

# ***STRANGERS IN OUR SKIES?***

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*“Ufology doesn’t often receive personal offerings from the scientific community, so we were naturally quite surprised to receive this article out of the blue from one Simeon Masmanian! Simeon informs us that he is an ex Mathematical physicist, a fact somewhat evident in his inherent scientific attitude towards UFO’s in general. He did, however, inform us in his original e-mail that he has maintained an interest in the phenomenon since his research days (which would no doubt translate into ‘scientific fascination’). I do get the distinct feeling that Simeon rather enjoyed indulging himself in this fifteen page speculative romp through the engine room of a saucer, which hopefully the more scientifically orientated readers amongst you will equally enjoy. We would therefore like to thank Simeon for this article, and hand you over to him now as he first leads you through a sighting, his own thoughts on the subject and then onwards to the engine room itself...”*

*Robert.*

## **PART 1**

### **Foreword**

Not too long ago, while enjoying a pleasant evening dinner at my home, a middle-aged housewife told us of an event that had occurred to her when she was still a young woman. It happened in Oxfordshire, sometime in the 1950s.

The weather was warm and she had been out for an evening drive with some friends. After driving around for a while they parked their car on a deserted stretch of country road beside a wooded hill. There were no houses in the area, and on either side of the road there were only fields and woodland.

A few drinks later, they decided to leave the car and continue the fun in the woods on the side of the hill. It was almost dark as they stumbled among the trees, but they had not gone far when they suddenly saw a very bright light coming from behind the hill. It looked as though a car had switched on its headlights. Thinking that someone might have driven off the road and had an

accident, they ran over to investigate. What they saw on the other side of the hill was a large circular pie-shaped craft standing stationary a short distance above the ground. It was all lit up and had what appeared to be portholes or vents around its perimeter. Without a second look they all ran back to the car and drove off. They never reported the incident to the authorities and they never discussed it among themselves.

I happen to believe the lady's story because she had no reason to make it up and, anyway, she is not the kind to make up tall stories. Yet, although the incident must have been quite impressive to be remembered vividly after some forty years, I cannot automatically accept the lady's claim that what she saw was an interplanetary craft. Human memory and imagination are strange things. What she saw might have been a hot air balloon that had somehow landed in the fields, it could have been a grounded experimental aircraft, or it could even have been a hoax perpetrated by someone who wanted to discourage young people from frolicking in the woods.

And here we have the crux of the UFO problem. A UFO experience cannot be investigated systematically because it cannot be repeated under controlled conditions. The only persons who can know for sure whether they *really* saw what they claim to have seen are the witnesses themselves, assuming they are not insane or prone to hallucinations. In this respect UFOs are a bit like rare atmospheric phenomena such as ball lightning or frog-laden rainfalls. The main difference, of course, is that reports of obviously atmospheric oddities do not carry the psychologically and socially explosive implications of interplanetary craft. These implications can tempt imaginative witnesses to dramatise and/or embellish their stories.

Evidently, the main impediment to the objective evaluation of UFO reports, let alone the rational appraisal of whether they imply the likelihood of alien craft in our skies, are:

- (i) The unrepeatability of the alleged experiences;
- (ii) The anecdotal nature of the reports;
- (iii) The fallibility of human testimony.

An airline pilot whose airliner suffered an almost head-on collision with a silver disc may not need persuasion as to the existence of UFOs, but when he tells of his experience to others, be they the authorities or just members of the public, all *they* have is his story. The perceived veracity of the story perforce depends on the reputation of the witness's moral calibre and on what can be inferred of his observational skills, but it is well known that both these qualities can be affected by external conditions (e.g. the weather) and/or his psychological state at the time of his alleged experience. Even airline pilots can hallucinate sometimes, or lie, or misinterpret perfectly natural but unusual events. Moreover, if one intends to deceive it is increasingly easy to fake photographs and other recordings.

The problem is compounded by the fact that accounts of alleged sightings can only reach the general public through the testimony of self-professed witnesses, usually on the radio or television, or through books and journals. The integrity of the producers who make the programmes, like that of the authors, is usually beyond doubt, but even in the best researched books (such as the compendium edited by Carl Sagan) the accounts are almost invariably second- or third-hand, if that. One is always left wondering how much the stories have been changed or embellished during their literary journey from the primary witness or witnesses to the author of a book or the producer of a TV documentary. That is not to say, of course, that some reports of UFO sightings *could* not be convincing. For example, if the main points of the supposed incident at Lakenheath (1956) could be shown to be true then the series of events that occurred at that Air Force base would constitute proof of the existence of UFOs for all but the most robust bigots. However, one has only to read about the Lakenheath incident in different books to find serious discrepancies. Such variations in the accounts dilute their credibility.

In short, if we sift through the literature and the television documentaries we come across large numbers of intriguing accounts that whet our curiosity but only serve to disappoint us, in the final analysis, because none is based on strong enough foundations to provide, of itself, definitive proof. We are reminded of a National Socialist attempt to discredit Einstein's Theory of Relativity: the Nazis produced a book that quoted '100 authors against Einstein'. The physicist's riposte was brief but adequate. "Surely," he said "A *single* valid argument would have been enough." As with the Theory of Relativity, it is the quality of the arguments for, or against, the existence of UFOs that matter, not the quantity.

## Background

The 'UFO phenomenon' is supposed to have started in 1947 with an alleged sighting by one Kenneth Arnold, a professional pilot. Arnold claimed to have seen a number of 'flying discs' flying over the Cascade Mountains in Washington State. They were apparently silver in colour and flew in a strange up-and-down manner 'like saucers skipping on water'. Although Arnold's story may have ushered the use of the term 'flying saucers' it was not the earliest report of unknown or unidentifiable flying objects. World War II pilots had reported several times what became known as 'foo fighters', strange and highly manoeuvrable craft that seemed to show an interest in both Allied and German aircraft. And long before WWII unknown 'airships' had been allegedly seen over several American states and reported in some American newspapers. If one reads Charles Fort's 'Book of the Damned' one comes across newspaper reports of mysterious 'airships' with incredible rates of displacement as early as the nineteenth century. Indeed, with some goodwill and imagination one could view ancient references to 'flying chariots' and 'flying shields' as the earliest UFO reports, and there is always the story of Ioannes and his successors, the amphibian visitors whose craft landed on water and who emerged from the sea each day to teach the Sumerians agriculture and social mores.

Among the first serious books on the subject were Captain Edward Ruppelt's 'Project Blue Book' and the University of Colorado (Boulder) study under the directorship of Edward U. Condon. Both books were evidently attempts by well-meaning and sincere people to present the truth as they saw it, but the former could not help but leave the reader with a sense of incompleteness due to its (unintentional) catalogue of missed opportunities and the latter came across as a poorly organised collage of articles and investigations that ranged from the worthwhile, through the incompetent, to the irrelevant. The fact that the concluding articles in the voluminous Colorado study contradicted much of what was explicitly or implicitly contained in previous sections did not help the coherence of the book. The conclusion of the Colorado study that UFOs do not merit serious investigation because all but a very small percentage of reports (about 3%) could be explained is simply not warranted. After all, if there *were* alien visitors in our skies one would *expect* only a very small percentage of alleged sightings to be genuine. The vast majority would indeed be attributable to misidentifications of aircraft, Venus, fireflies, ball lightning, and so on. A somewhat loosely written follow-up of the Colorado study ('Where the Colorado Study Went Wrong') by two of its members (who were dismissed while the study was going on for not toeing the party line) further undermines the Colorado Study's conclusions.

The issue has been further complicated by the fact that many of the more interesting reports contain statements to the effect that, in the interest of national security, some of the official documentation is not open to public scrutiny. The assertion that our military and intelligence organisation are unwilling to disclose the 'truth' about UFOs may be true (for a serious discussion see 'Above Top Secret' by Timothy Good) but it is nonetheless a very convenient escape clause for those who are prepared to write amazing but not-totally-true stories about UFO encounters without having to validate their sources. This has opened the door to the insane and

the unscrupulous, with the result that scores of overimaginative books on UFOs have appeared on the market. The main consequence of this trivialisation of the UFO question is that scientists and other responsible investigators are no longer prepared to consider the UFO problem for fear of being ridiculed.

To summarise, the history of flying objects that defy explanation or identification goes a long way. Yet, to the author's knowledge, there is no single account of a UFO encounter that may be considered absolutely dependable or definitive. As a result, again in the author's opinion, no single report is sufficient to justify the serious investigation of UFOs.

But what if one considers the reports collectively?

### **Setting the paradigm: A hypothetical story**

Imagine a remote undiscovered island whose inhabitants are unusually intelligent but have no advanced technology. All they have are some ponderous steam engines which they use to pump water. The islanders have had no contact with the rest of Mankind and they are absolutely certain that they are the sole intelligent creatures on the planet, which they believe to be covered by water everywhere except for their island. To entertain themselves the islanders build and fly kites; their kites are of marvellous shapes and sizes.

We shall call the hero of our story Prometheus: he was a young islander who lived alone but had reached the age when he was expected to find a wife. One day, Prometheus was at the top of a coconut tree when he saw an airliner flying over the island. There were no other witnesses because it was raining furiously and no one was flying kites or looking for coconuts. The reason why Prometheus was at the top of a coconut tree while everyone else was at home was that he absolutely loved coconuts! So he climbed up coconut trees even on rainy days. And that is why when an airliner passed over the island he was the only one to see it.

That day Prometheus did not get any coconuts. He ran back to the village to tell the village elders what he had seen.

Elder 1: "So you think you saw a strange flying machine of some kind? Hmm..."

Prometheus: "Yes! I did!"

Elder 1: "And did this strange flying machine have wings?"

Prometheus: "It did!"

Elder 1: "So it was not a kite. Did it flap its wings like a bird?"

Prometheus: "No, it didn't flap them."

Elder 1: "If it wasn't a kite and it didn't flap its wings then how could it fly? Heh heh!"

Elder 2: "Be reasonable, Prometheus. Where could this thing have come from? If, as some people claim, there is land with people somewhere beyond the sea, can you imagine how far it would be?"

Prometheus: "Very far indeed. Our fishing boats have sometimes sailed for weeks without finding anything."

Elder 2: "Exactly. So how could this supposed flying machine have got here?"

Prometheus: "I really don't know."

Elder 2: "Heh, heh!"

Elder 3 (the Village Psychologist): "You say, Prometheus, that this thing was *long and hard and blunt at the front*?"

Prometheus: "Yes, but it also had wings!"

Elder 3: "Of *course* it had wings. And you say it made a loud virile sound?"

Prometheus: "I think so. It was very far away."

Elder 3: "I understand perfectly. I think you need a wife, Prometheus. Heh heh!"

Prometheus' chances of finding a wife were now smaller than ever. He had become a figure of derision, especially so because the village idiots from all the villages on the island had got together to form a 'flying machine cult'. These idiots met periodically to chant weird hymns and loudly talk about Prometheus' sighting. Some strongly maintained that it was a vision sent by the gods while others proclaimed, equally loudly, that it was an attempt by the 'people from beyond the sea' to establish contact in order to solve all the islanders' problems. Meanwhile, the more sober islanders stopped eating coconuts, blaming them for Prometheus' apparent dementia.

One day, while wandering dejectedly very far from his village, Prometheus came across The Hermit. This individual was shunned by the islanders because he was in the habit of asking questions that subverted their most cherished delusions. The Hermit listened attentively to Prometheus' story and became very thoughtful. Prometheus could not wait for the verdict.

"So do you think I've gone bananas?" he asked, expecting the dreaded "Heh, heh!" at any moment.

"It's more likely you've gone coconuts," replied The Hermit. "Too much coconut milk, you know. But let's think carefully about this. You say this thing had wings but didn't flap them. You say it made a loud noise."

"Yes," said Prometheus weakly.

"Hmmm..." The Hermit reached into his voluminous pockets and brought out a small contraption that he had made earlier. "Hmmm... I got the idea for this toy from the seeds of a tree. Most seeds from trees, as you know, just fall to the ground and wait for the right conditions to grow. But this species of tree has come up with an idea that helps its seeds scatter better in the wind. Each seed has two wings of a special shape. The seeds don't flap their wings, nor do they rise up in the air. Instead, the special shape of the wings makes the seeds spin as they fall. This enables them to fall much more slowly than the seeds of other trees, allowing them to scatter farther from the tree from which they fell."

"I know that tree," said Prometheus, "But what does this have to do with..."

The Hermit smiled and said: "Patience, boy! This toy that I hold in my hands has wings shaped like those of the seeds of that tree, except that the wings are attached not to seeds but to a long thin shaft. Watch what happens when I hold the shaft vertically between the palms of my hands and move my hands swiftly in opposite directions as I let go!"

The motion of The Hermit's hands made the shaft spin very quickly and, to Prometheus' amazement, the toy flew straight up into the air!

"Wow!" exclaimed Prometheus.

"I call the little wings a *propeller*," said The Hermit. "Now imagine if propellers with *horizontal* shafts were attached to an engine that was attached to a kite. Not the usual kind of kite, mind you, but to a kite shaped like the wings of a bird that is flying without flapping its wings. What do you think would happen?"

"Why, it would fly on its own," whispered Prometheus, "Without the need for wind!"

"Yes boy, it would fly without the need for wind provided the wings had a special shape. Now let's think this problem through."

The Hermit and Prometheus sat together for many days trying to puzzle out the appearance and properties of a machine that flew with the aid of propellers. They made scores of drawings, and the more they thought about it, the more their hypothetical flying machine looked like the object Prometheus had seen! It was all terribly exciting, and Prometheus almost swooned when they deduced that the flying machine would need a pair of smaller wings at the rear to give it stability. He did, in fact, faint from over-excitement when The Hermit added a little swivelling fin above the rear wings, which he said would be necessary for the flying machine to be steerable. The Hermit resuscitated him with a bucket of cold water.

“That’s exactly like the thing I saw!” gasped Prometheus after he had dried himself.

“Are you sure?” asked The Hermit.

“I swear it by all the coconuts on the island!”

“So we have explained your sighting!” said The Hermit smugly.

But Prometheus looked downcast. “Well no, Hermit,” he said. “We haven’t. As we all know, it’s impossible to build a steam engine that can turn a propeller fast enough to lift its own weight.”

“Don’t forget the role of the wings, boy!” Remember their special shape! Anyway our flying machine doesn’t have to use a steam engine.”

“What other kinds of engine are there?”

“Who knows? There must be many kinds of engine that we don’t know yet. And we *have* explained your sighting.”

“How have we explained my sighting?”

“You see, boy, there are many levels of explanation,” said The Hermit. “We made only one assumption, namely that it is possible to build an engine that can rotate a propeller fast enough to lift a machine with specially made wings, right?”

“Yes.”

“The properties of a flying machine we deduced agree pretty well with the more obvious properties of what you saw, right?”

“Yes.”

“Well,” said The Hermit, “The probability that a single assumption can do this is less than the probability that you lied or hallucinated. Therefore, weighing probabilities, we do have an explanation for your sighting, albeit a low-level explanation.”

“What would constitute a high-level explanation?”

“Actually building a flying machine that can fly, and showing that it is similar to the one you saw.”

“But we cannot build an engine like the one we assumed,” persisted Prometheus. “And as I’ve already said our steam engines are too slow and heavy!”

“Perhaps someone else has come up with such an engine,” countered The Hermit, “Just because *we* can’t build one doesn’t mean it can’t be done.”

“How could they?”

“I don’t know. But because something is beyond our present technology does not mean that it is impossible, and the fact that a *single* assumption can explain a set of otherwise unexplainable observations doesn’t just make your story much more likely to be true, it also lends support to the assumption!”

“You mean it’s possible to build a flying machine?”

“No,” said The Hermit as he rose and collected all the drawings they had made. “But, weighing probabilities, it means that it’s worth trying to build one!”

Prometheus’ self-confidence was restored, and he had no problem finding a wife.

## **PART 2**

### **UFO appearance and behaviour**

Is there *one* technical assumption that would explain the alleged appearance and some of the reported properties of UFOs? There is, but before we make it let us list what this assumption should explain. The information below is by way of a non-exhaustive summary of UFO characteristics common to many reported sightings. As with all summaries gleaned from a variety of reports, there are exceptional cases that would not fit in with the summary. This is a

consequence of the variability of witness truthfulness and imagination, not to speak of the wide range of human capacity to notice and remember detail. In particular, reports of the interiors of UFOs by alleged 'abductees' and 'contactees' are not included, nor are the detailed descriptions of UFOs given by alleged witnesses who have profited financially from their supposed encounters. This does not imply that such witnesses are necessarily lying, but only that their claims do not satisfy our selection criteria. On the whole, we have chosen properties that are common to many reports and have given statistical weight to alleged witnesses who had no overt reason to tell untruths. It should also be stressed that most written accounts of UFO sightings dwell on the situation-dependent aspects and emotional aspects ("It was dark," "The pilot had several hundred hours of flying experience," "The children howled with terror," etc). Very few reports are by engineers, scientists or other people who would be inclined to observe and note the *physical characteristics* of any strange craft. It is also possible, of course, that the more technical considerations in the reports have been censored 'in the interests of national security'.

### **1- Shape**

The smaller craft, reported to be 3 to 5 metres in diameter, are usually shaped like two soup-bowls stuck rim to rim, most often with a central bulge on top. Medium-sized craft, 10 to 30 metres along their major axes, sometimes appear to have perimeters that are roughly elliptical or in the shape of curved triangles. Those with elliptical perimeters have sometimes been reported to show what might be a superstructure, much like the conning tower of a submarine, along the main diagonal but not always at its centre. The very large craft are most often described as cigar-shaped with blunted ends and without fins. There are also reports of much smaller objects whose size could be between that of an orange and that of a football. An example of these very small objects would be the small silvery sphere that was filmed as it flew parallel to the (then new) Concorde during a test flight. To the camera moving at the same speed and parallel to the Concorde the small silvery sphere appeared to descend vertically, halt its descent by performing vertical damped oscillations reminiscent of negative feedback, and finally stabilise when it was level with the aircraft. After a few seconds the silvery sphere accelerated upwards and ascended vertically out of the picture. If the film is genuine the object could be interpreted as a teleguided probe of unknown origin.

### **2- Angle of attack**

From our experience with aircraft of the 'flying wing' type we would expect the angle of attack of a level-flying saucer-shaped craft to be zero or positive, i.e. for the front end of the saucer to be at the same level or higher, respectively, than the rear end. Conventional aircraft fly horizontally because the positive angle of attack resides in the aerofoil shape of the wings (which is variable in large aircraft due to the ailerons). It is surprising, therefore, to find that when the reports of UFOs include the angle of attack it is claimed to be zero or negative. The alleged flight with the front end lower than the rear appears to contradict what we know from aerodynamics. The alleged negative angle of attack is also counter-intuitive and therefore not what we would expect from someone who has made up the story but has not been informed of this strange characteristic.

### **3- Violent manoeuvres**

Perhaps the least credible property of UFOs is their alleged ability to perform very abrupt manoeuvres at high velocities. Several military pilots who claim to have pursued UFOs have reported enormous accelerations and even virtual 180-degree turns at supersonic speeds. Such shenanigans, it is reasonably claimed, would completely flatten any occupants. But even if it were assumed that the craft are without living occupants, the stresses induced would be beyond the physical capabilities of anything present-day metallurgy can produce, or indeed predict. The

recurrence of reports involving ultra violent manoeuvres has led to the suggestion that the witnesses had experienced optical illusions.

#### 4- Spin

The smaller craft are often reported to spin about their vertical axes of symmetry when hovering. A slight wobble, reminiscent of precessing tops, is also frequently reported.

#### 5- The 'falling leaf' landing pattern

Sightings of UFOs in the process of landing are not common, but the few extant reports of small craft observed whilst landing often describe the process as being 'like a falling leaf'. This presumably means that the craft did not land vertically, like a helicopter, but in an oscillatory pattern as though the craft were at the end of a long pendulum that is slowly lowered.

#### 6- Absence of sonic boom

UFOs have been reported as following jet aircraft at subsonic speeds and then rapidly accelerating to supersonic speeds within a few seconds. Yet there has never been a report of a sonic boom. Likewise no sonic boom was reported when UFOs have allegedly been observed to traverse the celestial arc, from horizon to horizon, in a few tens of seconds. In the latter cases UFO speeds have been estimated to be in excess of 40,000 mph. It is interesting to note that the absence of a sonic boom does not preclude a certain degree of friction between the atmosphere and at least some parts of the UFO. The outer edges of the smaller saucer-shaped craft have often been reported as glowing, as though they were displaying a corona discharge or were very hot.

#### 7- Effects on non-diesel car engines

Low-flying UFOs are reported to cause the engines of some cars to stall and to do strange things to the electrics. Interestingly, diesel-powered vehicles seem to be unaffected by the proximity of UFOs. A possible explanation for this alleged phenomenon is that UFOs produce a strong electromagnetic (EM) field. Indeed, one of the few technical investigations in the Condon Report found that the bodies of cars whose engines were alleged to have been stopped by the presence of a UFO had no significant magnetization. This was presented as evidence against the genuineness of the alleged encounter with a UFO. The investigator seems to have been unaware of the fact that a rapidly oscillating magnetic field whose amplitude decreases at a rate that is slow compared to its frequency would not leave an observable magnetic signature.

To show this more precisely, let us represent the decline of the amplitude of an oscillating magnetic field by an exponential  $\exp(-\lambda t)$  (a plausible model for the magnetic field of a receding UFO) and the oscillating part by a sine or a cosine (to encompass all phase relations):

$$B(t) = B_0 \exp(-\lambda t)\sin(\omega t) \text{ or } B(t) = B_0 \exp(-\lambda t)\cos(\omega t)$$

Then any residual magnetization would be proportional to

$$\int B(t) dt$$

where the integral is from zero to infinity. This gives

$$\omega/(\omega^2 + \lambda^2) \text{ for the sine and}$$

$\lambda/(\omega^2 + \lambda^2)$  for the cosine

both these quantities are very small if  $\omega \gg \lambda$ . Thus, we do not expect any significant magnetization if the frequency of the field is very high.

## PART 3

### Applying the paradigm

#### Physical assumption:

*It is technically feasible to produce an artificial gravitational field powerful enough to offset the gravitational field of a planet*

#### Negative mass and negative energy

By an ‘artificial gravitational field’ we mean one that is produced in a way other than through the presence of positive or negative masses. In this concluding part we first look at some of the technical aspects of the concept of *gravitational propulsion*, then we look at some of the characteristics of a ‘gravitationally propelled’ vehicle, and finally we draw some conclusions.

Einstein’s theory of gravitation relates the spacetime curvature tensor to the energy-momentum tensor:

$$\mathbf{R}^{ij} - \frac{1}{2}\mathbf{g}^{ij}\mathbf{R} = -\kappa\mathbf{T}^{ij} \quad (1)$$

Here  $\mathbf{R}^{ij}$  is the curvature tensor,  $\mathbf{T}^{ij}$  is the energy-momentum tensor, and  $\mathbf{g}^{ij}$  is the spacetime metric. The constant  $\kappa$  can be shown to be positive. Eqn. (1) states that the (local) curvature of space depends on the (local) energy density, where the latter may include energy in the form of mass. Since energy as we know it is positive definite, at least for macroscopic systems, the curvature of spacetime in the neighbourhood of positive masses produces convergent geodesics, i.e. an attractive gravitational ‘force’. In the weak-field approximation, the latter can be represented as a force derivable from a scalar potential that can be set to vanish at infinity. This approximation gives the familiar Newton’s Law of Gravitation:

$$\mathbf{F}_G = -\mathbf{GMm}/r^2 \quad (2)$$

As usual the negative sign indicates an attractive force.

For the gravitational field to be used as a method of propulsion the ‘engine’ must be able to produce a repulsive gravitational force. It follows from (1), however, that for the ‘force’ to be repulsive the energy-momentum tensor must be negative. This brings up the vexed questions of negative energy and negative mass. Although negative energy states appear in the *formalism* of quantum theory, the *concept* of negative energy is not yet understood to the extent that it could be applied to yield theoretical solutions (let alone practical applications) at the macroscopic level. Witness the problems encountered in trying to explain the apparent

acceleration of the expansion of the universe, and the recourse of appealing to ‘dark matter’ and ‘dark energy’. Yet the possibility of negative energy states goes back at least to Dirac’s early pioneering work. In Dirac’s quantum-relativistic theory of the electron the expression for the energy appears under a radical so that the energy can take either positive or negative values:

$$E = \pm\sqrt{(\mathbf{m}c^2)^2 + (\mathbf{p}c)^2} \quad (3)$$

Here  $\mathbf{E}$  is energy,  $\mathbf{m}$  is the rest mass and  $\mathbf{p}$  is the momentum.

It is sometimes asserted that the discovery of the positron and other antiparticles confirmed the reality of negative energy states. But when a gamma-ray photon, for example, converts to an electron-positron pair (in the presence of a nucleus or other heavy particle) all that happens is that part of the gamma-ray photon’s energy converts spontaneously to mass. The rest of the gamma-ray energy appears as kinetic energy. In other words, when the positive energy of the gamma-ray photon exceeds  $2m_e c^2$ , where  $m_e$  is the mass of an electron or positron, the vacuum gives birth to a particle-antiparticle pair. The presence of the heavy particle is to satisfy momentum conservation. Although the cross-sections for electron-positron production can be readily calculated as a function of the mass of the neighbouring heavy particle, the ratio of the electron’s initial kinetic energy to that of the positron cannot, in general, be predicted. There are parallels between the production of antiparticles and the emission of *bremsstrahlung*.

To emphasise that the antiparticle is produced by *positive* energy, and therefore cannot be considered to have negative mass, consider an idealised version of pair production directly from an electric field. Two parallel conducting plates in a partial vacuum are connected to a source of electrical potential difference (PD). This source is such that the PD, and hence the electrostatic energy density between the plates, can be increased at will. The vacuum is partial because, as before, the presence of a heavy particle is necessary for momentum to be conserved when the particle-antiparticle pair is formed. When the energy density of the field between the plates is such that the energy within a small enough volume  $\delta V$  exceeds  $2m_e c^2$  the field, the vacuum and the heavy particle mutually interact so as to rip the vacuum apart and produce an electron-positron pair. The electron accelerates towards the positive plate and the positron towards the negative plate. Part of the energy that was initially within  $\delta V$  appears in the form of mass and the rest in the kinetic energy of the particles and their fields:

**Electrostatic field energy  $\rightarrow m_e \gamma c^2 + m_p \gamma c^2 + \text{Energy in the fields of the particles}$**

Where we have set

$$\gamma = 1/(\sqrt{1 - v^2/c^2})$$

The mass of the positron is thus positive in the sense that it owes its existence to the positive energy of the electric field between the plates. The positron mass therefore cannot be considered as an archetype of the ‘negative energy’ one would need to produce a repulsive gravitational field. In other words, according to present-day theory an antiparticle would ‘fall’ in a normal gravitational field.

### **The negative energy ‘sea’**

Electroweak formalism for pair production suggests that an antiparticle is indistinguishable from its conjugate *moving backwards in time*. If this were literally true then the geodesics around antiparticles could also, in some sense, be time-reversed. Would the geodesics be divergent in some useful sense? Could this line of inquiry lead to a repulsive gravitational

‘force’? As we have seen, according to present-day theory an antiparticle would ‘fall’ in a gravitational field just like its conjugate (‘real’) particle. This suggests that although the geodesics around the antiparticle diverge they do so *from the future to the past via the present*. They thus diverge in a way that is apparently unsuitable for producing a repulsive gravitational ‘force’.

Paul Dirac presented an intuitive explanation for the production of antiparticles by positive energies. He postulated the existence of an all-pervasive ‘sea’ of negative energy that exists in parallel with our own positive-energy universe. At every point of that ‘sea’ the negative energy states were assumed to be ‘full’ in the sense that no further negative energy particles could be added to it. However, if enough *positive* energy were concentrated within a small region  $\check{r}$  of the negative-energy ‘sea’ (and here we must also assume that the spatial regions of this ‘sea’ correspond exactly to their counterparts in our own spacetime) then the particles that occupy  $\check{r}$  would be ‘raised’ to our positive-energy world by the infusion of positive energy. Although Dirac’s model has been shown to lead to inconsistencies that required QED and electroweak theory for their resolution, the concept of an all-pervasive but dormant negative energy has survived at the intuitive level even though modern relativistic quantum theory may be said to have made it unnecessary.

Unnecessary perhaps, but not necessarily false or misleading. If we retain the concept of dormant and normally inaccessible negative-energy states then the achievement of a repulsive gravitational ‘force’ would require no more than a ‘twist’ of the spacetime manifold (which, as we assumed, we share with the negative-energy ‘sea’) so that negative energy is *lifted* into our positive-energy world. This would answer the question: ‘If the substance of antiparticles is not made of negative energy, where would we get negative energy from?’. We thus avoid the conundrums that would arise were we to advocate the *creation* of negative energy. If it is there, co-existing with our own positive-energy world but normally inaccessible, then it could, at least in principle given the limitations of present-day Physics, be tapped to produce a localised region in which the spacetime geodesics diverge. In other words, we would need to create a negative-energy pump. This is the gist of our opening Assumption.

### **Speculations about the properties of an artificial gravitational field**

A negative-energy pump is most likely to involve the manipulation of time-varying EM fields. However, although the relationship between the weak nuclear force and the EM force is formally well understood, any relationship linking the two nuclear forces and the EM field with the gravitational field has, so far, eluded us. More specifically, Eqn. (1) has not yet been linked with Maxwell’s equations. This does not imply that Maxwell’s equations are wrong. They are Lorenz invariant, as required, and they summarise succinctly all that is presently known about the EM field. However, there is no reason to believe that Maxwell’s equations are not but the limiting form of other, more general, equations. These would describe the distortion of spacetime not only due to the energy density of the EM field but also by the time-dependent variations of *particular configurations* of the EM field. In short, they would tell us how to create a gravitational field without needing to resort to positive or negative masses.

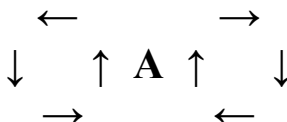
An isolated negative mass would produce a distortion of spacetime described by Eqn. (1) with a negative energy-momentum tensor. If the negative energies are small, Eqn. (1) may be interpreted as describing a rotation-free field around but not including the mass-energy point at its centre. But our experience with induced fields (as compared with fields produced by point charges or masses) suggests that an artificial gravitational field, like induced electric

or magnetic fields, would have zero divergence and a non-zero curl. Thus, if  $\hat{\mathbf{g}}$  represents the artificially induced gravitational field strength:

$$\nabla \cdot \hat{\mathbf{g}} = 0 \quad (7a)$$

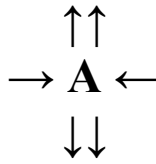
$$\nabla \times \hat{\mathbf{g}} \neq 0 \quad (7b)$$

At large distances from any hypothetical apparatus that could produce a spacetime ‘twist’ the net disturbance of the spacetime manifold would be effectively zero, as the field should decrease at least as fast as a dipole. A bipolar configuration for an artificial gravitational field could then be tentatively represented as:



**A** represents the apparatus creating the fields and the arrows show the direction of the ‘force’ associated with the fields. It is evident that such a configuration is forbidden by momentum and angular momentum considerations because the upward-pointing arrows imply that whatever is located at the centre would spontaneously propel itself upwards. Thus, the apparatus, at least, would experience an uncompensated upward acceleration even in the absence of other masses, contravening the law of momentum conservation. Likewise, the presence of a mass on either side would lead to an unbalanced torque and hence to an infringement of the law of conservation of angular momentum.

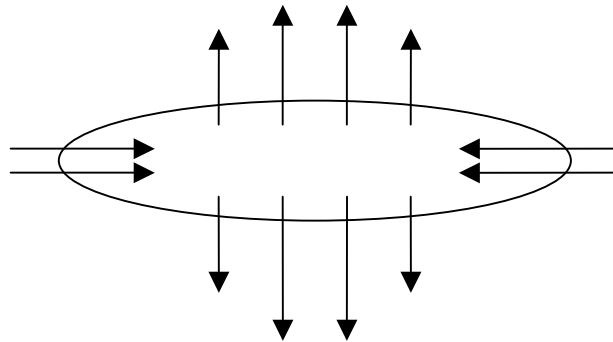
A plausible configuration for an artificially produced gravitational field would be as follows:



The arrows above and beneath the centre denote repulsion and the arrows on either side denote attraction. We assumed that the forces are symmetrical about the vertical axis, so that the vertical forces are strongest along the axis itself whereas the horizontal forces converge from all directions in the plane perpendicular to the axis (the vertical double arrows are to show that, because the 'lines of force' may be assumed to be continuous, the vertical forces should be more intense than the horizontal forces shown in cross-section). Left to itself, a body at **A** would experience no net force, much like an isolated mass or an isolated electrical charge. However, it would experience a net force and/or torque in the presence of any mass that is within the range of its fields, and that mass would experience an equal but opposite force or torque. We shall adopt this configuration for the hypothetical artificial gravitational field that propels UFOs.

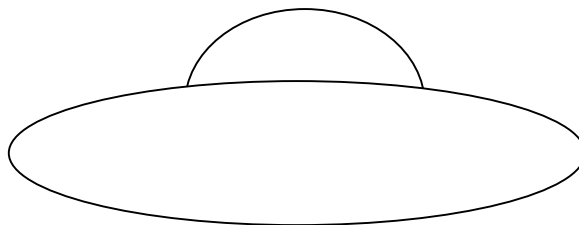
### **Low-level explanation of UFO properties and behaviour**

A craft propelled by a gravitational force field such as the one above would experience considerable physical stresses. These stresses would tend to compress the craft laterally, radially towards the centre, and extend it along the vertical axis, upwards above the centre and downwards below the centre. If the purpose of the field is mainly for propulsion, given that the intensity of the fields is strongest along the vertical axis the energetically most economical structural configuration is a disc:



In the light of our present technology perhaps the most unacceptable property of UFOs is their alleged ability to perform violent manoeuvres, with reported accelerations that would destroy most apparatus and prove fatal to any known living creature. The problem of 'blackout', or worse, experienced by a pilot when his aircraft accelerates violently is due to the fact that his body is pushed in the direction opposite to the acceleration by the seat in which he is strapped while his blood, flesh, internal organs and bones tend to continue to move with their previous velocity. The problem is akin to colliding with a rigid wall at high speed. Now recall that a gravitational field cannot be shielded. Hence *all* the particles in the bodies of any occupants above the centre of the field, i.e. in the region of the upwards-pointing arrows, shall experience the same upward force provided the field does not change significantly over their heights (if it does they shall be compressed). This means that, no matter how violent the acceleration, it will not be felt by the occupants provided that the

artificial gravitations field that propels the craft points in the direction of the resulting acceleration. Assuming that the hypothetical operators are built of stuff not much different from ours, they would therefore have to be located in a region where the field is almost constant and in the direction of the acceleration, i.e. they would be in a squat compartment just above the power source, thus:



Our assumption has provided a low-level explanation of the *shape* of typical small to medium-sized UFOs, viz. the saucer shape and the protruding squat dome. For larger craft it would be energetically more economical to have a number of gravitational propulsion systems, much like our larger aircraft that depend on two or more engines. For reasons of stability there would be more than two, and these would be symmetrically distributed. Hence the larger craft would tend to be triangular or elliptical in shape.

An electric charge experiences an electrical force only when in the presence of another charge, in which case the two charges experience equal but opposite forces. Analogously, a gravitationally propelled craft (henceforth referred to as a **g-craft**) would feel no net force unless it was in the vicinity of a large mass or planet. Given that an artificial gravitational field is most likely to be of comparatively short range, a g-craft would not be suitable for interplanetary travel. Far from large masses the (presumably) optimal method of propulsion might then be the rocket, the ion drive, or the fusion (ram)jet. The optimal shape for such long-range vehicles, which would act as ‘mother ships’ to the much smaller g-craft, would thus be cylindrical, i.e. they would be cigar-shaped but without fins. They will be finless because they would not need fins in the airless void between planets.

The positive angle of attack can be explained if we assume that the artificial gravitational field, which when vertical offsets the gravitational pull of a planet, is also the field that allows horizontal motion. Let the downward force exerted on a planet beneath the g-craft have magnitude  $F$ . This force is equal and opposite to the force on the g-craft, so that if the latter is stationary (‘hovering’)

$$F = mg$$

Where  $m$  is the mass of the craft. For the craft to accelerate horizontally it will

(1) Tilt the axis of its repulsive field by an angle  $\theta$  relative to the vertical and

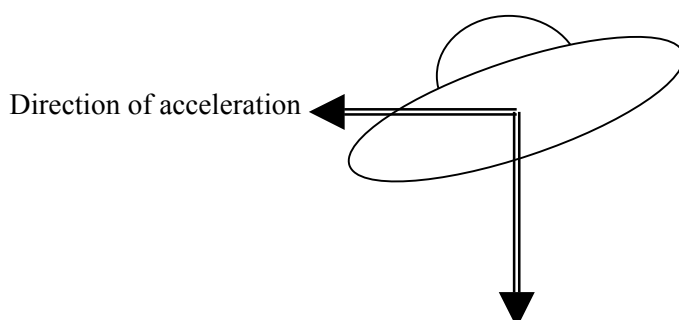
(2) Increase the magnitude of  $F$ , say to  $F'$

such that

$$F' \cos(\theta) = mg$$

Its horizontal acceleration will then be

$$a = F' \sin(\theta) / m$$



mg

Thus, a horizontally accelerating UFO would have a negative angle of attack.

A sonic boom is produced when a conventional aircraft exceeds the speed of sound in air. As the speed of sound is approached from subsonic speeds a region of high pressure is created ahead of the aircraft. The formation of this high-pressure region may be understood, intuitively if not very precisely, as being due to the fact that the air finds it increasingly difficult to get out of the way. The sonic boom is the shockwave produced when the aircraft breaks through this region of high pressure and produces a new streamline pattern.

The upward pointing field above the g-craft would repel the air ahead of it so that the region of high pressure does not form because the air ahead would travel roughly at the same speed as the craft. The precise shape of the streamlines would be very complicated, as they would depend both on the shape of the field and on that of the g-craft, but it is most probable that only the outer edges of the craft will have a sizeable velocity relative to the air. Though these edges could get very hot, and may even glow due to their high temperature, there will be no sonic boom no matter how fast the g-craft is moving because there will be no shock wave.

Finally, a g-craft would be inherently unstable. The repulsive field beneath the craft would have a strong tendency to flip over so that the repulsive forces along its axis become horizontal. We see this tendency in vertically rising top-heavy rockets and it is a bit like trying to balance a sharp pencil on its tip. The main difference between a g-craft and a rocket is that the former would tend to flip by 90 degrees, whereas a rocket would tend to flip by as much as 180 degrees.

Without appropriate safeguards, a UFO would therefore be in acute danger of flipping over and accelerating towards the planet with an acceleration due to the planet's field plus an added acceleration due to its own attractive lateral fields. A UFO crash would be quite spectacular! The instability could be partially controlled by spinning the craft, as any fluctuations in the direction of the repulsive field would thereby be smoothed out. However, spinning the craft would not remove the instability altogether and there would be a need for further stabilising mechanisms. These mechanisms, involving negative feedback, would manifest themselves as a *wobble* such as that displayed by a spinning top. This behaviour is mentioned frequently in UFO reports.

The g-craft would be most vulnerable to the 'flipover instability' during a vertical landing. The vertical component of the 'push' exerted against the ground below has to be reduced gradually, much like a top-heavy rocket trying to land on its tail (this problem does not arise in helicopters because the upward-pulling rotors are above the vehicle's centre-of mass). Enter the negative-feedback stabilising mechanisms mentioned above. If the vertical axis of a g-craft tilts towards the left, they shall immediately induce a counter-tendency towards the right, and so on. However, negative-feedback mechanisms always involve a time delay, with the result that they need to overcompensate. The result on a descending g-craft would then not be just a wobble but a full swing, producing a zig-zag descent exactly like the 'falling leaf' motion that has been reported.

Finally, although we do not know how to produce an artificial gravitational field, we can reasonably suppose that *if* such a field could be produced it would entail the creation of powerful electric and/or magnetic waves. Such waves would interfere with the electrics of a car, sometimes shorting the high-voltage spark plugs and causing the car to stall. On the other hand, Diesel engines, which do not have spark plugs, would be comparatively unaffected by whatever electromagnetic waves low-flying UFOs emit.

## **Conclusion**

One cannot *prove* the existence of UFOs by theoretical arguments based on their reported properties. But, like our friends Prometheus and the Hermit, a case can be made by making *one* assumption and then showing that the alleged observations, no matter how counter-intuitive or how much they fly against known technology, follow more-or-less logically. We have shown that, by postulating the possibility of a propulsion system based on an artificial gravitational field, the main features of a vehicle thus propelled will show significant similarities to the alleged physical characteristics of UFOs. This does not mean that a gravitationally propelled craft can be built. Nor does it mean that UFOs necessarily exist. But we submit that it constitutes reasonable grounds for taking the reports of UFOs more seriously than has been the case thus far.

[7886 words]