Project for a network of automatic stations for UFO monitoring

MASSIMO TEODORANI, Ph.D. *Astrophysicist / UFOAC Consulting Scientist*

with:

MARK RODEGHIER, Ph.D. *Astronomer & Sociologist / CUFOS / UFOAC Scientist*

RON MASTERS, Ph.D. *Physical Chemist / UFOAC Consulting Scientist*

PHILIPPE AILLERIS, *UAP Observations Reporting Scheme* / *UFOAC Consultant*

ABSTRACT. After presenting the past history of scientific methodology applied to UFO monitoring operations, a new project for an automatic station is presented and discussed. Some engineering issues are also presented to stimulate a pragmatic "problem solving" aptitude. The proposed idea is intended to be a basis of discussion concerning the implementation of a permanent station containing off-the-shelf measurement instruments that, being in function all the time, are able to acquire scientific data on unidentified flying targets, which are then transmitted to investigators located at remote areas. Such an automatic station is intended to be a pilot project for a future network of similar stations scattered throughout the territory. The physical parameters that can be obtained this way are conceptually presented. The main goal is to ascertain what the nature of the UFO phenomenon is and which physics can be extracted from it.

1. Introduction

The UFO phenomenon is mostly known for its testimonial character, for its great social impact and for its random nature (Condon, 1969; Hendry, 1979; Hynek, 1972; Kean, 2011; Sturrock, 1969; CUFOS website; Wendt & Duvall, 2008). Nothing of such a phenomenon is predictable. Therefore no scientific treatment is apparently possible so far. The evaluation of witness cases is typically subject to a series of errors due to a too subjective description of persons who are most often emotionally involved from what allegedly happened to them (Teodorani, 2009a). Testimonial data screening is often deficient in accuracy, while a careful analysis of witness cases most often shows that reports of alleged UFO sightings can be explained by natural or man-made phenomena. On one side photos or videos of UFO events can be explained as well as prosaic phenomena (such as insects, birds or airplanes in distance); on another side too many alleged videos and photos are hoaxes and fakes. In most of the cases a photo and/or a video, taken alone, cannot be considered an evidence to be taken seriously in order to carry out a scientific analysis. In the same way marks left on the ground cannot be alone a proof of a "UFO landing", unless such a "landing" can be accurately documented. Chemical analysis of alleged ground samples is not sufficient alone to prove the exogenous nature of an anomalous phenomenon.

Is it possible to carry out a scientific analysis of a UFO phenomenon? In principle, yes, it is. The main point is that – except for some very rare attempts based on testimonial cases (Condon, 1969; Haines, 1980; Hill, 1995; Maccabee, 1999; NARCAP website; Rodeghier, 1981; Sturrock, 1999; Teodorani, 2009b; CUFOS website; UAPRS website; UAPSG website) – such an analysis is effectively possible only when data are taken using appropriate scientific instrumentation (Bunnell, 2003; MLR website; ICPH website; PH website; PSI website; Rutledge, 1981; Stephan et al., 2009; Strand, 1984; Teodorani & Strand, 1998; Teodorani, 2004, 2009b, 2011) and when similar data can be compared together by different observers. Anyway such an attempt has been only partial so far. A scientific fact must bring investigators to deduce physical parameters, such as speed, luminosity and distance, for instance. As luminosity of a flying target is a manifestation of an ongoing physical process that involves the state of excitation and ionization of atoms, it is clear that nocturnal lights are the most suitable cases that can be investigated scientifically. This can be done by analyzing the behavior and surface distribution of the light of the aerial target and of the spectrum of such a light in order to search and measure spectral lines and/or a simple continuum spectrum (Kitchin, 2008; Lang, 2005). All of this is not clearly sufficient, because what we see in the optical range might be only a fraction of the entire energy spectrum. Therefore optical instruments must be necessarily coupled to sensors that operate at different wavelengths, and where the detected radiation is not significantly affected by our atmosphere. The infrared window is the best choice in this case, and in some cases the ultraviolet window too. But the electromagnetic radiation that an energy source is able to emit is even wider. If we exclude high-energy emission (such as X and gamma-rays) that is easily absorbed by the atmosphere, we must necessarily consider the very wide range of radio emission, in particular the UHF (microwaves, 1-30 GHz), VHF (30-300 MHz), and VLF/ELF (3-30 KHz) ranges. In brief it is necessary to monitor the optical phenomenon simultaneously (and not separately) with the electromagnetic field that it possibly produces. As several reports exist about UFO phenomena that are able to produce electromagnetic interference (Rodeghier, 1981; Maccabee, 1994; Meessen, 2012) it is also necessary to verify if the local magnetic field is subject to disturbances that are temporally correlated with such a phenomenon (Strand, 1984). Finally, the dynamics of the phenomenon can be studied only if it is possible to deduce how the measured physical parameters vary with time (Teodorani, 2000, 2001): in fact it is expected that the data that one is able to acquire are spread along a certain period of time in which the phenomenon produces its effects. If we have all of these essential data in hands we are then in a condition to extract true scientific data, namely: data that, differently from the qualitative nature of witness information, are quantitatively treatable in the form of pure numbers. When we have all the numbers in hand (plus the associated error) we are then in a condition to build charts of the several parameters that we can infer from the monitoring operations, so that we are finally able to search for possible correlations between the several measured parameters. Correlations can potentially bring us to the construction of the physics of the observed phenomenon.

Crucial scientific information, using an automatic monitoring station, cannot be limited to the case of so called "nocturnal lights" (Hynek, 1972; Hendry, 1979) but it must be also extended to anomalous (often with structured shape) aerial phenomena that appear in daylight. This is justified by one part of the UFO sightings that have been reported both in the past and at the present time (Hendry, 1979). In such a specific case, even if optical spectra cannot be obtained, we can obtain crucial data as well. For instance we can simultaneously obtain high-quality videos of the aerial phenomenon and extremely important data concerning the electromagnetic and magnetic field that is time-correlated with it in case (Rodeghier, 1981; Meessen, 2012). Electrostatic measurements can be carried out as well. And photographs and or videos might also show luminous spot-like sources that are in case located on the extended surface of the target, which can be accurately studied, especially their possible time variation and their possible correlation with the speed parameter (Teodorani, 2001). Possible shape changes and their variation in time, more probably due to magnetic refraction effects, can be studied as well using optical devices.

Clearly only an appropriate scientific analysis of this kind (regarding both nocturnal and daily lights) can permit one to ascertain if an alleged UFO phenomenon is a true anomaly or if it can be explained and/or identified with a well-known manifestation. Therefore it is more than evident that a healthy (certainly not dogmatic) skepticism is the only possible aptitude that can help serious investigators to make a correct screening of the monitored phenomena.

Apart from locations in the world in which the UFO phenomenon (in particular nocturnal lights) seems to be constantly or occasionally recurrent (Teodorani, 2008), in most cases UFO accidents occur randomly in space and time (Hendry, 1979; CUFOS website). Therefore it is virtually impossible to use scientific personnel on field in order to obtain measurements data using sensor devices. In order to solve – possibly – such an unavoidable problem, it is inevitably necessary to install and use automatic and remotely controlled stations that are equipped with measurement instruments that are able to furnish the most essential physical parameters of the phenomenon.

2. Previous experience of instrumented UFO monitoring

Before discussing which are the optimal characteristics that an automatic monitoring station should have, it is necessary to mention what has been done in the past using such a methodology. More or less successful attempts have been done since the seventies. Let's mention the most important experience done on the instrumented monitoring of UFO phenomena, just quoting some examples.

"Project Starlight International" (PSI) (PSI, website) is probably the first important attempt to monitor UFO phenomena using measurement instrumentation that was located at a station. It was founded in 1964 by technician and ufologist Ray Stanford, with the purpose of gathering and disseminate a broad range of instrumented UFO data to the scientific community. During its existence (years '60 and '70), the project has utilized magnetometers, a gravimeter, radio spectrometer, radar, laser-telescope-video system, and other electronic and optical systems for recording the physical effects, optical images, and location of UFOs. The project conducted in-depth analyses of motion-picture films of UFOs obtained by PSI staff members, along with magnetometric, spectrographic, and other data recorded during UFO events. Apart from this such data have not directly produced true scientific publications of academic level, but allowed anyway some academic scientists to do this (Meessen, 2012). The choice of PSI instruments was certainly optimal and complete, even if they were mainly aimed at monitoring UFOs under the preconceived assumption that they are due to extraterrestrial visitation.

In the period of time 1973-1980 physicist Harley Rutledge of the Southeast Missouri State University, together with his Ph.D. students, carried out a monitoring campaign in Piedmont, Missouri, where suddenly a recurrent light phenomenon started to appear sometimes very frequently. Telescopes, optical and radio spectrometers, and magnetometers were used at that time with some occasional measurement and result, together with detailed reports of the very many witnessed visual cases. In any fact such first scientific instrumented attempt, although being tenacious, academically directed and partially productive, couldn't offer a truly systematic approach to the problem as no automatic system was operating at that time. But this was a great trigger for the future of scientific investigation of such phenomena. A very important book was published by Rutledge (Rutledge, 1981).

Starting from 1984 a new project was born in Norway, thanks to electronic engineer Erling Strand of Østfold College. That was "Project Hessdalen" (PH, website), aimed at monitoring instrumentally typically unstructured plasma-like light phenomena that were reported very often in Hessdalen, a very little village in central Norway. During only forty days an instrumented measurement campaign was carried out very intensely in the winter of 1984 (Strand, 1984), bringing to very reliable results after using a magnetometer, a radio VHF spectrometer, some telescopes, and many cameras equipped with a spectrographic grating too. Such a campaign, probably the most important ever conducted in the world up to that time, demonstrated that anomalous aerial phenomena, when recurrent, can be measured indeed. From that time on, especially after a very important workshop occurred in spring 1994, the interest of the scientific community grew more and more and several important academic papers have been published so far (Fryberger, 1997; Teodorani & Strand, 1998; Zou, 1995). In the last 19 years Italian, US and French engineers and scientists have been fruitfully involved in the project (ICPH, website; IEA, website; Project Hessdalen website;

Zlotnicki et al., 2012). The grown scientific interest at an international level allowed Hessdalen researchers, to which electronic engineer Björn Gitle Hauge of Østfold College was productively added meanwhile, permitted finally to build up a fixed station (PH, website) where the following instruments were permanently installed: several sophisticated videocameras, a magnetometer, two types of radar, a very advanced VLF-ELF spectrometer and a microwave spectrometer. Compared to previous experience in other areas of the world the peculiarity represented by the so called "Hessdalen Observatory" was that it was the first attempt to make an automated station. It was used as such mostly with the videocameras, which for a period of time of some years acquired continuously video data, permitting to find some important evidence of the phenomenon. VLF-ELF data were automatically recorded as well but their full analysis is still lacking. In the last years, due to lack of funding and to problems of technical maintenance also because of occasional bad weather, such a station is operational mostly only using simple streaming cameras. The "Hessdalen Camp" initiative (born in the beginning of this century) was another meritorious initiative (PH, website), in which the first steps of scientific method applied to the Hessdalen mystery were taught very fruitfully to young students with the stimulus of the phenomenon occurring in that area. The Hessdalen experience has globally shown to be fruitful and even revolutionary, but in time, apart from the good "politics" adopted in order to raise the interest of people, it showed some gaps from which everyone should now learn in the perspective of future projects there and elsewhere in the world. Such gaps might be probably resumed in the following points: a) problems with constant money funding; b) difficulties of a constant and prompt maintenance during hardware and software failure; c) lack of minimum competent technical personnel that is constantly on site; d) much and good engineering and computer science work but little true experimental and observational physics work (even if good non-Norwegian papers of theoretical physics were published indeed by someone; [Fryberger, 1995]). Such gaps, which were and are mostly due to practical difficulties and not just to human inefficiency, should teach us to understand where and how it is possible to do better in future projects.

Other important, but more limited, monitoring projects on UFO and similar phenomena (such as the so called "earthlights") have been carried out by other very competent scholars. Since 2003 the international group conducted by geophysicist Marsha Adams has permitted to carry out several instrumented missions in USA and abroad using portable instrumentation (IEA, website). The past experience of electronic engineer David Akers (in the seventies, eighties and nineties) with his video and magnetic monitoring of anomalous light phenomena occurring recurrently in the Yakima (Washington) area (Akers, website), and of aerospace engineer James Bunnell in the Marfa (Texas) area are very reliable from the professional point of view. In particular, during more recent monitoring work (this century, up to now) Bunnell deployed and used very sophisticated optical instrumentation such as telescopes, cameras, true spectrographs, and videocameras, the last ones being automatically controlled inside two small permanent observing stations. Bunnell's work has allowed to obtain important physical information on what is occurring in Marfa and several valuable papers have been published by him and by his academic collaborators (Bunnell, 2003; MLR, website; Stephan et al., 2009). Geologist Bruce Cornet's work in Pine Bush (New York) during the nineties cannot be ignored as well due to his meticulous monitoring work of that area of light phenomenon recurrence (often mixed up with structured anomalous aerial objects) using magnetometers, videocameras, cameras and sound sensors (Cornet, website). Important and original design of a quite sophisticated UFO monitoring station is nowadays carried out by astronomer Eamonn Ansbro too, in Ireland (Ansbro, 2004), where video, spectrographic and electromagnetic instruments are implemented as a short-range version of the SETV experiment (Ansbro, 2001).

As it has been presented above, most of the instrumented systematic efforts have been devoted to the study of Hessdalen-like lights (to be categorized as "nocturnal lights" in the standard ufological nomenclature) as in several parts of the world this kind of phenomenon (otherwise called "earthlights") is much more frequent than more proper "structured aerial objects" (which, in any fact, have been reported many times also at areas of earthlight recurrence). But such an experience, from an instrumental point of view, is of course perfectly suitable to monitor every kind of aerial phenomenon, and the acquired experience and know-how has opened the door to this kind of investigation. Therefore, in the light of the past experience what should be done in order to build up an optimal automatic monitoring system aimed at future research projects?

3. Automatic measurement station

What are the characteristics that an automatic station should have nowadays in order to obtain data that are able to satisfy a fully scientific procedure? The following points are probably the most important ones to point out (see also Figure 2).

A. Optimal Power Sources. A station that works all the time without interruption, except during maintenance, needs an efficient system that guarantees with reasonable continuity its power supply. Being batteries unpractical for this specific use or, anyway, of limited use in time, previous experience (PH, website) shows that long cables (with a length of the order of 1800 feet) can be used quite efficiently. Therefore such a station should be located at an optimal position, where an energy source is available (for instance: a house that is not too far from the station). This logistical problem must be accurately solved as the "battery option" is of very limited use in terms of time of utilization and would require periodic and very frequent battery changes or recharge, considering that more than one batteries should be used in order to serve several instruments inside the station. Due to possible black-outs, which might be caused both by bad weather and by the phenomenon itself (PH, website; Hendry, 1979), the cable system for energy supply should be coupled to a continuity module, which is ready to enter in function as soon as an energy failure occurs. A cable system is able to serve simultaneously all the measurement instruments in only one hit.

B. Station Multiplicity. In order to cover wide areas of a country (such as USA, for instance) it is inevitably necessary to implement several stations that are wisely spread in a targeted way over the country. The project might be started with two or three stations that are set up at strategic points of the country.

C. Effectiveness vs Costs. Due to the realistic availability of money funding and to the necessity of simplicity of maintenance, each station must be equipped with essential instruments that are both simple for use and at the same time sophisticated enough.

D. Range and Sensitivity. Every instrument that composes an automatically and remotely controlled monitoring station must be able to detect weak signals (comprising all wavelengths, ranging from radio to the ultraviolet if a complete system is used). This increases the possibility to record light phenomena that are away from the station but over the horizon. Typically such instruments should be able to detect and record signals coming from sources that are at least 10 miles away from the station.

E. Instrument Completeness. Every station, which is exp ected to be a compact "box", must contain inside several instruments (see Figure 1). The most important instruments that must be used are probably the following ones: one all-sky camera [1] (UWO website) connected to a low or medium-high resolution spectrographic grating, one triaxial fluxgate magnetometer [2], one electrostatic detector and one weather station. Such four instruments should constitute a "basic unit". An "optical unit", which can be added and connected to the basic one in a subsequent phase, should contain the following instruments: one high-sensitivity videocamera for taking videos [3] (SOSO, website), one

---

[1] **All-sky camera.** A good example is given by the system used by NASA for fireball research: http://fireballs.ndc.nasa.gov/ A simpler but more dedicated system is represented by the "UFOCATCH" platform: http://www.ufo-science.com/fr/telechargements/pdf/ufocatch.pdf

[2] **Magnetometer.** A good example is given by the very portable and sophisticated *MEDA* fluxgate magnetometer: http://www.meda.com/

[3] **Multiple Videocameras.** Concerning the specific issue of videocameras an important point, due to Dr. Ron Masters (Masters, 2013), should be made taking advantage of previous projects (Gröschel, website) concerning the used frame rate and exposure times, where two videocameras are simultaneously used with different rates (1/sec and 25/sec) to optimize signal to noise (S/N) ratio. Such a procedure could be decided as an alternative to the basic videocameras present in the standard optical system proposed here. This would allow one to use correct exposure times to obtain best S/N ratio for the UAP of interest in an image frame. At the same time large dynamic intensity range would be gained so that dim and bright objects can be selected from images and not be over or under exposed (Masters). A third high-resolution system (camera or optical zoom) is needed (Masters' idea) that responds to the image location observed by the first two cameras to provide sufficient optical resolution to distinguish shape. This third camera system

high-sensitivity videocamera attached to a low-dispersion grating for optical spectroscopy (Masters, 2012), one DSLR professional camera attached to a dispersion grating for medium-high resolution of “echelle” kind (Masters, 2012), one specialized videocamera with the capability to record many frames per second [4] (high time-resolution; typically: 10.000 fr/sec), one specialized DSLR professional camera for infrared and ultraviolet photos [5], one optical radiometer. An “electromagnetic unit”, which can be added and connected to the basic one in a subsequent phase, should contain the following instruments: one spectrum analyzer for microwave-UHF signals [6] (plus antenna), one receiver/spectrometer (plus antenna) for VHF signals (PSI, website; Strand, 1984), one receiver/spectrometer for VLF/ELF signals, one Geiger counter. A large part of the described instruments can be chosen among several high-quality models that are available on the market. All instruments must be computer controlled. A gravimeter (which is typically much heavier and more expensive than all the other instruments), a high sensitivity sound sensor and a thermal imaging camera might be added to the station if money funding will permit in a subsequent phase. All of such instruments must be of the off-the-shelf kind (namely: very portable, light and cheap) and connected directly to a computer server where data can be constantly recorded and then promptly downloaded from remote areas where investigators are located. The station needs a periodic maintenance both for the proper functioning of the instruments themselves and for an appropriate internet connection and efficiency.

Of course such a proposed instrument completeness, complexity and sophistication must be balanced against the cost and the available power source to run the instrumentation. But it should be reminded that the optical and the EM ones are just optional units (although extremely important for an appropriate and more rigorous physical study) that can be added only in a subsequent phase and only if results have

---

would use data from the first two cameras to point to the location of interest and set exposure conditions to provide best ability to discern shape. This idea is similar to how global observatory networks provide information to specific telescopes to point to an area of interest based on data obtained from other telescopes, such as when a supernova or some other interesting event is detected. This camera could also connect to a spectrograph (Masters’ idea). Many systems could be deployed in many locations using the first two cameras. Hot spots could be equipped with the third system. Other types of detectors would be added to the equipment as the rest of the team decides, perhaps initially at the hot spot locations, then eventually to all locations.

[4] **High-speed videocamera.** A good example is given by the very portable and sophisticated *Olympus i-SPEED* : http://www.olympus-ims.com/it/hsv-products/

[5] **UV/IR DSLR camera.** Probably the best example on the marked is represented by the *Fuji FinePix S-3 Pro UVIR* : http://www.dpreview.com/news/2006/8/9/fujifilms3prouvir

[6] **Microwave spectrometer.** One of the best portable spectrometers of this kind is represented by the *Aaronia Spectran* : http://www.rtelecom.net/product/127/rf-spectrum-analyzer-1mhz-9-4ghz-spectran-hf-xfr-aaronia.html

been previously obtained using the basic system in order to justify further money funding. First one must be able to demonstrate that such a station is able to catch "UFO data", then all the good reasons would come in order to implement more sophisticated instrumentation. Without considering the limiting factor per se in terms of time of utilization, if a battery option is used as an energy source evidently if the number of instruments increases the number of batteries must increase and the cost would increase as well with them. That's the reason why a battery system is not viable both in practical and in economic terms. Past experience done with the Hessdalen station (PH, website) shows that a cable system can be used indeed. Therefore much of all the efforts should be concentrated in finding an existing appropriate power source in the vicinity of the station itself or not too far from it.

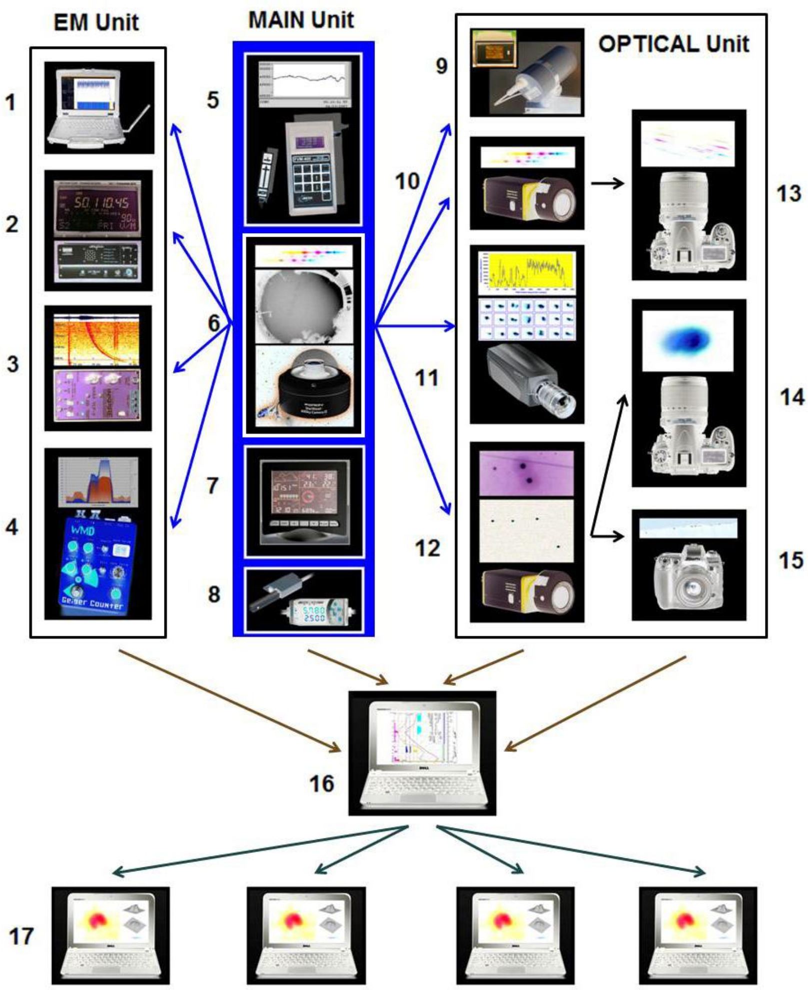

Figure 1. Automatic Station. 1) UHF Spectrum analyzer, 2) VHF Receiver, 3 VLF/ELF Receiver, 4) Geiger Counter, 5) Magnetometer, 6) All-Sky Camera, 7) Weather Station, 8) Electrostatic Detector, 9) Optical Radiometer, 10) High-Sensitivity Videocamera + Low-Resolution Grating, 11) High-Speed Videocamera, 12) High-Sensitivity Videocamera (normal + night shot modes), 13) DLRS Camera + Echelle Grating, 14) DLRS Camera, 15) UV-IR DLRS Camera, 16) Computer/Server, 17) Remote Computers.

F. Alarm device. An appropriate alarm facility must activate all the instruments together. Such a device might be constituted of a multi-instrument “EM box” [7] (able to communicate with the computers that control all the main instruments) or of the all-sky camera itself, which would be the only instrument that would presumably work all the time.

G. Station Location Choice. On the basis of which criteria is the location of the stations decided? Clearly maximum priority should be given where the incidence of UFO reports is more frequent in the country. This can be evaluated through an accurate statistical analysis (Teodorani, 2009b; The Canadian UFO Survey, website).

H. Scientific redundancy. Instruments to be deployed at the stations must be able to be used for purposes that are also different from UFO monitoring. For instance, all of the available optical sensors can be used to monitor (and measure) the passage of meteors/bolides and fireballs in the sky and electric phenomena of the high atmosphere such as Elves and Sprites. This already partially happened with the instrumentation used during previous or current anomaly research (MLR, website; SOSO, website). All the electromagnetic instruments might be able to monitor phenomena generated by geophysical causes (such as tectonic stresses near faults), by meteorological factors (storms in distance, atmospheric electricity), and by the activity phase of the Sun. Of course, in order to allow the employed instruments to be useful for standard science too, one will need to consult with various specialists to obtain their advice on what measurements they would find useful, in what format and with what sensitivity. If both needs (the study both of the anomalies and of natural phenomena) can match together, one would reach a solid and efficient multiplicative factor as well as an attraction pole for “standard” physical scientists, who indirectly (or even directly) might become interested (and involved too, in case) in the study of aerial anomalies too, thus bringing potentially the physical study of such kind of anomalies fully inside the academic environment.

I. Station Flexibility. Due to some practical reasons, a monitoring station can be intended in two distinct modes: a) as a permanently fixed station on ground; b) as a fully portable station. In the first case the station, although fixed for use, must be easily transported since it will have to be shipped to its final location, or shipped back for periodic maintenance. This mode seems to be considered realistic today due to the rarity of specific areas of USA (or Earth in general) in which aerial anomalies that show a systematically structured shape suddenly occurs in the form of time “flaps” at several locations (Hendry, 1979; CUFOS website). In the second case the station should be easily moved elsewhere in case of necessity, typically in order to monitor continuously several

[7] **UFO Multisensor.** A possibly useful “alarm device” might be represented by the “UFO Multisensor 1.0”: http://digital-service.biz11.de/images/Dateien/c-Ufomultisensor%201-0%20englisch.pdf

recurrence areas where Hessdalen and plasma-like phenomena occur. Due to this such a station should be placed over a little transportable wagon (equipped with wheels) to be attached to a truck, and, in case, also transportable aboard a cargo airplane. A decision on which of the two options must be adopted will depend on if one is more interested in monitoring highly anomalous structured aerial phenomena of probable artificial nature or if one is more interested in monitoring anomalous plasma-like phenomena of possible (but not assured yet) geophysical nature. In the first case the probability to find something is much lower than in the second case, but the importance to study structured aerial phenomena is so higher than the importance to study probable geophysical phenomena that the first mode should be chosen, also considering that anyway an automated station that records data continuously at a fixed location is expected to obtain results in time. This time – in terms of probability of finding something – is much longer than for natural-like phenomena's, but the much higher importance to study structured phenomena (due to what it might involve) justifies the fact that the first mode of making a station should be preferred to the second one.

J. <u>Security against interference and intrusions</u>. Stations must be placed at areas where no electromagnetic interference occurs due to human devices and where natural magnetic anomalies are not present. Therefore places that are isolated and safe at the same time must be chosen, but with the fundamental compromise in mind that a power source of the cable kind (located at an house, for instance) should be reasonably close to the station (Kelleher & Knapp, 2005; PH, website). Such a vicinity in principle should render the station much safer than if it is totally isolated (in which case a battery mode would be necessarily used as a power supply). A constant but soft control of the cops should be guaranteed too according to standard vigilance of houses, even the most isolated ones. In any fact the area should be fenced and an appropriate tag should be attached. As a permanent technician for the station's periodic maintenance might be of basic importance for the efficient and continuous functioning of the station, one could think of such a collaborator on site (in case more collaborators who take periodic turns among them) who momentarily is accommodated at the same house where the power source is located for cable connections to the station. A similar mode (a private house close to the Hessdalen station) has been adopted in the recent past in Hessdalen by Italian engineers in order to allow the control of the radar screen. In such a specific case the power source was located at another house.

K. <u>Occasional presence of investigators</u>. In the case that a "UFO flap" (not only earthlights) occurs at a location whose contour (and/or "epicenter") can be evaluated precisely and that such a "flap area" is a typically long lasting one, the automatic station should be placed there (Cornet, website). In such a case it would be highly recommendable that some investigators are also present in situ during some period of time: this might help to carry out additional measurements that a normal station is not able to perform (Teodorani, 2009c). For instance, personnel on field might use portable telescopes both for imaging and high-resolution spectroscopy (Stephan et al., 2009), heavy and sophisticated gravimeters, portable radars (Montebugnoli et al., 2009) and other professional scientific instrumentation. Personnel might also conduct tests using a powerful Laser against a presumably anomalous light target (Strand, 1984; Teodorani & Strand, 1998; Teodorani, 2000, 2001, 2009c), after ascertaining – using a radio scanner – that the light phenomena are not airplanes.

L. Data processing and analysis. Data acquired using the measurement instruments that equip the automatic station are intended to be remotely downloaded by all the investigators that belong to this project. According to the competence data analysis is expected to be carried out by the specialists in several fields and, in case, shared with academic researchers and professors in order to profit from their technical response. More than one investigator should process the same kind of data, using the same or different software, while results must be compared together.

M. Hiring of Ph.D. students. It would be extremely interesting and profitable to involve young scientists (graduate students who already own a master degree) who want to work for their Ph.D. research in this specific field. Such students might be searched at Universities in the faculties of observational astronomy, experimental physics and optical and/or electronic engineering. They might be involved both in the data acquisition and in the data processing/analysis/interpretation phase. Such students should be supervised both by their academic professor and by the physical scientists/engineers who work directly in the project. Young scientists are notoriously very mentally fast and motivated, and being able to find at least one of them would be a great resource for the project.

N. Consultancy with engineering experts. The experience acquired on the data acquisition of UFO phenomena using automated stations (PH website) is quite new and the technical experts (including technical personnel from the military in case) in this specific field are still very few in the world. Such experts should be promptly consulted and, in case, involved inside the project as external consultants. In particular, engineering competence might be extremely important when one deals with the desired data rate of the entire system (Masters, 2013). In fact, whatever the sophistication of the system is a time latency problem inevitably occurs at the time in which data are acquired. This causes a delay in communication between sensors within a given unit, and between units in the global network. The faster the communication and less the latency, the greater the cost. Accurate time stamp data for each unit in the network will be vital for relating observed events to each other, in order to allow an acceptable synchronization between all systems. A bad synchronization might prevent one to correlate two crucial events (especially the very short time-scale ones) recorded using different instruments, so that important information might be lost. Concerning electromagnetic sensors, problems related to the use of a PC interface (Ailleris, 2013), constituted by a microcontroller with buffers connected to each sensor and each USB bridge, could create self-interference (or intermodulation) and contaminate the sensors masking the results. Therefore the use of microcontrollers or bridges relying on cycles of clock should be reduced. If still a PC interface is needed, the compact 'box' would need either a real time remote connection via wireless network (through a cellular modem) or have its own record board with memory circuit that would be later assessed by the PC. The correct circuitry (where all circuits are properly connected) and microelectronics must be used in order to solve this problem: on the contrary data might be polluted by electronics itself. Considering these important issues of electronic engineering, which once properly faced would inevitably increase the cost of the entire apparatus, there are good reasons to suggest that at the same cost it is better to use less instruments but with such problems reasonably solved than too many instruments (even if absolutely important per se in order to face the physics of the investigated problem properly) for which data communication and PC interface are unsatisfactory.

4. Measurement instruments: procedures

The idea consists in starting the project using only the basic unit (or: “main system”), in order to test its functioning for a certain period of time and to verify if such a strategy is effectively able to record the passage of possible UFOs. The main unit employs an all-sky camera that is simultaneously able to acquire both images and optical spectra. Regarding the possibility to take spectra (Kitchin, 2008) simultaneously with images, it is expected that a beamsplitter directs half of the light from the main lens to the entrance slit of the optical spectrometer, which can be of low or medium-high dispersion kind according to the choice that will be done. When a luminous phenomenon of whatever nature appears in the sky, there will be an increase in the intensity of the all-sky collected light. The all-sky background without the object is subtracted to obtain the spectrum of the luminous object. A recent aimed development and patented realization shows that a spectrograph for UFO detection (low and medium-high resolution variants) can be of the slit-free and direct-viewing type (Masters, 2012). At the same time in which optical measurements are taken, a magnetometer, an electrostatic detector (or electronic electroscope) and a weather station are expected to acquire data all the time. Obviously all of the four instruments are time-synchronized and connected together using one or more dedicated computers that pilot them and save the obtained data. If during a certain period of time (typically: one or two years) the basic unit demonstrates to be productive then the demand of new money funding would be justified in order to implement two additional units: the optical and the electromagnetic units. The scope of such additional units is to improve the monitoring procedure following a more analytic mode. Of course in order to achieve this task it is necessary to carry out a lot of engineering and informatics work, in particular in order to permit to the main unit to communicate with the additional two units. One “trigger parameter” must be chosen in order to permit the main unit to activate the other two ones. For instance, such a parameter might be given by the target’s luminosity threshold (PH, website) or speed or by an alert coming from the magnetometer or the electrostatic detector. Moreover the Altazimuth coordinates of the target must be recorded continuously. In such a case the coordinates would be immediately communicated to all the instruments of the optical system, which then would start to track the target and acquire data of it. All the three videocameras and the radiometer are expected to be mounted on a solid steerable tripod. A second steerable tripod would have all the three DSLR cameras mounted over it as well. All the operations using the main system and the optical system would be synchronous with the operations using the electromagnetic system, which would be activated by the trigger parameter from the main unit. Computers (certainly more than one, or a single powerful workstation) are intended to control: a) the Altazimuth movement of optical instruments; b) all the data acquisition operations. Data are then deposited on a memory storage disk, and can then be downloaded from remote stations for analysis.

5. Physical parameters to be obtained

All the measurements that are acquired using all the described instruments (see Figure 2) must permit investigators to obtain a possibly accurate evaluation of the most important physical, geometric and kinematic parameters (Kitchin, 2008; Lang, 2005) of the luminous flying target. According to the used instrument it is possible to obtain the following physical parameters:

MAIN UNIT

- Electrostatic Detector – Number of electrostatic particles per second.
- Weather Station – Atmospheric parameters (air temperature, pressure, humidity, wind speed, clouds, etc.).
- Magnetometer – Magnetic field intensity (x, y and z components).
- All-Sky Camera – Apparent target luminosity and color (using photometry). Light surface distribution (Point Spread Function). Angular speed of the target in the sky. Spectrochemical line identification. Intensity and equivalent width of spectral lines (if present), from which it is possible to: a) calculate the number of atoms of a given (identified) chemical element that are excited; b) measure the flux of the continuum spectrum.

OPTICAL UNIT

- Optical Radiometer – Electromagnetic radiation intensity in the optical (and, in case, in the near IR and UV too).
- High-Sensitivity Videocamera – Kinematic characteristics of the target (speed, acceleration, changes of directions). Angular speed of the target in the sky. Apparent target luminosity and color. Light surface distribution (Point Spread Function).
- High-Sensitivity Videocamera + Low-Resolution Grating – Spectrochemical line identification. Intensity and equivalent width of spectral lines and their variation with time.
- DLRS Camera + Echelle Grating – Spectrochemical line identification. High-precision intensity and equivalent width of spectral lines. Morphology of spectral lines. Magnetic field intensity from possible Zeeman Effect that is in case present in spectral lines. Possible line blue or red-shift in case of extremely high speed of excited gases. Possible rotational line broadening.
- Optical and UV-IR DSLR Cameras – Apparent target luminosity, color and light surface distribution from high-resolution photographs, in the infrared, optical and ultraviolet ranges.
- High-Speed Videocamera – Possible high-speed variation of luminosity, color and surface shape and dimensions from optical video frames (typically: 10.000 fr/sec).

ELECTROMAGNETIC UNIT

- VHF and VLF/ELF Receivers and UHF Spectrometer – Intensity, variation, periodicity and morphology of radio waves in the UHF, VHF and VLF/ELF ranges.
- Geiger Counter – Intensity of radioactivity emission (alpha, beta, gamma particles).

Clearly, being all the measurement instruments working all the time and all together simultaneously, it becomes possible to: a) evaluate the time-variation of all the measured parameters; b) search for correlations between them. From this it may be possible to infer some important information on the physics of the problem (Teodorani, 2001).

Apart from inevitable limitations for the use of spectrographic systems and the optical radiometer – except for the case in which the target is very luminous, being the background emission of the sky known – all the other instruments that are implemented inside the automated station may permit to furnish important information about diurnal anomalous flying phenomena too, in particular about their kinematic and morphologic characteristics in the optical and in the infrared and all the magnetic, electromagnetic and radioactivity parameters.

Concerning photometric and geometric parameters of such kind of flying target, it is evident that, until its distance is not known, what we can obtain are only their apparent value. In order to obtain their intrinsic value we need to obtain the distance parameter (Teodorani, 2001; see TECHNICAL APPENDIX). In the absence of a radar or a Laser range finder – which might be anyway implemented inside the station in a further phase – triangulation is the only way to obtain distance and consequently the intrinsic (linear) dimensions and the absolute luminosity of an extended target (Kitchin, 2008; Lang, 2005). In order to achieve this goal it is necessary to place a further videocamera or DSLR camera at some distance from the main measurement station (PH website). Assuming that such an external optical device is working simultaneously with the optical devices that are working inside the station, it is then possible to obtain the target's distance whose precision will the higher, the higher the used baseline (distance of the station from the external optical system). At this point we are in a condition to pass from the measured apparent luminosity, angular velocity and angular dimensions of the target to intrinsic luminosity, linear (projected) velocity and linear dimensions. Once the distance parameter is acquired our physics action is completed. Such procedures are identical to the ones used in astronomy (Lang, 2005).

As Dr. Mark Rodeghier rightly noted (Rodeghier, 2013), having several types of optical instruments is ideal, but this might not be financially viable, so such devices should be ranked in terms of optimal scientific value versus the cost and complexity. Such a specialized optical unit in general is obviously an (extremely important per se, in physical terms) opportunity that might be employed in the (more or less near) future only if the data previously obtained from the main unit are in case so crucial to justify a further money funding. According to the obtained money funding it might be possible to further implement all the listed optical instrumentation, or only some components of it with a possible priority given to the high-sensitivity videocamera plus its attached low-resolution grating and to the high-speed videocamera. Further optical instruments might be added in a subsequent phase (if the necessary money funding is sufficient), considering that anyway a container of them should be prepared since the beginning to contain all the proposed instruments of the optical system. It is anyway clear that, apart from the costs, when the complexity of the system increases the global efficiency of the entire system might decrease as well at times. Of course the best compromise between complexity, costs and physical prominence of the data that are expected to be obtained, can be discussed according to which priorities will be decided.

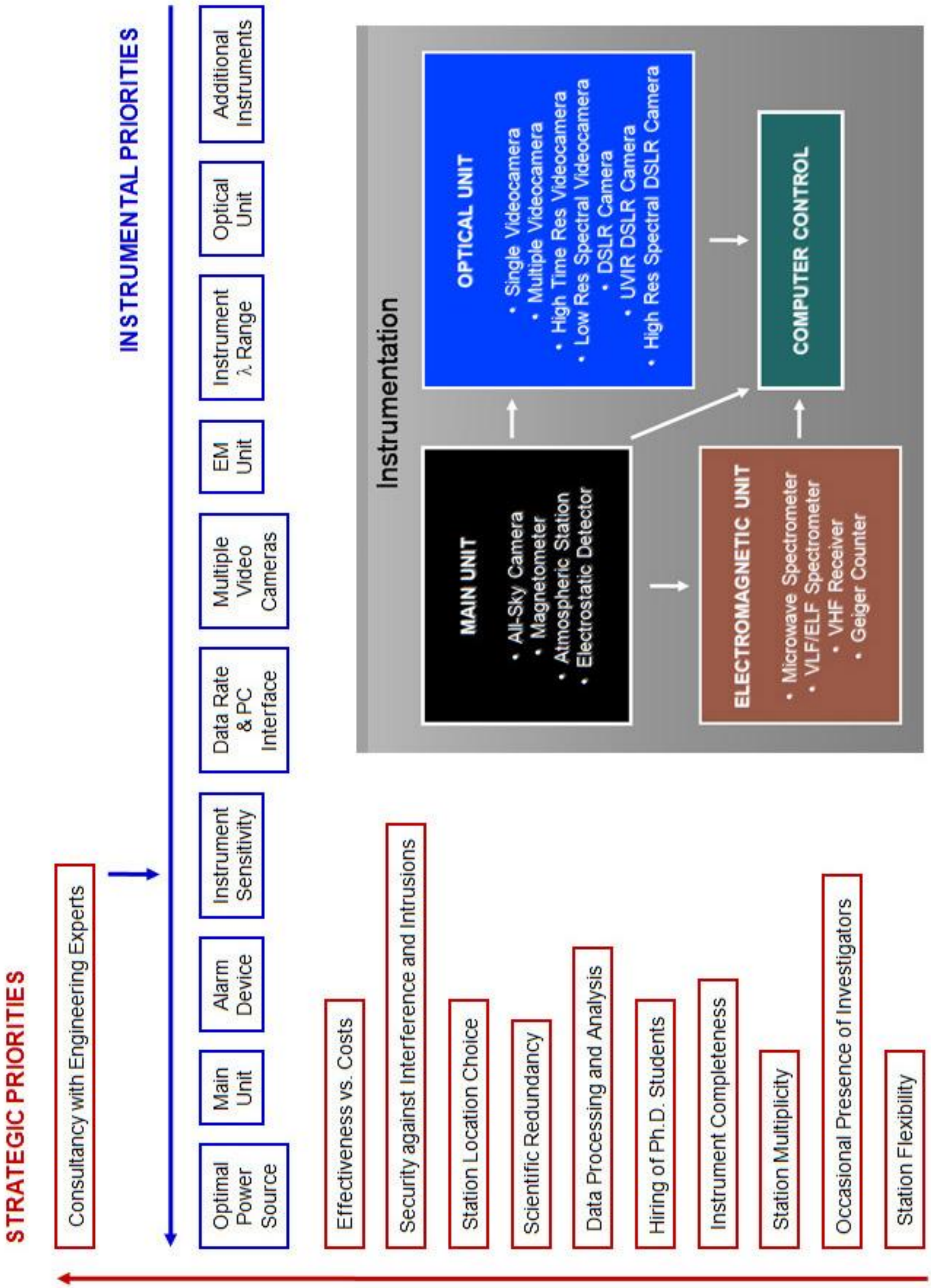

Figure 2. List of instrumental and strategic priorities.

6. Strategy and goals

The UFO phenomenon is an unidentified phenomenon per se (Hynek, 1972). Therefore what are we searching for with this research? The answer is very simple and it can be given in three ways, as it follows.

I – We want to ascertain if the observed phenomenon can be identified with known causes, which can be natural, optical or manmade (Condon, 1969; CUFOS website; Hendry, 1979; Hourcade, 2011; Pettigrew, 2003; Teodorani, 2009a). There is no doubt that a rigorous procedure such as the one described previously can permit scientific investigators to achieve this goal very accurately.

II – We want to ascertain how and where anomalous natural luminous phenomena occur (Teodorani, 2008, 2011), in order to be able to explain their physics once and for all. Much previous research work has been already done in the course of instrumented missions to areas such as Hessdalen in Norway and other locations in the world where a similar phenomenon occurs (Bunnell, 2003; MLR website; PH website; PSI website; Rutledge, 1981; Stephan et al., 2009; Strand 1984; Teodorani, 2004, 2009c, 2011). This research is of great importance as it might deal with a new form of energy able to confine plasma inside a spherically-shaped object (Teodorani, 2011). Such ball-shaped plasma phenomena are apparently similar to the ball lightning phenomenon, but much larger and much longer in duration (Stenhoff, 1999) and are possibly triggered by geophysical causes such as piezoelectricity (Derr, 1986; Teodorani, 2004, 2008), wave-particle interaction (Zou, 1995), the P-hole mechanism (Freund, 2003), triboluminescence or a (recently proposed) “natural battery mechanism” (Monari et al., 2013). Of course the strategy adopted with the proposed automated station might largely help to understand something more about ball lightning too.

III – Is Earth visited by exogenous intelligences from other planets or dimensions? This possibility is scientifically non-zero and must be accurately investigated. Of course if this would be the case what we would observe would be simply flying machines in the sky, able to self-sustain and to move due to their own specific propulsion mechanism (Davis, 2004; Hill, 1995; LaViolette, 2008). Our instruments are indeed able to ascertain if what we observe is a natural phenomenon or not. In particular the dynamic behavior of the physical parameters that we can obtain can tell us something (or much, in case) just on the nature of the propulsion system (Teodorani, 2000, 2001). For instance, the variability of light, spectral lines, magnetic field intensity and speed might be a byproduct of propulsion. Alternatively (but less probably) the produced light might be due to the illumination system of such alleged machines. We have at our disposal a quite rich database describing the radiometric, photometric and spectroscopic behavior of man-made illumination systems, which could be then compared with what we effectively might observe of such hypothetic flying machines of non-human origin (unless they adopt a sort of “mimicry strategy”). A project called SETV (Search for Extraterrestrial Visitation) was born more than a decade ago and is a corollary of the standard SETI Project. SETV involves both a long-range (within the entire solar system) and a short-range variant (Ailleris, 2011; Ansbro, 2001; Deardorff et al., 2004; Gato-Rivera, 2006; Stride, 2001; Teodorani, 2006, 2013). The second one would be exactly what our automatic station would aim to. Evidently if a true “smoking gun” would come out from the results obtained from the measurement instruments of such a station, this would mean the word *end* of over 60 years of disinformation, unconvincing stories and anecdotes, hoaxes, conspiracies, pseudoscience, new age sects. Only science, together with excellent investigators of ufology (CUFOS website; Haines, 1980; Hourcade, 2011; Kean, 2011; Maccabee, 1994, 1999; NARCAP website; Rodeghier, 1981; UAPSG website), can furnish a solid answer to this ultimate question and numbers speak alone. But science might also demonstrate (or disprove, in case) that much of the so called “UFO phenomenon” might be just a huge piloted hoax that is a part of a colossal experiment of psychological warfare (Teodorani, 2009a).

7. Conclusive remarks

Whatever the UFO phenomenon may be a serious investigation urges, especially during an epoch in which the gradual collapse of authentic human and intellectual values together with the fear for the future drives people to escape from reality: whatever apparently strange flies in the sky can become automatically a sign of visitation from outer space. Internet is literally full of hoaxes and badly interpreted prosaic phenomena. Such a childish and ill aptitude, together with delusional sickness, indirectly discredits the determined efforts of serious scholars – scientists and ufologists who are devoted to this study most of the time at their own expense – that are directed to investigate an anomalous phenomenon that, in spite of misunderstanding and disinformation, truly exists. In fact several decades of testimonial and instrumental researches show that an anomalous signal can be effectively extracted from the noise. The unpredictability and random nature of the UFO phenomenon shows without any shadow of doubt that the only way to acquire scientific data of it consists of using measurement stations that, being placed at locations that are considered statistically “hot”, work automatically. This permits investigators to analyze the obtained data using a methodology that is fully scientific and that would be – if properly realized – extremely similar to the one used in astronomy and astrophysics. This paper must be just intended as a platform of discussion in order to attempt to trigger a rational dialectics about a concrete realization of such a project. Several manifestations presented by the true UFO phenomenon, once witnesses are accurately screened and first measurements are taken, show something that seems to defy sometimes the known laws of ordinary physics. This should be enough as a stimulus for the physical scientists of the entire world. Whatever the nature of the observed phenomenon is, it might open some doors to new laws of physics that might largely expand our scientific knowledge and understanding of the facts of the Universe, and maybe mean a significant evolution for Mankind.

TECHNICAL APPENDIX – How physical parameters are deduced

The luminosity that we can measure of a nocturnal light represents only the "apparent luminosity", as the electromagnetic radiation that is received (at whatever wavelength) decreases with the inverse square of distance. If we really want to make true physics on the acquired data it is necessary to obtain the "absolute luminosity", from which it is possible to obtain the energy density of the monitored luminous phenomenon. In this regard it is very important to show how to proceed in practice.

Let's imagine that one is able to obtain videos, photographs or CCD images of a strange light phenomenon, and that we are able to assess in some way the fundamental factor given by "distance". Then we are in a condition to obtain the absolute luminosity using the following formula (Maccabee, 1999):

$$\mathbf{L_{ABS}} = \mathbf{4\pi \cdot d^2 \cdot \frac{L_{APP}}{\tau \cdot \frac{\pi}{4} \cdot D^2 \cdot T} \cdot e^{\frac{3.9 \cdot d}{V}}} \qquad (1)$$

Where **d** is the distance (in m) of the luminous phenomenon, $\mathbf{L_{APP}} = \mathbf{I} \cdot \mathbf{A}$ (in lm·sec) is the total energy received by the CCD chip of the camera integrated over the image area (namely, $\mathbf{L_{APP}}$ represents the value of the apparent luminosity), **I** is the energy per unit area of the image (in lm·sec m^{-2}), **A** is the image area (in m^2), **V** is the optical visibility distance (in m), $\boldsymbol{\tau}$ is the duration of the light phenomenon (in sec), **D** = **F** / **f** (the ratio, in m^2) gives the aperture diameter of the lens, where **F** and **f** are respectively the focal length and the f-number of the camera, **T** is the lens transmission factor.

At this point we have all the elements that allow us to obtain the important value of the absolute luminosity $\mathbf{L_{ABS}}$, namely the intrinsic luminosity of the light phenomenon when the value of distance is zero. From this value we are then able to obtain the quantity of energy that is produced by the phenomenon at any given instant. Realistically what we obtain is the absolute luminosity that is produced by the phenomenon during a time interval $\boldsymbol{\Delta t}$, which corresponds to the integration time **t** that is used by the optical instruments in order to expose correctly the light on the used photon-recording sensor. Clearly only the high-speed videocamera can narrow $\boldsymbol{\Delta t}$ down to 1/10.000 sec (typically). On the contrary, the value of $\boldsymbol{\Delta t}$ is typically a factor 10^2-10^3 higher for normal videocameras and a factor 10^5-10^7 higher for DSLR cameras (which require a given exposure time in order to collect enough photons on the CCD chip). Of course we have also to consider that the absolute luminosity that we obtain is not the total luminosity of the light phenomenon, but rather the absolute luminosity that can be obtained only on a limited frequency range given by $\boldsymbol{\Delta\nu}$, where $\boldsymbol{\nu}$ is the frequency, according to the bandwidth that is used, which in our case is constituted by the near infrared, optical and near ultraviolet ranges.

In any fact: a) if we assume that the nature of the emitted light is due to a thermal process that is typical of a blackbody radiation and which causes a ionization/excitation condition around or within the light phenomenon; b) if we assume that (for simplicity of calculation) the light phenomenon is spherically shaped and that it emits light as an isotropic radiator; c) if we assume that the emitted radiation at frequencies that are beyond the near infrared and near ultraviolet bandwidths is negligible, then we can obtain an important relation between the absolute luminosity, the intrinsic radius **R** of the object and its temperature **T**. This relation is given by a reasonable approximation of the Stefan-Boltzmann equation (Lang, 2005) given by:

$$\mathbf{L_{ABS} = 4\pi \cdot R^2 \cdot \sigma \cdot T^4} \tag{2}$$

considering that:

$$\mathbf{R \approx \frac{\alpha \cdot d}{2}}$$

where $\boldsymbol{\sigma}$ is the Stefan-Boltzmann constant, **T** is the temperature of the object, $\boldsymbol{\alpha}$ is the angular diameter of the object and **d** is the distance of the object from the observer.

It is obvious that this way we are in a condition to obtain easily the intrinsic diameter **D** = **2R** of the object, once the angular diameter $\boldsymbol{\alpha}$ and the distance **d** (via triangulation, radar, Laser telemetry and other methods) are known. At this point if we insert the value of **R** inside formula (2) for absolute luminosity (whose value is obtained by formula (1)) then we are able to obtain the approximate value of the temperature **T** of the object (the same value can be cross-confronted with the value of **T** that is obtained from spectroscopy after analyzing spectral lines). More precisely what we obtain is the “color temperature” of the object, but if we assume that the value of **T** at the very high energy (above the ultraviolet) and at the very low energy (below the infrared) frequency windows are negligible, there would be good reasons to argue that the color temperature approximates very well the total or “effective” temperature.

It is clear that if we have the “factor distance” at our disposal we are also in a condition to calculate the absolute flux of the electromagnetic radiation emitted in the radio range and the absolute magnetic field intensity too.

This was just an example furnished in order to show how the determination of the distance parameter is absolutely necessary if we want to obtain three fundamental parameters of the object directly from observations: the absolute luminosity, the effective temperature and the real dimensions of the object. With these data in hands, we are in a condition to understand the physical nature of the anomalous phenomenon, from which it is maybe possible to understand something of the propulsion mechanism if the observed luminous phenomenon is really a flying machine.

It is more than obvious that such “static data” – namely referred to a precise instant in which the phenomenon is measured – will acquire a maximized importance when we study how the obtained parameters vary with time. In fact all the instruments are intended to acquire data all the time. For instance, we might obtain a pulsation period **P** (if a regular pulsation is effectively recorded) and possibly a (both increasing a decreasing) variation of it: this might be a very important measurement, and, especially if it is correlated with color and speed variation of the object, it might furnish to us some possible crucial information on a possible object’s propulsion, which would be deduced dynamically. Of course such an information will be even more maximized if at the same time we are able to measure the variation of: a) the intensity of spectral lines; b) the change of morphology of spectral lines; c) the magnetic field intensity; d) the intensity of the electromagnetic emission in the UHF, VHF and VLF/ELF radio frequency intervals, e) the number of electrostatic and radioactive particles. In any fact, in the absence of the important factor given by the object's distance, there is no doubt that we might obtain a satisfactory physics as well limiting ourselves to study the time-variation of the apparent observed parameters.

References

1. Akers, D. (2006). The Willard J. Vogel Study : http://www.ltpaobserverproject.com/uploads/3/0/2/0/3020041/the_willard_j._vogel_study.pdf
2. Ailleris, P. (2011). "The lure of local SETI: fifty years of field experiments". *Acta Astronautica*. Volume 68, Issues 1–2, pp. 2–15.
3. Ailleris, P. (2013). Personal extensive communications through an ESTEC engineering expert. August 21, 2013.
4. Ansbro, E. (2001). "New OSETI observatory to search for interstellar probes". In: S. A. Kingsley and R. Bhathal (eds.) *The Search for Extraterrestrial Intelligence (SETI) in the Optical Spectrum III*. Proc. SPIE, Vol. 4273, pp. 246-253. USA.
5. Ansbro, E. (2004). "A new wide-field spectrograph". In: *Proc. SPIE* 5492, Ground-based Instrumentation for Astronomy, 1290 (September 30, 2004).
6. Bunnell, J. (2003). *Night Orbs*. Ed. Lacey Publishing Company, USA.
7. Condon, E. U. (1969). *Scientific Study of Unidentified Flying Objects*, University of Colorado, Bantam Books, New York (USA), Toronto (Canada), London (GB). Online at: http://www.avia-it.com/act/biblioteca/libri/PDF_Libri_By_Archive.org/AVIATION/Final%20report%20of%20the%20Scientific%20study%20of%20Unidentified%20Flying%20Objects%20-%20Condon%20E..pdf
8. Cornet, B. (1998). "The Performance" : http://www.abcfield.force9.co.uk/bcornet/
9. Davis, E. W. (2004). "Teleportation Physics Study". *Special Report*, N. AFRL-PR-ED-TR-2003-0034. Air Force Research Laboratory, Air Force Meteriel Command, Edwards Air Force Base CA 93524-7048 : http://www.fas.org/sgp/eprint/teleport.pdf
10. Derr, J. S. (1986). "Luminous phenomena and their relationship to rock fracture". *Nature,* 321, pp. 470-471.
11. Deardorff, J.; Haish, B.; Maccabee, B. & Puthoff, H. E. (2005). "Inflation theory implications for Extraterrestrial Visitation". *JBIS*, Vol. 58, pp. 43-50. Online: http://www.ufoskeptic.org/JBIS.pdf
12. Freund, F. T. (2003) "Rocks that Crackle and Sparkle and Glow: Strange Pre-Earthquake Phenomena". *Journal of Scientific Exploration*, 17, no. 1, pp. 37-71 : http://www.scientificexploration.org/jse/articles/pdf/17.1_freund.pdf
13. Fryberger D. (1997). "A Model for Ball Lightning". *ØIH Rapport*, 1997(5), Høgskolen i Østfold (Norway), pp. 1–82.
14. Gato-Rivera, B. (2006). "Brane Worlds, the Subanthropic Principle and the Undetectability Conjecture". *ArXiv*: http://arxiv.org/pdf/physics/0308078v4.pdf

15. Gröschel, G. (website)."UFO Überwachungssystem Übersicht". Institut für Technische UFO-Forschung – Digital Service : http://www.biz11.de/images/Dateien/d-UFO-%C3%9Cberwachungssystem.pdf
16. Haines, R. (1980). *Observing UFOs – An Investigative Handbook*. Burnham Inc Pub.
17. Hill, P. R. (1995). *Unconventional Flying Objects: A Scientific Analysis*. Hampton Roads Publishing.
18. Hourcade, M. (2011). *In Search for Real UFOs*. AuthorHouse Publishing. Online at: http://www.scribd.com/doc/64140571/In-Search-of-Real-UFOs
19. Hendry, A. (1979). *The UFO Handbook.* Doubleday.
20. Hynek J. A. (1972). *The UFO Experience: A Scientific Inquiry*. H. Regnery Co.
21. Kean, L. (2011). *UFOs: Generals, Pilots, and Government Officials Go on the Record*. Three Rivers Press.
22. Kelleher, K. & Knapp, G. (2005) *Hunt for the Skinwalker*. Ed Paraview Pocket Books.
23. Kitchin, C. R. (2008). *Astrophysical Techniques*. CRC Press.
24. International Earthlight Alliance (IEA): http://www.earthlights.org/
25. Italian Committee for Project Hessdalen (ICPH): http://www.itacomm.net/PH/CIPH/HOME_PAGE.html
26. Lang, K. R. (2005). *Astrophysical Formulae*. Springer.
27. LaViolette, P. A. (2008). *Secrets of Antigravity Propulsion*. Bear & Co.
28. Maccabee, B. (1994). "Strong Magnetic Field Detected Following a Sighting of and Unidentified Flying Object". *Journal of Scientific Exploration*, 8, p. 347.
29. Maccabee, B. (1999). "Optical power output of an unidentified high altitude light source". *Journal of Scientific Exploration*, 13, pp. 199-211.
30. Marfa Lights Research (MLR) : http://www.nightorbs.net/
31. Masters, R. A. (2012). "High-Resolution Slit-Free Direct-Viewing Multiplexing Field Spectrograph". *United States Patent Application Publication*. Pub. No. US 2012/0287430 A1 . Online at: http://www.freepatentsonline.com/20120287430.pdf
32. Masters, R. A. (2013). Personal extensive communications. August 20, 2013 – August 24, 2013 – September 10, 2013.
33. Meessen, A. (2012). "Evidence of Very Strong Low Frequency Magnetic Fields". *PIERS Proceedings*, Moscow, Russia, August 19{23, 2012 : http://www.cobeps.org/pdf/meessen_evidence.pdf
34. Monari, J.; Montebugnoli, S. & Serra, R. (2013). "Hessdalen – a perfect "natural battery"". *ICPH Articles*: http://www.itacomm.net/PH/2013_Monari_et-al-en.pdf
35. Montebugnoli, S.; Monari, J.; Cattani, A.; Maccaferri, A.; Poloni, M.; Bortolotti, C.; Roma, M.; Hauge, B. G.; Strand, E. P. & Cevolani, G. (2002). "Measurements with a low power pulsed radar in the Hessdalen 2002 camp". *ICPH Articles* : http://www.itacomm.net/ph/radar/radar_e.pdf
36. National Aviation Reporting Center on Anomalous Phenomena (NARCAP) : http://www.narcap.org/
37. Pettigrew, J. D. (2003) "The Min Min light and the Fata Morgana - An optical account of a mysterious Australian phenomenon". *Clinical and Experimental Optometry*, 86: 2: 109–120 : http://www.uq.edu.au/nuq/jack/MinMinCEO.pdf
38. Project Hessdalen (PH) : http://www.hessdalen.org/
39. Project Starlight International (PSI) : http://www.nicap.org/madar/psi.htm

40. Rodeghier, M. (1981). *UFO Reports Involving Vehicle Interference: A Catalogue and Data Analysis*. Center for UFO Studies.

41. Rodeghier, M. (2013). Personal extensive communications in 8 points. September 9, 2013.

42. Rutledge, H. (1981). *Project Identification: The first Scientific Study of UFO Phenomena*. Prentice-Hall.

43. SOSO LIVE CAMERA (Massimo Silvestri et al.) : http://www.ciph-SOSO Live Camera.net/SOSO LIVE CAMERA/SOSO LIVE CAMERA_LIVE_CAMERA.html

44. Stephan, K. D.; Ghimire, S.; Stapleton,W. A.; & Bunnell J. (2009). "Spectroscopy applied to observations of terrestrial light sources of uncertain origin". *American Journal of Physics*, 77(8), pp. 697-703 : http://uweb.txstate.edu/~ks22/pdfs/MLPaper_AJP.pdf

45. Stenhoff, (1999). *Ball lightning. An unsolved problem in atmospheric physics.* New York: Kluwer Academic/Plenum.

46. Strand, E. P. (1984). "Project Hessdalen 1984 – Final Technical Report". *Project Hessdalen – Articles and Reports* : http://www.hessdalen.org/reports/hpreport84.shtml

47. Stride, S. L. (2001). "An instrument-based method to search for interstellar robotic probes". *J. Brit. Interplanetary Soc.*, n. 52, pp. 2-13. Online: http://www.sunstar-solutions.com/sunstar/SETV/JBIS-SETV01.pdf

48. Sturrock P. (1999) *The UFO Enigma: a New Review of the Physical Evidence*. New York: Warner Books.

49. Teodorani, M. & Strand, E.P. (1998). "Experimental methods for studying the Hessdalen phenomenon in the light of the proposed theories: a comparative overview". *ØIH Rapport*, n. 1998:5, Høgskolen i Østfold (Norway), pp. 1-93. Online: http://www.scribd.com/doc/126582698/Experimental-Methods-for-studying-the-Hessdalen-Phenomenon-in-the-light-of-the-Proposed-Theories-a-Comparative-Overview

50. Teodorani, M. (2000). "Physical data acquisition and analysis of possible flying extraterrestrial probes by using opto-electronic devices". *Extraterrestrial Physics Review*, Vol. 1, No. 3, pp. 32-37. Online: http://www.scribd.com/doc/126580079/Physical-Data-Acquisition-and-Analysis-of-Possible-Flying-Extraterrestrial-Probes-by-Using-Opto-Electronic-Devices

51. Teodorani, M. (2001). "Physics from UFO Data". *ICPH Articles*, N. 2 : http://www.itacomm.net/ph/phdata_e.pdf

52. Teodorani, M. (2004). "A Long-Term Scientific Survey of the Hessdalen Phenomenon". *Journal of Scientific Exploration*. Vol. 18, n. 2, pp. 217-251 : http://www.scientificexploration.org/journal/jse_18_2_teodorani.pdf

53. Teodorani, M. (2006). "An Alternative Method for the Scientific Search for Extraterrestrial Intelligent Life: "The Local SETI" ". In: J. Seckbach (ed.) Book: *Life as We Know It*, Springer, COLE Books, Vol. 10, pp. 487-503. Online: http://openseti.org/Docs/NewSETI_MT_LAKI.pdf

54. Teodorani, M. (2008). *Sfere di Luce*. Macro Edizioni.

55. Teodorani, M. (2009a). "Need to Know" vs. "Need to Believe" in UFOlogy. *Xpose UFO Truth* : http://fierycelt.tripod.com/xposeufotruth/needknow_vs_needbelieve.html

56. Teodorani, M. (2009b). "A Comparative Analytical and Observational Study of North American Databases on Unidentified Aerial Phenomena". *NARCAP Technical Reports*: http://narcap.org/reports/ONNYCT_Paper_MT_2009_REVISED.pdf

57. Teodorani, M. (2009c). “Scientific Inquiry on Anomalous Atmospheric Light Phenomena: Past Research Gaps and New Methodological Goals”. *ICPH Articles* : http://www.itacomm.net/PH/2009_Teodorani.pdf
58. Teodorani, M. (2011). “A Scientific Approach to the Investigation on Anomalous Atmospheric Light Phenomena”. Workshop *Fenomeni Luminosi in Atmosfera e precursori sismici: una nuova frontiera per la scienza?* Fornovo Taro (PR), 21 April 2010. GEOLAB Publication (Conference Proceedings). *CNR SOLAR*, n. 3641 : http://eprints.bice.rm.cnr.it/3641/1/Fornovo_MT_2010.pdf
59. Teodorani, M. (2013). *Intelligenze Oltre la Terra – una visione scientifica e filosofica*. Giochidimagia Editore. Ebook: http://www.macrolibrarsi.it/ebooks/ebook-intelligenze-oltre-la-terra.php
60. The J. Allen Hynek Center for UFO Studies (CUFOS): http://www.cufos.org/
61. The Canadian UFO Survey : http://www.canadianuforeport.com/survey/index.html
62. Unidentified Aerospace Phenomena Reporting Scheme (UAPRS) : http://www.uapreporting.org/
63. University of Western Ontario (UWO) – Meteor Physics Group. All-Sky Camera Network: http://meteor.uwo.ca/
64. Unusual Aerial Phenomena Study Group (U.A.P.S.G.): http://www.uapsg.com/
65. Williams, W. – SETV (Search for Extraterrestrial Visitation) : http://www.setv.org/
66. Wendt, A. & Duvall, R. (2008). “Sovereignty and the UFO”. *Political Theory*. Vol. 36, n. 4, pp. 607-633. Online: http://ptx.sagepub.com/content/36/4/607.abstract
67. Zeitlin, G. – Open SETI : http://openseti.org/Opening.shtml
68. Zlotnicki, J.; Yvetot, P. & Fauquet, F. (2012). “Existence of electric/magnetic signals related to unknown luminous lights observed in Hessdalen valley (Norway)?“ *Geophysical Research Abstracts*, Vol. 14, EGU2012-5967-1, 2012
69. Zou You-Suo (1995). “Some Physical Considerations for Unusual Atmospheric Lights Observed in Norway”, *Physica Scripta*, *52*, pp. 726-730.

Acknowledgments. This author wants to thank Professor Alexander Wendt (Ohio State University), main chief and coordinator of the UFOAC Project, for inviting me inside this enterprise, and Dr. Mark Rodeghier, Dr. Ron Masters and Philippe Ailleris for very sound feedbacks on this paper.

BRIEF BIOGRAPHY – Dr. Massimo Teodorani is an Italian astrophysicist. He obtained his degree in Astronomy and his Ph.D. in Stellar Physics at the University of Bologna. As a researcher at the Astronomical Observatories of Bologna and Naples, and later at the INAF Radiotelescope of Medicina (BO), he has been involved in research on many types of explosive stellar phenomena – such as supernovae, novae, eruptive protostars and high-mass close binary stars – and, more recently, in the search for extrasolar planets and extraterrestrial intelligence within the SETI Project. He subsequently taught quantum physics as a lecturer at the University of Bologna. Among his research interests there is also an active involvement in the physics study of anomalous aerial phenomena. He is an expert in military aeronautics. In addition to many technical papers in all of the mentioned subjects, he has published 17 books and several informative articles on quantum physics, atomic and nuclear physics, astronomy, astrophysics, bioastronomy, physics of anomalous atmospheric phenomena and aerospace subjects. He had many interviews on the media about some of his researches, and he gave many public presentations. During his free time is also a composer of electronic music under the pseudonym "Totemtag".

First UFOAC Workshop

Ohio State University

Columbus (Ohio, USA), November 1, 2013.