SEVEN MAXIMS OF UFOs – A SCIENTIFIC APPROACH*

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Introduction. Man, as a species, is an animal with great curiosity combined with an intelligence that caters to this curiosity. Over the centuries these facts have resulted in a vast accumulation of knowledge about the universe we live in, and especially about our immediate surroundings. If a very unusual event occurs an attempt is immediately made to fit this into the pattern of past collective experience, and if the event cannot be filed in some convenient and recognized category it may easily become an intellectual annoyance – spurned by the narrow-minded and over-emphasized by the uncritical. In recent years, with the advent of the Space Age, experiences involving what have been popularly termed Unidentified Flying Objects (UFOs) have displaced, in public interest, earlier enthusiasms for the study of psychic phenomena through spiritualism and the investigation of haunted locations.

Personally, I cannot claim to be an expert on UFO phenomena, nor to have special knowledge in any other area of strange events. However, from the age of five on I was taught by my parents to take a lively observational interest in the world around me, and as a result I ended up collecting almost everything as an amateur naturalist. My studies in astronomy commenced at the age of nine and I have followed a career of observing the sky for the subsequent sixty years.

Specializing in meteoritics, it is natural that I have been called upon to investigate a great variety of sky phenomena observed by the general public. Perhaps my most lasting impression, as I recall hundreds of conversations with people in all walks of life, is that of the tremendous variability of the human reaction to any given event. I can recall interviewing as many as 200 individuals who had witnessed a brilliant fireball that resulted in a meteorite fall, and a large percentage of these observers had a subconscious subjective input to add to the external, objective, physical event being reported. Courts taking evidence in a complicated traffic accident case experience the same pattern of individuality of the human reaction to events.

In this brief article I am not going to attempt a study or an explanation of

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specific UFO sightings. This type of treatment requires a book-length publication, and many of my readers would probably not agree with my conclusions in any case. However, over the years, my experience has made it clear that there are certain basic principles or maxims which are relevant to this subject, and about which there can be no real argument. Anyone studying a UFO incident should remember these maxims, while maintaining an open mind and an unprejudiced attitude. I think that each person should come to his own conclusions on the basis of unbiased common sense. Ridicule, or emotional reactions, are quite out of place. We will start with a quotation from the Bible.

MAXIM NO. 1. *There is no new thing under the sun* (Ecclesiastes 1, 9, Authorized Version). It is important to realize that, though the term "flying saucer" and the current association with space vehicles, originated in 1947, strange images, often circular or oval, have been observed in the skies for centuries. The prophet Ezekiel (580 BC) described "wheels" seen amid rainbow colours, early in the 6th century B.C. There is the record of a round, flat, silver disk that, in 1290 A.D., flew over a theological seminary near Byland, Yorkshire, terrifying all who saw it. Other accounts from the 18th and 19th centuries come from widely separated areas such as France, Russia, and the Pacific Ocean. One must bear in mind that the UFO phenomenon is not new, nor is it particularly connected with the development of atomic energy or the international space program. As far as we can tell mysterious events in the sky have not materially changed their pattern since man first started keeping records. Only the emphasis varies with the changing occupations of man and with the increasing efficiency of human communication systems. During this long period there has never been a fully proven case of physical contact with an alien spacecraft, and not a single artifact of undoubted extra-terrestrial origin.

The passage of time inevitably brings greatly improved techniques of observation and investigation, and there is a problem in applying the scientific critique to the study of a series of events in our local environment which, continually over the years, seems to be on the verge of producing physical contact data and yet never does. In his excellent book *Fads and Fallacies in the Name of Science* Martin Gardner (1957) reviews the rise and fall of many pseudo-scientific enthusiasms of past decades.

MAXIM NO. 2. *Seeing is Not Believing.* I am grateful to Professor Roy M. Pritchard of McMaster University for first interesting me in the detailed physiology of the human eye-brain combination, a living instrument of amazing power and flexibility. In analysing observations of inexplicable

phenomena it is essential to understand the basic interaction of the eye and the brain. For example, although there are about 260 million light-sensitive elements in the two eyes, there are only some 2 million nerve channels for carrying the visual messages back to the brain, which is actually a miniaturized computer of large capacity. Thus, right at the start, a process of selection occurs and the way this operates depends on a number of factors, mostly subjective. When the on-line electrical nerve signals arrive at the brain they are frequently mixed, on a subconscious level, with an input from the memory bank of the brain. A good example of this is a trained observer reporting a disk with a number of portholes which represents a resolution greater than is possible with the unaided eye. On the average the eye can resolve an angle of 3.5 minutes of arc, or roughly one-tenth the diameter of the moon. Earlier storage of detail on a similar disk form, seen on a larger scale, may influence a later observational record.

The power of the two eyes to determine distance by true stereoscopic vision is limited to well under a distance of 100 metres, so any estimates of distance much beyond this value must be by analogy and the superposition of one object in front of another. This action is subjective and relies greatly on past experience and a knowledge of the actual size of familiar objects. In the case of unidentified objects in the sky, observer estimates of distance have practically no value. The same holds for velocities and sizes which are very commonly quoted. The eye can make a crude quantitative estimate of angular velocity, but without any knowledge of the distance or geometry of the path of the object (assuming that in fact a physical object does exist) nothing can be said about linear velocity or absolute size. This brings up another point. One often encounters the statement that the object seen exhibited a metallic reflection and therefore must be, physically, a solid. Various atmospheric phenomena can simulate any kind of a surface or lighting condition and it is impossible for the eye, on the basis of the optical image alone, to determine the physical nature of the source. For a full treatment of atmospheric images see Minnaert's book *The Nature of Light and Colour in the Open Air* (1954).

There are many effects to which the perfectly healthy, normal eye is subject, and these have often played an important part in some of the famous UFO incidents. As examples I might mention the after-image, which is related to the better-known persistence of vision; the moving point effect, an autokinetic phenomenon; and the waterfall effect, originally noted by Aristotle. Many eyes have defects such as astigmatism, myopia, hypermetropia, etc., often corrected by glasses. As one approaches the age of 50 years a decrease in the accommodation of the eye inevitably takes place. Unfortunately, in collecting observational data on UFOs, very few investigators seem

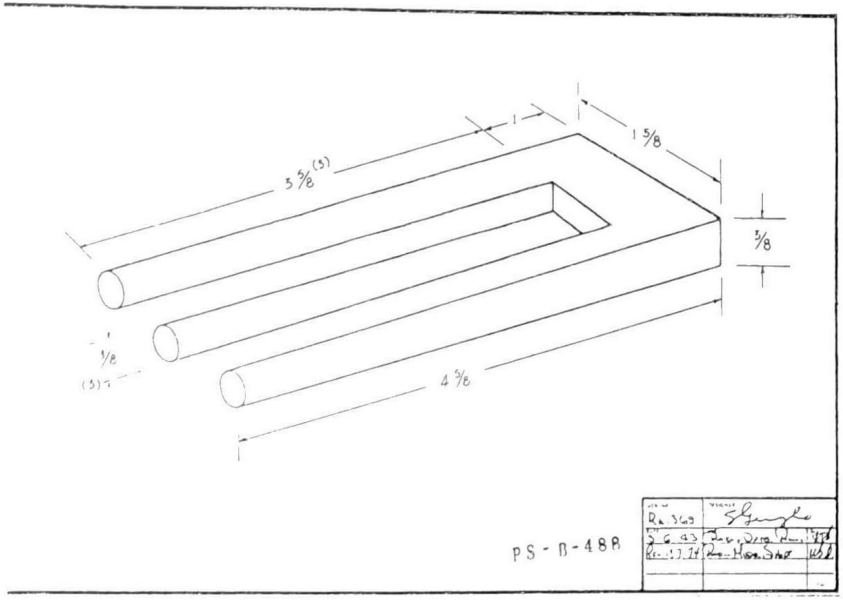

FIG. 1—A shop order for a "three-pronged widget", Radio and Electrical Engineering Division, National Research Council of Canada.

o have interested themselves in the physical condition of the observer's eyes, or in the straightforward fact as to whether the individual normally wore glasses and whether the observation was made with or without glasses.

Detailed physiological and psychological testing has shown that, basically, he eye sees on an emotional level. We see what we need to see, what we expect to see, what we are trying to see, what we are conditioned to see. The human act of seeing seems to be "learned" rather than "instinctive". It takes a new-born baby two years to learn to make full use of his two eyes.

Training and experience can produce very different reactions to a given visual image. Figure 1 reproduces a shop order that circulated in our building some time ago. Needless to say it was never satisfactorily filled by the machine shop but it did create quite a bit of amusement and considerable comment. The aborigines in the Amazon jungle, untrained to read engineering drawings, would probably show no particular reaction. However, unlike our mechanics, these same aborigines have the ability to detect the slightest movement of a single leaf in their surroundings, as this may indicate enemy danger or possible food, and is a requirement for continuing existence in that part of the world. For more on optical illusions see Tolansky (1964).

Good treatments of visual perception and of the interaction of the eye

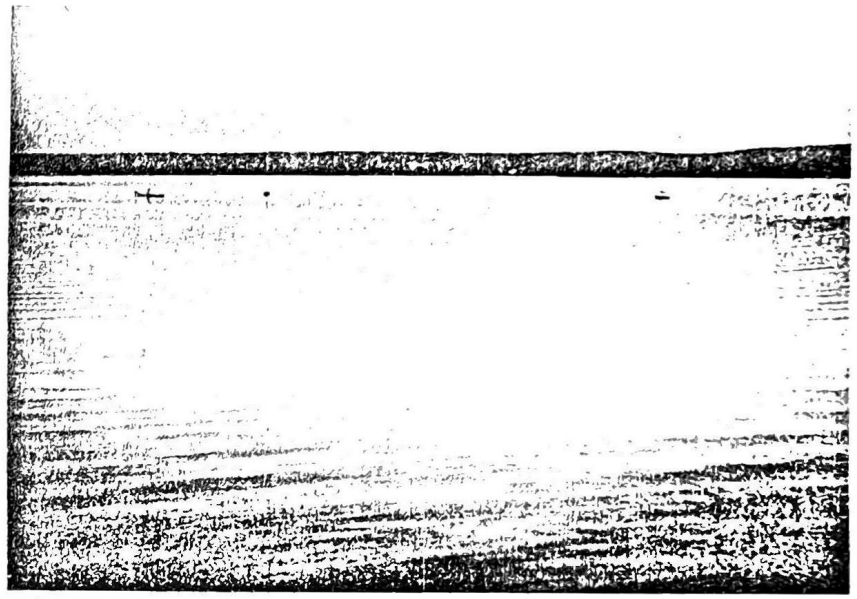

FIG. 2—Photograph taken shortly after sunset, looking east across the Annapolis Basin, Digby, N.S. on Sept. 24, 1974. (Photo by Author)

and the brain will be found in books by Vernon (1962, 1966) and by Gregory (1966, 1970). These should be required reading for anyone who is going to draw conclusions based on visual data. In my opinion this is the most important area that has been neglected in the past by almost all so-called UFO experts.

MAXIM NO. 3. *Instruments Can Deceive.* There is a popular belief that, though a visual record may be in question, an instrumental recording can be taken as proof positive of the circumstances of a given event. The trouble is that all instruments are subject to their own particular forms of ghosts and defects in the record. Certain photographs have been reproduced repeatedly in various publications, and have become well-known. I might mention the Lubbock Lights, the Salem Coast Guard photo, the James Lucci photos and the Paul Trent photos. These and others were published by Look Magazine (1967) in a special issue titled *Flying Saucers*. Figure 2 is the Peter Millman photo, taken on September 24, 1974 in Digby, N.S., and it represents very well a visual sighting that my wife and I made just after sunset from a restaurant on the waterfront where we were having dinner. The fact that the

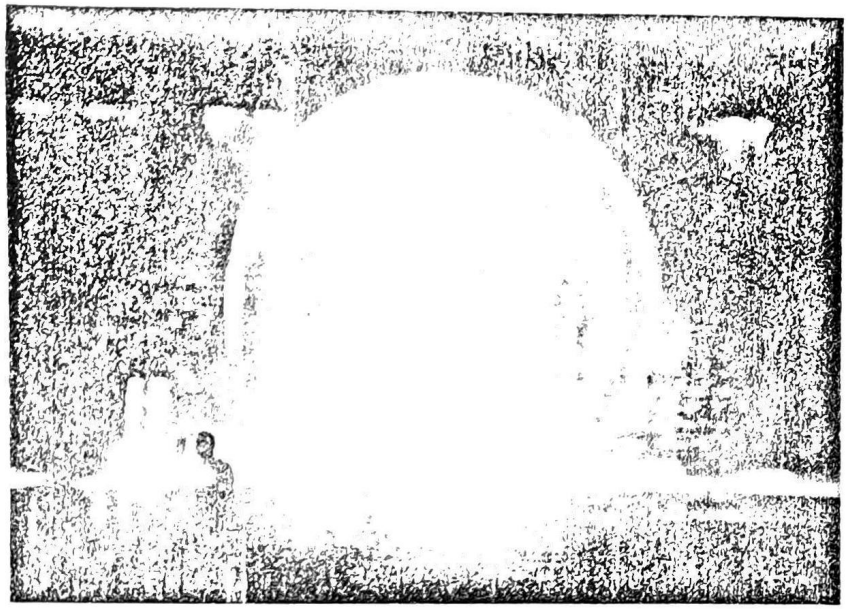

FIG. 3—A night firing on the McGill University HARP project, Barbados, 2321 hours on Feb. 23, 1966, photographed with a fast lens and a 200 line/mm grating. The zero-order image of the lower part of the rocket trail appears just to the right of the head-and-shoulders silhouette. The inverted, cross-axis image of this is at upper right, centred on the outer halo ring. Spectra of the firing appear in a horizontal line along the lower part of the picture and the cross-axis spectrum images in a horizontal line along the upper portion. The first-order spectrum on the blazed side of the grating is the very much overexposed image at lower centre. Double images of some of the trees result from the spectral dispersion of the basic dye colours used in the Kodachrome II emulsion. (Photo by Author)

lights in the dining room were turned on shortly before I took the picture was certainly not an irrelevant circumstance.

For some reason or other photography is the area where we find the majority of deliberate UFO hoaxes. And I might add that it is practically impossible to expose a well-designed hoax from the examination of the negative alone. One must draw conclusions from a great many other sources, and sometimes these other sources are not available.

Figure 3 is a black and white reproduction of a colour photograph I took while working on one of the McGill University HARP firings, February 23, 1966 in Barbados (Millman 1966). On this project a gun barrel 115 feet long was used to fire a shell containing a chemical that was released in the upper atmosphere. The picture reproduced here was taken with a 50 mm,

F/1.4 lens at full aperture with an objective transmission grating, 200 lines/mm and using Kodachrome II emulsion. The exposure was 1 second at 2321 hours and shows the firing and the lower part of the rocket trajectory. Because of heavy over-exposure for certain portions of the image, many effects found with modern fast lenses are present, including an inverted cross-axis image of the firing at upper right, the various orders of grating spectra along a horizontal line below, the cross-axis images of these along a horizontal line above, and a series of halos centred on the lens axis and resulting from internal reflections in the lens mounting. Although most cameras are used without a grating the effect of grating spectra occurs in any photo of lights taken through a screen. Iris diaphragms for cutting down the lens aperture often leave polygonal bright images on a picture of a bright source. Sometimes a ghost image appears even when the bright source is completely outside the camera field. Where roll film is used, careless handling can produce pressure images in the form of small arcs where the film was buckled. I could go on at great length concerning the hundreds of types of spurious images and photographic defects that have been encountered during my 47-years' experience in the examination of astronomical negatives.

When we come to radar records the situation is just as bad. During the war, in the early days of radar, I was in operational research with the R.C.A.F. We spoke of gremlins in the equipment and angels on the screens. In radar it is often more difficult to locate the origin of a ghost image (angel) than it is in photography. Those who do not work with radar may not realize that many radars do not provide a continuous image of a target but sweep at rates of from more than once per second down to one sweep every 15 seconds or longer. In these cases the target is illuminated only at regular intervals, and if moving, it appears on the screen as a series of small echoes in a line. I remember one interesting case studied at our office where two interacting radars at different sweep rates produced a series of spurious echoes in a straight line. If these had been taken as representing a single solid object, the resulting calculated velocity would have been greater than any known vehicle. This type of effect has operated in a number of UFO incidents.

Another great source of angels on radar is ducting in the atmosphere. Layers of air at different temperatures and densities can channel both radio waves and visible light along strange paths, or can create discontinuities which act as echo sources. The result is a varied array of anomalous echoes and mirage-type phenomena. Meteorological reports in general only give overall average conditions for large areas but cannot begin to cope with many cases of small-scale turbulence and discontinuities.

MAXIM NO. 4. *Beware the Printed Word.* I wonder why so many people take on faith what they see published in a journal or book. Just because something appears in print is no reason to assume its accuracy. Let me give one good example. Radio Officer Z. T. Fogl on the S.S. Ramsay took two pictures in December 1957, reportedly off the California coast as the ship sailed from Vancouver to the Panama Canal. These appeared in the British journal *Flying Saucer Review* in the January–February 1959 issue. They clearly showed an artificial looking craft with at least three radio antennas. Over the years this sighting was often quoted as an outstanding example of an alien spacecraft. Hall of NICAP (1964) listed it in his summary *The UFO Evidence*, the Illustrated London News reproduced a photograph in the February [illegible] issue and Life Magazine, in the issue of April 1, 1966, [illegible] one of the Fogl pictures and compared it with the drawing of a recent UFO sighting in Michigan. Finally, in the fall of 1966, Fogl confessed that he had made a flying saucer from plastic model aircraft parts, hung it by a thin silk thread and taken the photographs. The hoax was exposed in the *Flying Saucer Review* for September–October, 1966, and again in *Flying Saucers – UFO Reports*, No. 3 (1967) in an article by Rankow (see Figure 4). In spite of all this, in the Canadian journal *Product Design and Value Engineering* for February, 1968, the Fogl photo appears once more, in a review article on UFOs (Barnes 1968) without any indication that it is a fake, and again this picture appears in the *Canadian Scientist* for September 1968. This is only part of the history of one faked photo, covering over 11 years.

An important aspect of the newspaper accounts of UFOs is that the detailed coverage, with the story on the front page, usually appears so soon after the sighting that even the most meager amount of fact-checking cannot be carried out. Inevitably, important details are missed, inaccurate ones are over-emphasized and a story biased towards the sensational results. In many cases subsequent detailed investigation solves the sighting completely, *but very few newspapers are willing to publish this solution as it has no news value.* In the few cases where the follow-up is published it appears as a small note tucked away on an inner page. For this reason a statistical study of a vast collection of newspaper clippings is a pure waste of time.

MAXIM NO. 5. *Records are Never Complete.* Compilers of UFO data are fond of [illegible] may be ascribed to various known phenomena and usually conclude by pointing out that there is always a "hard core" of unexplained sightings which proves that something, or someone, mysterious is entering our atmosphere. Actually, this proves nothing of the kind. In any large compilation of strange observational data some items will be

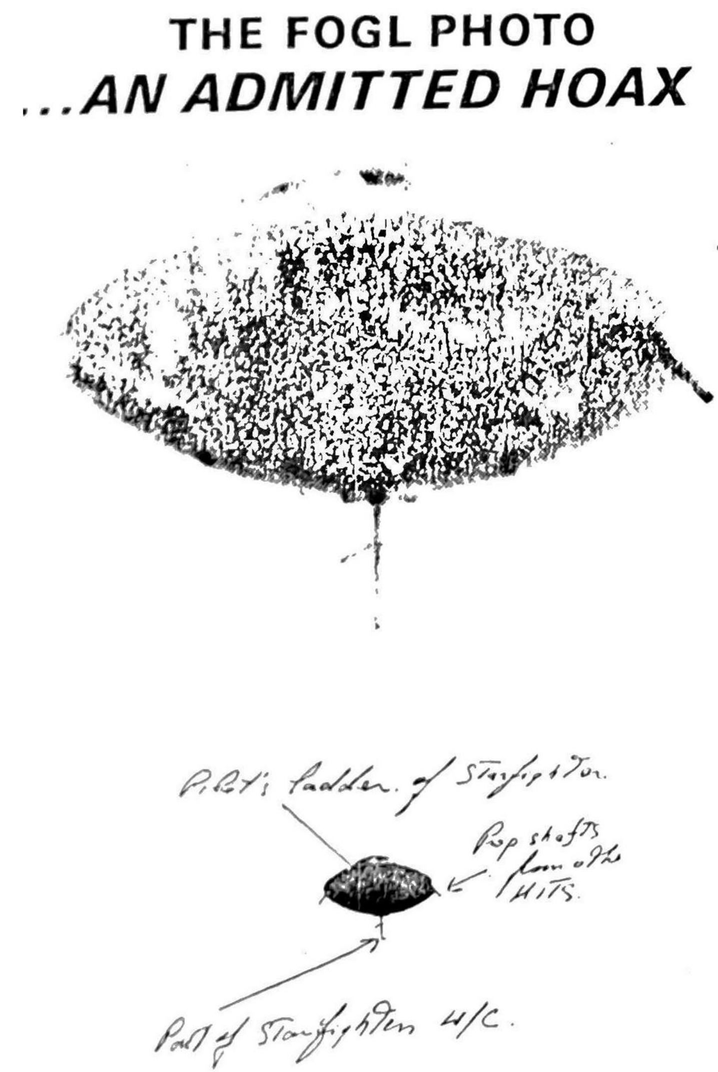

FIG. 4—The Fogl photo, reproduced from *Flying Saucers – UFO Reports*, No. 3, 1967, published by the Dell Publishing Co., New York. The lower view is annotated by Fogl himself to explain how he put the model together. (By permission of Dell Pub. Co.)

explained easily, some with a bit more difficulty and some only after an intensive investigation where eventually the missing clue turns up. According to statistical probability there are almost certain to be cases where the clue is lost and never does turn up, so the existence of the "hard core" proves little one way or the other. The great majority of unexplained UFO cases are so lacking in firm factual data that a good scientific study is very difficult, if not impossible.

I would like to mention three interesting cases where the clues did turn up, as described by Menzel and Boyd (1963). In August, 1951, strange lights were seen flying in scattered formations over the town of Lubbock, Texas. Thanks to one formation that came lower than the others, they were identified as plover, reflecting the mercury-vapour lights of the town from their white, oily breasts. In Norfolk, England, over a long period of years, strange ghostly lights had been seen in the air at night in a certain area. Eventually these proved to be owls that often seek refuge in hollow trees during the day. The owls were dusted with a common fungus, *Armillaria mellea*, that infests rotting wood and is phosphorescent. Strange irridescent globes floating in the sunlit sky, and seen in various parts of the USA and France, have turned out to be migrating spiders which spin a balloon-like web that allows them to be borne aloft on the rising currents of warm air on a fine day.

The Condon report (1969) concluded that little could be learned through additional interviews in re-investigating old incidents that had occurred a number of years earlier. Once a story has been told many times it becomes set in the mind of the narrator and new information of value does not become available. On the other hand sometimes a new fact comes to light by pure chance, and this may make possible the solution of an otherwise baffling case.

MAXIM NO. 6. *Man Makes Mysterious Machines.* There is no doubt that many widely publicised UFO sightings are the result of little-known or little-understood effects of man-made equipment. As certain types of upper-air experiments become more common there is less confusion, but it is surprising how often we still see UFO headlines for sightings of high-altitude balloons, flare tests, chemical releases, satellite re-entry and even aircraft landing lights. With the advent of the space program people are sky-conscious and look up more than they used to. In some cases tests of airborne equipment cannot be made public at the time the tests are made and later, when the information is released, the news media have lost interest. In connection with the possible sightings of various types of aircraft an observer often seems to base his conclusions on whether he heard a sound or not. This is probably one of the least significant bits of observational data, when

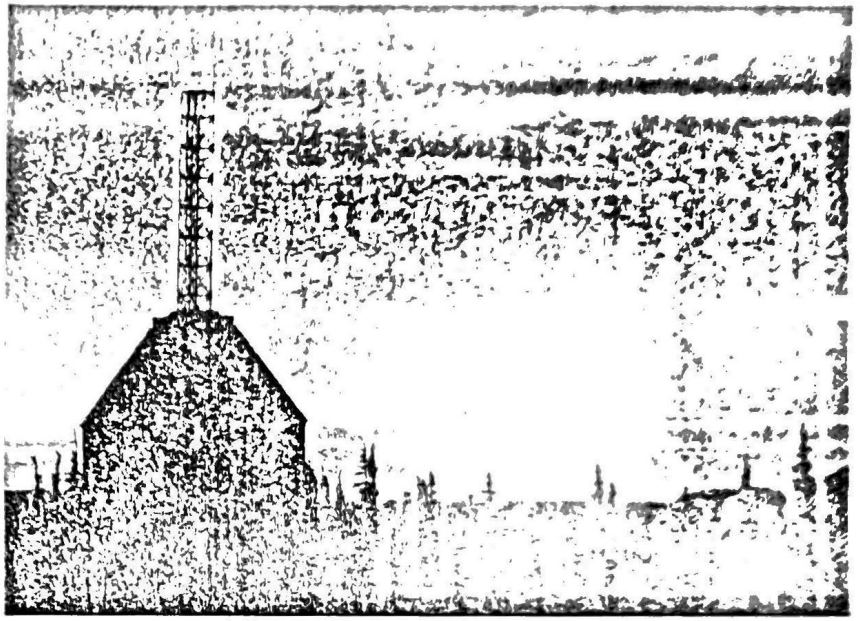

FIG. 5—A sundog observed at Churchill, Manitoba, on December 9, 1968 near the rocket launching tower. (Photo by Author)

related to aircraft. The factors of wind at various elevations, whether the observer is inside the house or out, in a moving vehicle or located near heavy traffic, etc., all have a bearing on whether a sound will be heard.

MAXIM NO. 7. *Knowest thou the ordinances of heaven?* (Job 38, 33, Authorized Version). With my final maxim, which is also a quote from the Bible, I wish to call attention to the many types of natural phenomena that add both beauty and mystery to our skies. These range from the better known examples of bright planets, auroras, meteors, halos, mirages, migrating birds and insects, and so on, to the rarer cases of anomalous refraction, multiple imaging, brilliant fireballs, lenticular cloud systems, and ball lightning. Menzel (1972) lists well over 100 items, both natural and artificial, that have been considered as UFOs and notes that this is only a selection.

Of all the celestial sights that have puzzled and even startled people the planet Venus probably holds the prize. About every two years it appears extremely bright, first in the evening sky then in the morning sky when it remains visible right on into bright sunshine. Various effects in the atmosphere and in the eye can deck Venus in scintillating, rainbow colours, make

FIG. 6—A subsun, seen on a flight over Europe in November, 1966. (Photo by Author)

it appear to dance and even, on rare occasions, scare you by making the planet seem to approach on a collision course. To a less spectacular extent every bright planet, and stars down to the first magnitude, have at some time caused real confusion in the mind of the observer.

Halos and mirages can also be very exciting. The best examples I have seen personally were published in this JOURNAL some years ago (Millman 1928, Chant 1934). Figure 5 is a recent picture of the portion of a halo complex called a sundog, observed at Churchill, Manitoba, near the rocket launch tower. Figure 6 is a subsun, an image that occurs directly below the sun, as far below the horizon as the sun is above. The effect is due to the presence of flat frost crystals floating horizontally and reflecting the solar image. Such images move with the observer, thus giving him the impression of being followed.

As an example of a much rarer phenomenon we have the multiple imaging of the moon, as recorded by Reimann (1887). Another very rare natural phenomenon was the meteoric procession, reported by Chant (1913), which appeared on Sunday evening, February 9, 1913. One often sees the comment that a certain sighting couldn't be a meteor because it was visible for too long a time, 15 or 20 seconds for example. It is worth noting that estimates

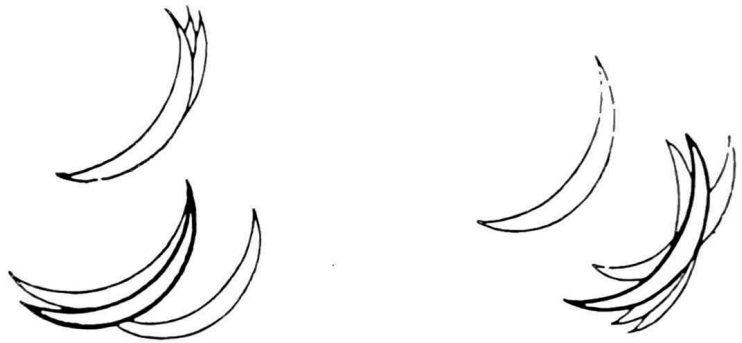

FIG. 7—Multiple imaging of the crescent moon, a rare atmospheric effect, as seen near Hirschberg, Germany (now Jelenia Gora, Poland) on the evenings of January 28 and 29, 1887, and reported by Reimann (1887). Left – observation from Hirschberg on January 28, 7:45–8:15 p.m.; right – observation from Cunnersdorf on January 29, 8:15 p.m.

of the length of time a single object was visible in the 1913 procession ranged from 20 to 30 seconds with some estimates being considerably longer. There is no reason why a meteor moving in a near-satellite orbit, as were the meteors in 1913, could not remain visible to an observer for well over a minute. Menzel (1953) has discussed in detail the ways in which natural phenomena have often been the origin of a UFO report.

Conclusion. I believe that these seven maxims emphasize the extremely complex character of this area of human experience. I mentioned earlier that I was not going to discuss specific cases in detail. Since starting to write this paper an excellent book has come to hand. It is by an author who has personally investigated in depth some of the most puzzling cases, under the title *UFOs Explained*, by Philip Klass (1974), and I recommend it strongly to those who wish to pursue this subject further. I should also mention the book by Allen Hynek (1972), an astronomer who has probably had the greatest direct contact with this subject of any of us, and a comprehensive, annotated bibliography by Catoe (1969).

For the future I suggest that fruitful fields of research may be plasma phenomena and small-scale atmospheric discontinuities which can be connected with image-forming mechanisms. I consider that a very general mistake made in UFO studies is the association of coincidental but completely unrelated events. This philosophy is encouraged by the news media who have the bad habit of using terms like a "wave" of sightings, which may include all peculiar events that happen to occur on this continent in a given period.

Finally, if you ask me "Can extra-terrestrial, intelligent life exist in the universe?" I would say yes, and it probably does. But if you ask "Have we, as of now, good scientific evidence that extra-terrestrial intelligence has visited our earth?" I must answer no, not in my opinion. After well over fifty years of studying the sky, I fail to find any pattern of physical events which suggests that our atmosphere has been visited by an alien and intelligent life-form. I have the distinct impression that if or when this event does occur, it will be much more self-evident than the cases now classified as UFOs.

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