



A social history of BALL LIGHTNING



The chimera that came in from the cold

by *Martin Shough*

Back in 1967 the astronomer Gerard Kuiper dismissed a 10% residue of unexplained UFO reports with a wave of the hand, thinking it “reasonable to assume” that this testimony must be “so distorted or incomplete as to defy all analysis.” However, he advocated a major Defence Department/FAA programme to research “very rare natural phenomena” such as ball lightning. Why? Because “no adequate data yet exist of ball lightning”, even though its existence had been “known for at least a century”.¹

This raises a very interesting question: How was it possible for science to “know” anything with “no adequate data”? The answer is that science did *not* know. Rather, ball lightning had been kept in

the natural philosopher's cabinet of curiosities along with a jumble of Forteanism such as sea serpents, will-o'-the-wisps, fabulous mirages and spirits of the dead for a couple of hundred years. Disbelief and credulity swirled around together in a miasma of hopeless speculation until, during the early 20th century, the authoritative consensus settled into scepticism - a position which had only quite recently begun to change at the time Kuiper was writing.

Unpicking some of the reason and unreason behind this curious condition of scientific double-think is instructive. Logically and evidentially speaking, there is precious little difference between a "very rare natural phenomenon" which is unexplained and an unexplained phenomenon characterised as a "UFO". Even more subtle is the distinction sometimes drawn between "a unique natural phenomenon never before observed" and a UFO. There will always be unique combinations of natural phenomena never before observed (in practice), so how is a distinction to be supported between such effects and UFOs? Is there a real epistemological distinction? Or is it mere semantics?

The difference appears in practice to arise because there are two levels of "explanation" whose meanings are weighted differently in the two cases: There is a level of detailed physical understanding, i.e. a link-by-link chain of observed processes accurately modelled in theory; and there is a level of conceptual classification. When either of these levels is satisfied we experience a sense of accounting, and when both are satisfied there is a closure which we experience as "explanation".

Neither in the case of "unknown natural phenomenon" nor in the case of "unidentified flying object" is the level of detailed physical understanding satisfied, by definition; the difference enters in the conceptual classification and has to do almost exclusively with the way these ideas are emotionally connoted. Specifically, it is the mechanistic aura of the former and the animistic aura of the latter that sets them apart. The history of science associates mechanistic models with

productive explanations, animistic models with backward-looking resistance to explanations. The extraterrestrial hypothesis (ETH) and its analogues are for practical purposes regarded as examples of relict primitive animism.

Ball lightning emerges with some sense of explanation out of the primary category of "rare and unexplained phenomena" to the extent that it replaces (these days) animistic with mechanistic connotations. The collective term is emotionally neutral, the terms "ball lightning" and "UFO" are not individually so, and parity is broken; a coupled particle-pair of overall neutral charge is, so to speak, dissociated into two particles of opposite charge which fly in different directions in the social field potential. The positive "ball lightning" particle is eventually scavenged by surrounding atoms of incomplete theory; the "UFO" particle is left to wander, a free negative ion in a lonely search for an appropriate theory with which to recombine. It is a pragmatic fact, quite separate from the question of evidence, that an animistically connoted interpretation is not supported by the usual social-institutional legitimations of science as a valid "explanation".

It was also in 1967 that the distinguished British physicist and erstwhile intelligence mandarin R. V. Jones opined that most witnesses in UFO cases which could not be explained had probably made "substantial errors", and that "flying saucers" were therefore almost certainly a fantasy; whereas this same corpus of substantial errors allowed Jones to conclude that "an as yet unrecognised natural phenomenon" was "distinctly possible". In illustration of this he noted that ball lightning "has long been both asserted and disputed" and could perhaps be a similar sort of case. But he objected that unexplained UFO cases, in contradistinction to ball lightning, were never reported by scientifically trained observers, finally declaring that "little short of a tangible relic would dispel my scepticism of flying saucers".² The error of fact here (many still-unexplained UFO reports have been made by scientifically trained, indeed scientifically illustrious, observers) seems almost negligible beside the tangle of

category mistakes, non sequiturs and imported assumptions in which it is embedded.

Exactly similar objections continue to be heard regularly in the 21st century, and it is fascinating to be able to record that it has all been said before. Respected authorities such as Humphreys, Hagenguth and Berger in the 1930s, 1940s, 1950s and even into the 1960s regularly dismissed ball lightning in much the same language. So how did ball lightning come to survive and flourish as a scientific topic in the absence of a “tangible relic”?

Photographs and films were refuted by these sceptics as hoaxes, lens flares, streetlights, fireworks and so forth; eyewitnesses were regarded as an unreliable source of data, and were said to have misreported ordinary lightning, burning debris or retinal after-images; reports of burns and damage were said to be due to ordinary lightning strikes, unrelated fires or hoaxes; there were no concrete data in new reports and “fantastic stories from the past” were hardly



scientific evidence; reports rarely seemed to be made by scientifically trained observers, instead they seemed more often to be made by peasants, labourers and other credulous laypersons; lightning experts declared that their long surveys with panoramic cameras had never so much as caught a glimpse of anything like ball lightning; and anyway, darting, drifting spheres of light were physically impossible, as no small volume of atmospheric gases could sustain the reported energies of the balls for even a moment by combustion, let alone move around for many seconds or even minutes against the wind, pass down chimneys and squeeze through keyholes. In short the authoritatively sanctioned view, shared by the dominant majority, was that the whole thing was utter nonsense, belonging with tales of sulphurous demons and sea serpents.

LIGHTNING IN A BOTTLE

Then along came the early days of research into nuclear fusion, and the concept of electromagnetic containment of hot plasmas. Lightning channels were such plasmas, confined in one dimension: could stable plasmas, confined in three dimensions, form in nature? The idea was no more than an analogy, but one which prompted a few physicists to look again at the reports. It turned out that self-confinement in the free atmosphere by means of electromagnetic forces alone would not work, and realistic energy densities could not be found; but it was a start, and gradually more people began to talk as though the stories were not quite so wild after all.

Perhaps, suggested Peter Kapitza in 1955, such a plasma could be externally fed by the energy of intense, high-frequency radio fields associated with storms? No such radio fields were discovered, and calculations showed that the energies available would be too small to support a lightning ball in this way, but the principle was a breakthrough. There were still no unimpeachable films, photographs

or instrumental data; no “baby Kugelblitz” had been captured and analysed. But suddenly it was no longer preposterous to think of lightning balls floating down chimneys to terrorise people in their kitchens, for example, because the radio energy sustaining the ball would tend to be ducted as in a wave-guide.

At about this time military scientists began to conceive the idea of an energy weapon based on plasmoid projectiles, synthetic thunderbolts which would be capable of vapourizing the toughest armour, and research began during the next few years to generate controlled “lightning” balls in the laboratory. By the early nineteen-sixties, the Berkeley Radiation Laboratory of the University of California had developed a prototype plasma-weapon that expelled annular deuterium plasmoids at impressive velocity. It was thought that military applications of such weapons might be found in space, either in ‘killer’ satellites for disabling the new generation of spy satellites or as defences against ICBMs. The US Air Force Office of Scientific Research (AFOSR) began funding expensive secret programmes which were mirrored by similar efforts in the Soviet Union.

Meanwhile other theories of natural ball lightning came and went, such as cosmic rays focussed by the electric fields in thunderclouds. There was a quantum mechanical model involving a cold, dense electron gas self-confined by exchange forces, and even one which proposed spontaneous thermonuclear reactions: An unsuccessful, but nonetheless remarkable, efflorescence of ingenuity springing from what until recently had been (and to some still was) so much mere “humbug”. Slowly the barometer of professional opinion continued to swing, so that despite a notable paucity of concrete evidence and an observational database inevitably corrupted by misinterpretations, hoaxes and old-wives’ tales, the once-derided ball lightning began to exist, in the very practical sense that there was a widespread and growing consensus. At last scientists could start doing science.

Then in 1964, working on a grant from AFOSR administered through the Air Force Cambridge Research Laboratories (AFCRL), two physicists at Yeshiva University in New York built on Kapitza’s idea and came up with the first nearly-workable theory based on dielectric inhomogeneities in DC electrical fields which remained the basis of further developments for many years. Now, thanks to the thirst for militarily useful ideas and the efforts of Finkelstein and Rubenstein, it was possible to give mathematical form to a model which explained many of the shapes, colours, movements, odours, noises, temperatures and durations which had been reported and scorned for generations.

Spheroidal and ellipsoidal forms turned out to be the only stable solutions of the field equation. These plasma forms could also be shown to behave somewhat like elastic solids, which explained the oft-reported “bouncing” motion of lightning balls. Later refinements based on low frequency AC. fields, such as had been observed in association with lightning, were developed by Edmond Dewan and others working at AFCRL.³ This explained the reported persistence of ball lightning indoors by getting round the problem that in DC fields even non-metallic building structures tended to behave like conductive Faraday cages. The fit between theory and observation was improving, and although a completely satisfactory theory remained (and still remains) to be worked out, it was at last permissible for lightning balls to behave somewhat as, in fact, they had always behaved: bouncing, swooping, hovering, “investigating” chimneys and rooms, “pursuing” objects and people, sneaking through windows, keyholes and drainpipes.

By this time many physicists had begun exercising some creative hindsight, and history, as always, was written by the victors. Ball lightning began to be cited as the sort of novel phenomenon that objective science was always ready to embrace, provided only that there was good, reliable evidence. One began to hear about the fine qualifications of witnesses who had previously been ignored and derided.

In 1967 R.V. Jones was now able to point out that ball lightning had been reported by no less an observer than a former Deputy Director of the UK Meteorological Office, although the worthy Mr. Durward's two separate experiences with ball lightning back in 1934 and 1938 had singularly failed to impress the scientific world at the time, and years later had been dismissed by Swiss lightning expert K. Berger as one of those unevaluable "fantastic stories from the past".⁴

University of California physicist Leonard Loeb now felt secure enough to pronounce that lightning balls "have been too often seen and described by competent observers to be classed with flying saucers. They are not illusions".⁵ And aviation journalist Philip Klass confidently explained in articles in 1966,^{6,7} and in a book two years later,⁸ that many puzzling reports of so-called UFOs could in fact now be explained as ball lightning.

Besides having unimpeachable witnesses, ball lightning could boast quantitative data, too. Back in 1936 a Mr. W. Morris, a resident of Dorstone, near Ross-on-Wye, Herefordshire, reported that a fireball "the size of a large orange" had descended into his water butt, which he said had contained "about four gallons of water". The water boiled for "several minutes" and even after twenty minutes was too hot to touch. Few people took much notice of Mr. Morris in 1936, but this feast of observational data has been richly savoured in more recent years.

In 1966 the University of Colorado was famously contracted by the US Air Force to assemble a report which would be a grand epitaph to its 20-year role as UFO report collection centre for the American public, a study known as the Condon Report. Not surprisingly ball lightning made its appearance therein and Mr. Morris's immortal fame was once more celebrated.

Martin D. Altschuler, a solar physicist then working at the National Center for Atmospheric Research, prefaced his discussion of UFOs and atmospheric electricity in the Condon Report by noting that ball lightning "although witnessed and reported many times in the



A contemporary woodcut of the 'Great Thunderstorm' at Widecombe in 1638, when an 8-foot ball of fire was described as striking and entering the church, killing four people.

past, has only with difficulty been established as a genuine scientific problem. Years of patient effort,” explained Altschuler, “were required to distinguish ball lightning from retinal after-images and optical illusions.” One may doubt that the witnesses, after years of thankless reporting, would much appreciate the “effort” of science in this regard. But Altschuler and many others have certainly appreciated the world-famous rain barrel anecdote of Mr. Morris.

Describing this antique story as a “singular” piece of evidence upon which much research has focused, Altschuler proceeded to assume that the initial water temperature in Mr. Morris’s barrel was 20°C, that 1 litre of water evaporated from the barrel, and that the remaining 17 litres was raised to 90°C, concluding that a plasma 10 cm in diameter must have had an energy density of 5×10^9 joule/m³, an order of magnitude greater than the energy density of an equivalent volume of singly-ionised air. Much depends, said Altschuler, on reliable energy estimates of such fireballs, and although these data have serious implications for some theories of ball lightning formation there are sufficient well-documented reports implying very high energy densities to “make the water barrel report very believable”.⁹

It may be doubted whether water standing outside in a barrel in Herefordshire in October would be at 20°C, but never mind; one is impressed by how much may be inferred from so little, and is led to wonder in turn why, so consistently, nothing whatsoever can be inferred from reports of other aerial phenomena currently languishing in the holding category of “unidentified flying objects”.

The Condon Report stopped thinking about any such story once it became evident that it could not be explained, typically appending the conclusion that it “cannot be verified or refuted” or that the lack of tangible evidence rendered it “of no probative value”. This had been the extent of scientific ingenuity for twenty years and was plainly less than helpful. True, certain promising unknowns were considered at a special conference of atmospheric and plasma physicists to see if

they had any relevance to the study of ball lightning and related phenomena. The general conclusion was that they probably did not, which appeared to put a stop to curiosity. “All participants agreed,” reported Altschuler, “that the UFO cases presented contained insufficient data for a definitive scientific conclusion.” End of story. Oh, but Altschuler encouraged people to write or ‘phone in with any sightings of ball lightning.

“The size of an orange”? “Several minutes”? Surely we can do better than this. The amount of latent information in many still-unexplained UFO reports is potentially enormous by comparison. Perhaps some of the phenomena would turn out to be relatives of ball lightning, and perhaps some would not, but certainly we will never know if we exert disproportionate negative pressure on efforts to find out.

The Condon Report made space for Gerard Kuiper to peer down his nose at “this odd and discouraging assemblage of data”, an ill-perfumed rabble beside the seemly decorum of ball lightning reports; and made space for R. V. Jones to perpetuate the dual myth that ball lightning gained scientific opprobrium due to reports from trained observers, whereas “flying saucers” were sadly less fortunate in being so often sponsored by hoaxers, liars, the deranged and the merely dull, never by wholly reliable people. Of course, added Jones as a rider, it was quite possible that the tiny residue of unexplained UFO reports from those few who were somewhat less dull could easily have been . . . you guessed it, misinterpretations of ball lightning.

RADAR-REFLECTIVE SOMETHINGS

Now whilst every conscientious sceptical investigator would recognise that there are some intriguing reports among that fluctuating residue of unknowns that represents the “evidence for unidentified flying objects”, and would agree that we must allow the possibility that remarkable phenomena are observed, nevertheless he

or she might feel that “intriguing” was slim evidence on which to found an animistic theory of extraterrestrial incursions. This is a very honourable position to take. But it is a difficult position to maintain, under tension between the opposite lazy equilibria of “debunking” and “believing”.

Consider as an apt example the Lakenheath-Bentwaters case of 1956 – itself brought to light in the Condon Report – which did much to alter the complexion of the UFO debate during the 1970s and 1980s with its compelling mix of multiple radar and visual detections, by both USAF ground observers and RAF interceptor jets, all wrapped up in official telex reports from impressed intelligence officers on the spot.¹⁰ It remains a fascinating microcosm of the whole debate more than half a century after the first investigations, confusing but still unresolved despite a considerable amount of new information. By this I mean, of course, that it isn’t resolved either as a simple and well-understood event or as a spaceship. The most one ought to say about this case is that radar-reflective somethings in the atmosphere possibly behaved in ways that stretch the theories developed to explain other radar-reflective somethings in the atmosphere. That isn’t to say much. For most people it isn’t enough. And because the information needed to explain in terms of link-by-link physical processes is lacking we tend to skip to the explanation-level of conceptual classification.

On this level the issues become cathected and significant, primitively polarised between mechanistic and animistic tendencies, and here the psychological desire for closure pulls us in the direction of incredulity or of credulity. Some give in to their sense of wonder, others to their sense of disgust. If it were a report of ball lightning everyone can see that the debate would have a wholly different complexion: Enchantment would not be embattled with its self-generated alter ego Disenchantment. The problem would be able to remain on the level of “physical process” explanation because the “conceptual classification” issue has been resolved in the act of naming.

This sounds such an attractive proposition that one is tempted to jump in on the side of the debunkers, because surely one is saying that without the animistic ETH and similar tosh we could get on with some science. But this is not correct reasoning. The success of this strategy in the case of ball lightning does not guarantee that it will translate to the case of UFOs despite the centuries of momentum behind the success of naturalistic theories everywhere else in physics.

The fact is that today the notion of intelligent life elsewhere (in a quantum cosmos where “elsewhere” acquires an increasingly boggling spectrum of definitions) is a naturalistic concept with wide currency in physics. Like the crude principle of self-contained stable plasmas in the free atmosphere in 1930, it isn’t yet a useful explanation of anything. But it could be. This is the door which somehow has to be held open against the pressure of what feels like irresistible improbability.

It is understandable – even, in some way, commendable – that an incompatible idea transplanted into the body of science risks triggering a sort of psychological tissue rejection. Modern minds are accustomed to classifying and systematising the world around them in a more focused way than “natural philosophers” were once wont to; the scientific trophy cabinet is packed to the doors, and there is little room today for the sort of vague tolerance that in centuries past might have been happy to call these events “tropospheric pseudometeors” and leave them be. Today we either understand phenomena (broadly speaking), or we are in the process of polishing up our understanding, or else we are clearing them out with all the uppish vigour of a house-proud hostess appalled by the discovery of a piece of cheap china behind the silverware.

Tropospheric pseudometeors? If such a classification had any sensible scientific meaning then we would no doubt chorus, “Ah yes, of course!” and it would no longer be necessary to whinge on about the fallibility of human perception, the absence of material evidence, of films and instrument readings, and people could simply

get on with the job. The incident would suddenly be snatched from the fuscatory darkness into the light of Science, who would smoothly claim it for her own and build an academic discipline of Tropospheric Pseudometeoritics.

But then isn't this the point? There is no such discipline precisely because there is no proof that it would have anything to study, and there can be neither proof nor progress without hard data. How can there be a science of memories, probabilities, paper histories, hunches and inferences? Okay, maybe something did leave its mark momentarily on a few human retinas in 1956, and maybe its radar echoes did leave their glowing traces for a few seconds on the tube phosphor of a few radar scopes. But how can we do research without something to get our hands on, something that absolutely cannot be gainsaid? Maybe something was there, and maybe not; but even if it was, it has long gone and we don't know what it meant.

THE LESSON OF BALL LIGHTNING FOR UFOLOGY

And perhaps we never will. But by a serendipitous quirk of fate, on August 12 that year – about 9.00 am GMT on the very day before our UFO reportedly pursued a jet over Lakenheath – an instructive and analogous event occurred 1800 miles away in the skies over the lower Tambovsk region of what was then the USSR. A glowing reddish-orange sphere approached a commercial aircraft flying near thunderclouds at 10,000 feet. It was ahead of the aircraft off the port side and closing rapidly. Watched by three aircrew from the flight deck it passed close by the nose then suddenly swerved back around the fuselage and impacted the port propellor with a flash of light and an audible explosion that rocked the aircraft. Upon landing nothing, reportedly, was found except a very small fused area at the tip of one propellor blade and a small patch of soot that could be wiped off with a finger. Doubtless some sceptical meteorologists at the time

explained that a smudge of soot was not really proof of anything, that it was probably caused by a minor lightning strike of the usual kind and that the witnesses had mistaken retinal afterimages of a lightning flash for a swerving ball of fire.

Now, I say all this happened. Possibly you even believe me. And why not? Today this story appears in scholarly discussions of ball lightning, generally cited without question not as something that happened “reportedly” but as a matter of historical record. “Cases like this are not unusual,” remarked Altschuler complacently, telling this very story in the Condon Report without feeling the need even to reference it.¹¹ You maybe feel an urge to go and interview ageing witnesses or translate yellowing maintenance logs scribbled in Cyrillic pencil. But I doubt it. And yet is this mysterious aerial phenomenon really much different from the phenomena we are considering here? Is that ambiguous mark – which was (we are told) found on the tip of a long-scraped Soviet propeller blade nearly six decades ago, and which no one reading this has ever touched or seen – so very much more real than the luminous marks which appeared on US and British radar screens a few hours later?

One's instinct is to reply: “Ah, but we could have touched and measured that mark ourselves, had we been there, and someone did. That it was not us is merely an historical accident.” Indeed. And we could have observed and measured the radar blips at Lakenheath, Bentwaters and Neatishead, too, had we been there; we could have flown that RAF Venom jet, had we been there; maybe we could have seen that blur of light speeding over the Bentwaters airfield, and seen the erratic manoeuvres of other lights over Lakenheath, had we been there. A number of people were there, and they say they did.

But although there are certainly epistemological parallels to be drawn - and, it may be, physical ones too - between the Lakenheath/Bentwaters sightings and ball lightning, in comparison with many of the extrovert traits of so-called ball lightning those UFOs seem relatively staid. None of them entered an aircraft cockpit to burn



off the pilot's eyebrows, for example, or inexplicably undid all the metal screws in a piece of telegraph apparatus, or spiralled around a domestic kitchen before carrying away several curing hams up the chimney and scattering them in the street – all of which have been earnestly reported by ball lightning witnesses. Instead we have to account for luminous bodies in generally linear (sometimes rectilinear) motion through the sky, one of which behaved as though drawn towards an intercepting aircraft. Why should this be so very preposterous? The luminous something that reportedly overflew Bentwaters did so at tremendous speed, but not faster than a charge might track along a conductor for instance. And the Lakenheath primary object behaved possibly in a capricious but not in a supernatural fashion. There is no reason to suppose that these behaviours could not be understood with a little effort, and it may be that the physics of ball lightning is a good point from which to start.

One tactical reason is that calling a phenomenon “ball lightning” simplifies an agonisingly raddled epistemology – it does wonders for witness credibility. When scientists cite dramatic tales of ball lightning they don't apply forensic chain-of-evidence rules with the same pedantic rigour that they are wont to insist on in the case of UFO reports. This is not because the eye-witness evidence they're citing is of a different character; it's because the existence of a consensus allows them to lighten up and start to think positively instead of curling up and thinking negatively of what they stand to lose.

John Rimmer, editor of the long-running Fortean magazine *Magonia*, suggests: “Misinterpretations, radical or otherwise, may well be as significant a part of ball lightning sightings as they are of UFO reports. However, as science has established a comfortable phenomenological niche for such reports, perhaps the impetus to identify and eliminate misinterpretations from the data base is not as strong amongst ball lightning researchers?”¹²

This is very possibly true, and it would be interesting to suggest to ball lightning physicists that they should study UFO research with a view to sharpening up their attitude to their data. What, I wonder, would they take from it? What would they make of the polarisation of psycho-social and physicalistic assumptions in this field? Would they be persuaded that the new physics they've begun to invent to explain ball lightning was unnecessary? Would they conclude that if only they'd known about ufology's RMP (Radical MisPerception) theory earlier then they needn't have bothered?

Probably not, because they and RMP are old friends. They've grown apart from it, and are embarrassed by that immature liaison. ball lightning physicists don't really like to be reminded of the fact that the first scientific explorers into ball lightning-land had a destructive effect on what had for centuries been a commonplace acceptance. For lack of a good theory consistent with the unfledged physics of the day, lightning balls ceased to exist. All reports of it were explained away by

a Victorian equivalent of the RMP theory. If the present orthodoxy refers to this fact it tends to be in language that celebrates the success of scientific hard work, of which in fairness there has been a great deal. But I never hear an apology to the witnesses. I never hear an admission of any failing. Of course the blame lies at the door of a vanished – or vanishing – era and one cannot take responsibility for the past. Still, to me this loud silence does speak of a lesson not learned.

The lesson of ball lightning for ufology is twofold:

Firstly, one needs to be careful about drawing a general conclusion from the fact that a theory of misperception is plausible in general and demonstrable in particular cases. A catalogue of resolved cases is not a theory. As John Rimmer points out: “If ball lightning, like UFOs, only exists via eyewitness reports, it seems to me that the general scientific acceptance it has received, vis-a-vis UFO reports, is probably unjustified, and perhaps here is an area where some IFOs might be reclassified as UFOs with sufficient investigation.”

This is probably quite true. There is nothing in science or logic that says signal cannot coexist with noise. In fact the situation in any sampling is that noise is universal, and a set of data which has too-sharp a peak of pure signal with no noise would typically suggest fraud, or a filter due to some artifact of the measurement process.

Secondly - and this is a lesson that has redoubled relevance for the internet generations – it is not enough just to assemble catalogues of mysteries. Mysteries do not constitute new knowledge. A list of unresolved anecdotes is not a theory either. The sceptics are right that they do not have to take a residue of intriguing mysteries seriously until someone comes up with a link-by-link chain of evidence matched to a testable new theory that predicts specific measurable effects.

But at the same time that doesn't mean that it is the sceptic's role to discourage such efforts – that is the debunker's role and it can be done without. It is useless to science. No testable theory was ever produced by negativity and pessimism.

On methodology in science Percy Bridgeman wrote: “The only possible attitude to the facts of experience as it unrolls is one of acceptance ... In particular, since there is no means by which we can foresee the future we cannot tell in advance whether any mental device or invention will be successful in meeting new situations, and the only possible way of finding out is to try it.”

This is what happened with ball lightning. Cerillo in the 1940s and Kapitsa in the 1950s, then others, began to explore the “what if?” questions. They tried out the idea that at least some witnesses were describing something real and novel and came up with sketches of theories. Some of their peers then started to get the idea that maybe physics could model ball lightning after all, and that's how the stories changed from old-wives' tales to reports. All of a sudden, what had previously been hearsay of no probative value now became a fit subject for research grants. Serious analysis was begun on collections of ball lightning tales – the same tales, not new and instrumentally validated ones.

The world-famous “rain barrel observation” wasn't an experiment in a refereed journal but was the subject of a letter to a newspaper in 1936! I still get a shiver of delicious irony from recalling Altschuler's sober contemplation of the constraints placed on physical theory by the implied energy density of Mr. Morris's orange-sized lightning ball. No one at the Colorado University Plasma UFO conference seemed concerned that Mr. Morris may not have known a tangerine from a pomegranate or that his heirloom fob-watch might have stopped...

Then are the ball lightning theoreticians wrong? Is there no “new empirical phenomenon” called ball lightning? Or did they make a good judgement call on insufficient data and thereby generate a scientific conclusion whose value is becoming self-justifying? If they are right - and a virtual consensus now says that they are - this emphasises the importance of helping to facilitate a climate of productive and original theorising in anomalistics alongside a rigorous winnowing of the noisy evidence base.

The history of how ball lightning came to be rehabilitated from the outer darkness of mythology *can* of course fairly be described, with hindsight, as a success of science; but it ought not itself to be mythologised as a victory of the scientific hero over the dragon of popular superstition. Rather, it shows science happening as a social activity, the opportunistic product of a difficult but fruitful tension between cultural forces, in which cynical testing and naive openness to possibility (only rarely able to coexist in an individual) both have roles to play. Somehow it succeeds, almost despite us, in a pattern we are fated (I deliberately do not say “condemned”) always to repeat because understanding is possible only in hindsight.

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