitives have been describing the phenomenon correctly for 40 years although very few were acquainted with General Relativity. We have not listened well.

References & Notes

[1] McCampbell, James M., "The Scientific Challenge of UFOs," *The MUFON UFO Journal*, No. 194, April 1984.

[2] Fowler, Raymond E., *Casebook of a UFO Investigator*, p. 45, Prentice-Hall, 1981, and *Interplanetary Visitors*, p. 12, Exposition Press, 1974. Also see Salisbury, Frank B., *The Utah UFO Display*, p. 94, Devin-Adair, 1974.

[3] Pratt, Bob, Editor, translated by James E. O'Brien, "GEPAN's Most Significant Case," *The MUFON UFO Journal*, March 1984.

[4] McCampbell, James M., *UFOlogy*, Chapter 4, Celestial Arts, 1973.

[5] Basterfield, Keith and Bill Chalker, "*New Physical Evidence Cases in Australia*," *MUFON UFO Journal*, No. 156, February 1981.

[6] McCampbell, James M., "An Hypothesis Concerning the Origin of UFOs — Horses Under the Hood," p. 37, *Thesis-Antithesis*, Proceedings of a Symposium sponsored by the Los Angeles Chapter of the American Institute for Aeronautics and Astronautics, September 27, 1985; and "UFO Technology and Technicians," p. 109, *The Golden Gateway to Astronomy*, WAA/ALPO/AANC Joint Conference on Astronomy, San Francisco, August 7–10, 1975.

[7] Stevens, Wendelle C. and Paul Dong, *UFOs Over Modern China, A Survey of the Phenomenon*, UFO Photo Archives, 1983.

[8] Fawcett, Lawrence and Barry J. Greenwood, *Clear Intent*, Prentice-Hall, 1984.

[9] Lin, James C., *Microwave Auditory Effects and Applications*, Charles C. Thomas, 1978.

[10] Ibid., p. 157.

[11] McCampbell, James M., "Hum and Whistle a UFO Tune," *The MUFON UFO Journal*, No. 205, February 1985.

[12] McCampbell, James M., *UFOlogy*, p. 38.

[13] McCampbell, James M., "A Taste For UFOs," *The MUFON UFO Journal*, No. 205, May 1985.

[14] Bujas, Zoran, "Electrical Taste," Chapter 10, *Handbook of Sensory Physiology*, Volume IV, Part 2, *Chemical Senses*; Lloyd M. Beidler, Editor, Springer-Verlag, 1971.

[15] McCampbell, James, *UFO Interference with Radios*, In press.

[16] Hauck, Dennis W., Editor, "Pilot Experiences Electromagnetic Effects," *The MUFON UFO Journal*, No. 107, p. 11, October 1976.

[17] Hynek, J. Allen and Jacques Vallée, *The Edge of Reality*, p. 89, Regnery, 1975.

[18] Barron, Charles I. and Albert A. Baraff, "Medical Considerations of Exposure to Microwaves (RADAR)," *Journal of the American Medical Association*, Vol. 168, No. 9, pp. 1194–1199, November 1, 1958.

[19] Hynek, J. Allen, Editor-In-Chief, "California Policeman Burned by UFO," *International UFO Reporter*, Vol. 3, No. 9, p. 10, September 1978.

[20] Vallée, Jacques, *Passport to Magonia*, Case 677, p. 313, Regnery, 1969.

[21] McCampbell, James M., "UFO Interference With Automobile Electrical Systems, Part I: Headlights," *Proceedings of the 1976 CUFOS Conference*, Lincolnwood, Illinois.

[22] McCampbell, James M., "Overheating of Car Batteries," *The MUFON UFO Journal*, No. 167, January 1982.

[23] McCampbell, James M., "UFOs and Hot Rings," *The MUFON UFO Journal*, No. 189, November 1983.

[24] Hall, Richard H., *The UFO Evidence*, p. 73, NICAP, 1964.

[25] McCampbell, James M., *UFOlogy*, p. 77.

[26] McCampbell, James M., "Interpreting Reports of UFOs," *Proceedings of 1975 MUFON Symposium*, Des Moines.

[27] McCampbell, James M., *UFOlogy*, p. 75.

[28] Milroy, William C. and Sol M. Michaelson, "Biological Effects of Microwave Radiation," *Health Physics*, pp. 567–575, Vol. 20, June 1971.

[29] Stringfield, Leonard H., *Situation Red, The UFO Siege!*, Doubleday, 1977.

[30] Schuessler, John F., "Cash-Landrum Case: Speculation About the Medical Effects," p. 108, *MUFON 1984 UFO Symposium Proceedings*.

[31] A convenient approach is to convert watts and cal/sec. 1 erg = 1 erg x 1 BTU/1055 joule x 1 joule/10^7 erg x 252 cal/BTU = 2.39 x 10^{-8} cal. Then 1 watt = 1 joule/sec = 10^7 erg/sec x 2.39 x 10^{-8} cal/erg = 0.239 cal/sec and dividing through by 1,000 gives 1 mW = 0.239 mcal/sec. Hence the threshold = 2 mcal/cm^{2}sec x 1 mW/0.239 (mcal/sec) = 8.37 mW/cm^2.