

Anomalous Light Phenomena: 1994-2003 Research Papers

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Abstract. A collection of abstracts of papers and reports concerning the research on anomalous light phenomena (ALP) is presented. The reader is then immediately guided to the internet link in the case of electronic works. The presentation covers several aspects: 1) physical-technological proposals, 2) observational projects in order to prove or confute several theories, 3) epistemological subjects, 4) field missions and results, 5) SETV studies. This collection, which is preceded by a detailed introduction concerning the research by the author, is intended to encourage a more in-depth scientific study of anomalous aerial phenomena in general.

1. Presentation of Research

In the period 1992-2003 I devoted myself, in form of an initially private enterprise (1992), later in form of collaboration with a norwegian research institute (1993-1995), lastly as a research parallel to the astronomical research (1995-2003), to the following studies:

- SETI studies and related. I carried out a literature research on SETI (Search for Extraterrestrial Intelligence) studies, including sub-program SETA (Search for Extraterrestrial Artifacts), which have been developed in the period 1978-1998 by several research groups and, parallely, on the very few reliable investigations on the "Ufo phenomenon" which have been carried out by a restricted group of scientists in the period 1955-1998 (the "Condon Report" of the University of Colorado - USA (1968) and the "Sturrock Report" of the Stanford University (1998) can be quoted as authoritative examples). I have also established and maintained strict contacts (up to 2003) with italian and foreign SETI scientists and with scientists who dedicate part of their time to investigations on the Ufo phenomenon. In this ambit I have presented several research proposals concerning the SETV (Search for Extraterrestrial Visitation) variant, by considering the work-hypothesis that our planet can be reached by exogenous civilizations and that the scientific proof of this can be obtained by using the universally accepted Galilean methods of physical science.
- Research Project I: definition of instrumentation, observational tactics, physical parameters and preliminary calculations. I prepared a research project aimed at studying unidentified nocturnal lights (1992-1994), in which targets are considered and treated on a par with celestial and/or atmospheric objects having no fixed coordinates (as in the case of meteors, fireballs, satellite reenters and ball lightnings). This project involves the use of a battery of 20 small telescopes which can be interchangeable with wide field lenses. Telescopes and wide-field lenses are intended to work in the near-IR, optical and near-UV ranges. Light collectors are planned to be connected to detectors for CCD imaging and fast photon-counting photometry, to objective-prisms for low-resolution spectroscopy and to grism-slit spectrographs for high-resolution spectroscopy. The overall measurement instrumented set-up is intended to be guided simultaneously by a radar, by an IR alarm sensor (IRST) and by a laser telemetric device in order to allow the search, the pointing and the tracking of a bright flying object which is characterized supposedly by random motions.

I have carried out some preliminary calculations aimed at predicting the numerical value of the following parameters:

1. The expected integration times by using all the chosen kinds of detectors and analyzers, by assuming that the apparent luminosity of the target and the employed spectral resolution range over the intervals $L = 10\text{-}10^{10}$ watts and $SR = 10^{-3}\text{-}10^3$ Å respectively.
2. The expected time-variation of the integration times for targets which are approaching or receding along the line of sight and whose linear velocities range over the interval $V = 0.1\text{-}10$ km s⁻¹.
3. The expected angular velocity variation and accuracy of target tracking for targets whose linear velocities and distances range over the intervals $V = 0.1\text{-}10$ km s⁻¹ and $d = 0.1\text{-}100$ km respectively, by assuming that the possible telescope fields of view are included in the interval $\alpha = 0.5\text{-}90$ °.

A detailed discussion of the strategies which are intended to be adopted for data acquisition and a complete description of the physical parameters which are expected to be measured, have been presented. I have been stressing how a rigorous and methodic search for correlations, in the frame of the investigation of a dynamic phenomenon which is expected to be subject to time-variations of its physical (kinematic, photometric, spectroscopic) parameters, could shed some light on the "Ufo phenomenon" whatever its origin may be.

- Scientific collaboration with a research group. In the period 1993-1995 I actively collaborated as a scientific consultant with a norwegian team of university researchers, lead by Prof. E. P. Strand and Prof. B. G. Hauge of Østfold College of Engineering - Sarpsborg - Norway, who in the ambit of *Project Hessdalen* have prepared and are at present improving an automatic platform (Automatic Measurement Station) which is currently equipped with several multi-mode detectors (radar, radio spectrum analyzer, magnetometer, and CCD cameras). Such detectors are intended to acquire measurements of the multi-wavelength radiation of anomalous light phenomena at low atmosphere which are reported in a recurrent way in the *Hessdalen* valley in central Norway and which paralely cause sudden outbursts of radio emission and of the magnetic field intensity and intermittent radar signatures. Recorded data are currently stored in databases and made available to the scientific community through the *Internet*.

In this context, my specific contribution consisted in the following specific research activities:

- A. Research Project II: strategy planning, theorization and preparation of tests. I prepared a new research project - complementary to the one previously described - in which I planned to carry out various kinds of observational multi-wavelength and multi-mode techniques, measurement procedures and tests (82 procedures) in order to prove or confute 18 (natural and "non-natural") theories which were proposed to explain the nature and the origin of the luminous phenomenon (among these theories: piezo-electricity, magnetic monopoles, aerogel matter, atmospheric ionization triggered by solar activity and cosmic rays, mini black holes, zero point energy and exotic propulsion systems). For each specific theory brief descriptions of the observable parameters and of the essential instrumental choices and a very detailed discussion of measurement procedures coupled with suitable flow-charts are presented.
- B. Data analysis and results. I carried out a complete analysis of the data acquired with first-generation instrumentation by *Project Hessdalen* in 1984, trying to investigate in particular the possibility that the luminous phenomenon is triggered by the maxima of solar activity. This analysis, involving the use of Julian Date (JD) as a time variable for data synchronization, has led to the following results:
 1. The luminous phenomenon occurs with a strict periodicity of 24 hours peaked at about 20.00 pm.
 2. Luminous phenomenon, in terms of "strangeness index", daily number of observed events and duration, is not temporally correlated with solar activity.
 3. Radar (number of tracks), radio (amplitude of spikes) and magnetic (amplitude of pulsations) phenomena present correlation of respectively 46.8%, 47.5% and 41.7% with solar activity.
 4. As a preliminary conclusion, it is suspected that some kind of ionizing mechanism caused by solar activity and acting in our atmosphere, may play a determinant role in triggering the possibly *delayed* formation of luminous plasmoids which are able to acquire self-governing EM and magnetic fields with a peculiar morphology, and that the interaction between solar-driven ionization, magnetic storms and terrestrial magnetic field could constitute the right interaction able to make so that such phenomena are suddenly born.
- Advice for students. During this research I also gave advices regarding the physics of radiation and opto-electronic optical instrumentation to a group of students in electronic engineering of Østfold College, who developed their degree thesis on subjects concerning the implementation of optical instrumentation aimed at measuring the Hessdalen luminous phenomenon.

- Research evolution since 1995 up to now. Until April 2003 I maintained strict collaborative contacts (joint scientific expeditions, meetings, workshops, e-mail communications, data exchanges, preparation and publications of papers) with Prof. E. P. Strand and with Prof. B. G. Hauge. Since very recently I have continued to give seminars on the scientific treatment of luminous phenomena at low atmosphere (1994-2003), after receiving very often invitations by recognized scientific institutions. Since 1998 I am proposing to apply the same method used to study the Hessdalen phenomenon, to study similar phenomena which reoccur in Italian areas too. Moreover, I have completed the statistical analysis of the data acquired in the period 1998-2002 from the Norwegian AMS station, by constructing histograms describing the hourly and monthly distribution of the phenomenon, and by studying the spatial distribution of the phenomenon in the sky. Moreover I prepared an archive containing a list of 35 other locations in the world in which the same kind of light phenomenon occurs more often, of which I have also collected and rationalized the pertinent documentation. Since 1999 I am studying very carefully also the Ontario light phenomenon (Canada), by maintaining very strict and constant contacts with documenter Jennifer Jarvis, and by analyzing some of her video, photographic and spectrographic data. Since 1997 I have presented detailed research proposals regarding the instrumented investigation of recurrent luminous phenomena to several research institutes and organizations.

- The EMBLA 2000 Mission. In August 2000 I participated for two weeks, as a CNR external collaborator and scientific consultant, to the "EMBLA 2000" mission organized jointly by IRA-CNR (Italy) and Østfold College (Norway). "EMBLA 2000" was an instrumented scientific expedition to Hessdalen, during which I collaborated by monitoring VLF spectrometric instruments, acquiring and processing video and photo frames, and preparing interpretative models. I have written down a detailed report on this mission, where the following phenomenological and interpretative picture is extensively discussed:

1. The luminous phenomenon is often accompanied with two types of events in the VLF frequency range: "spike-like" signals and "doppler-like" signals. *Spike* signals show a sharp pulsating and periodic behaviour characterized by peaks of constant amplitude and very short duration. The temporal sequence of the signals appears and disappears sometimes in a gradual way and sometimes suddenly, at times it persists for several tens of minutes. Such signals, of which a cause of interference is excluded so far, might have two origins: a) an emitter of radio waves operating in an intermittent way (maybe due to submarine man-made communication), b) a localized emitter of radio waves operating in a continuous way and which is modulated by the rotation of a spheroidal or cylindrical (or similar) invisible body, whose surface contains an emission spot. *Doppler* signals, largely the most anomalous of all, manifest themselves as inclined lines on a graph which gives the frequency as a function of time. This means that the signal is subject to a frequency-shift in very short times: this is due to an emission-source which is moving with a velocity ranging from 10.000 up to 100.000 km s⁻¹. The velocity variation occurs in an extremely gradual way just in a matter of few seconds, while the inclination of the doppler lines is subject to inversion in a matter of a minute (at most). This means that the recorded doppler signals are due to an emitting source which is alternately approaching and receding from the observer. The semi-relativistic velocities which are measured in doppler signals, together with the periodic inversion of the doppler shift, are hypothesized to be due to a physical mechanism involving the magnetically collimated acceleration of high-energy particles modulated by the rotation of a self-contained 'plasma spheroid' whose magnetic axis is misaligned in comparison with its rotation axis.

2. The luminous phenomenon itself, after a processing and analysis of video and photo frames has been carried out, shows characteristics which are not typical of a 'classical plasma', as the luminosity distribution inside the illuminated surface (Point Spread Function: PSF) is not of gaussian type. In some cases a totally saturated core, typical of a source generating a "flash effect", is present, in other cases the PSF shows a linear behaviour which is apparently typical of a uniformly illuminated solid body.

- The EMBLA 2001 Mission. In August 2001 I participated for a month, as Principal Investigator and Mission Director, to the *EMBLA 2001* mission sponsored and organized by the Italian Committee for Project Hessdalen (ICPH - Italy), jointly with CNR-IRA (Italy) and with Østfold College (Norway). EMBLA 2001 consisted of a scientific expedition of instrumented type to Hessdalen, during which I coordinated and personally carried out the acquisition of optical data (digital, photographic, video and spectrographic images), and I participated to a Workshop. After the mission, I carried out an intense activity of processing and analysis of photometric and spectroscopic data, followed by a physical interpretation of the data. I have written down a detailed report on this mission, where the following phenomenological and interpretative picture is extensively discussed:

1. On the basis of a photometric (Point Spread Function) and spectroscopic (low-resolution spectra) analysis, the luminous phenomenon appears to be, in the very most part of the cases, a thermal plasma.

From the maximum of the Planck curve a temperature $T \sim 6500 \text{ }^\circ\text{K}$ is measured, which remains approximately constant for all the duration of the luminous phenomenon (sometimes up to 3 minutes), in spite of the sharp luminosity variations.

2. The luminous phenomenon is subject to irregular variations on a time-scale of the order of seconds and tenths of seconds. A light-curve shows characteristics of semi-pulsation (with a period of about ten seconds) of the “on-off” type in the primary phase, while in the secondary phase it presents a semi-stable behaviour which is settled at the maximum luminosity and with small semi-periodic oscillations (1 second) The luminosity maxima are reached only when the radiating surface reaches the largest dimensions, by remaining the flux approximately constant.
3. The luminous phenomenon when seen by naked eye appears like “light orbs”, while an instrumented analysis (both video and photographic) demonstrates that the light-orbs are often constituted of many smaller orbs which appear to vibrate around a common barycenter which coincides with a larger central body, and it is evident that the central body is sometimes able to eject smaller orbs on a time-scale of the order of 1 second. The increase of the radiating surface is often due to an integrated effect which is caused by the sudden presence of many light-components which are occasionally situated immediately outside of the central body.
4. The luminous phenomenon is able to acquire any kind of shape, sometimes also geometric.
5. In spite of the fact that “it looks like” a thermal plasma, the luminous phenomenon doesn’t present, from a thermodynamic point of view, an adiabatic behaviour (consequent to cooling of a plasma after expansion). This is demonstrated by the lack of the expected anticorrelation between the diameter of the luminous body and its luminosity.
6. A qualitative model is presented. It is hypothesized that the luminous orbs are thermal plasma structures which are triggered by a “central force” which simulates a mini-black hole and which are internally confined by a magnetic cage. The verified lack of heat production is hypothesized to be due to a blocking of the electrons of conduction. Other models, involving the presence of magnetic monopoles, and the photoionization of low-energy plasmas by cosmic rays, are considered too.
7. The Hessdalen area is also featured by other objects with anomalous characteristics, from the analysis of two of which no plasma signature was found. One of these objects presents sharply “metal-like” characteristics, whose appearance in the photo after a flash exposure is interpreted to be due to an effect of stimulated emission on a substance of semiconductive kind.

- The EMBLA 2002 Mission. A two-weeks scientific expedition to Hessdalen, aimed at investigating on field mysterious atmospheric light-phenomena, was carried out in August 2002 by the physics section of an Italian team of scientists which was coordinated by myself. Results are presented and discussed in a detailed report. Photometric analysis shows that the light-phenomenon is able to produce a luminous power of up-to 100 kW. A 3-D analysis of photo frames shows that the luminous phenomenon doesn’t resemble canonical plasma features (a sharply gaussian PSF) unless the light phenomenon is caused by one recently discovered natural light-ball of BL type whose light-distribution (PSF) might be able to simulate an uniformly illuminated solid due to heated silicon nanoparticles. A comparison of the light-distribution in different time-sequential frames shows that apparent slightly exponential wings and Gaussian profile of the PSF features are probably due to variations of atmospheric turbulence and transparency and not to intrinsic properties: this fact excludes that the light phenomenon is constituted of a “classic plasma”. Maximum phases of luminosity of the radiating surface are demonstrated to be due to the sudden apparition of a cluster of co-existing light-balls at constant temperature, while the inflation of light-balls is ruled out. Spectra show no resolved lines but a three-peaked feature which might be attributed both to some kind of artificial illumination system (most probably due to Light Emitting Diodes) and to a mixture of many blended lines due to several chemical elements (more possibly: silicon). The results of a lab analysis of ground samples shows that some powder which was collected near a river, at a specific spot which was approached by a light-phenomenon, contains anomalous iron spheres of micrometric dimensions. A biophysical research-proposal aimed at studying the connection between the EM field produced by the phenomenon and the electrical activity of the human body is also presented. On the basis of this third explorative experience, the importance of having at disposal a sophisticated opto-electronic portable station (missing at present) is stressed for the future.

- The IEA 2003 Mission. A 3-weeks scientific mission to the Arizona desert was organized in April 2003 by a group (International Earthlight Alliance) composed by geophysicist Marsha Adams, technological scientist Erling Strand and myself. The goal of this expedition was of testing on-field team-work in difficult areas where anomalous light-phenomena are seen very often, and of acquiring data with several instruments including magnetometers, VLF receivers, radioactivity detectors, a weather station and optical tools for photography and spectroscopy. The report is the description of the results which came out from the analysis of optical data (acquired by Teodorani). The analysis of digital and film photographs is presented in detail, by distinguishing all the conventional light-events which have been identified, from the unidentified ones and the ones which can be definitively considered as “anomalous cases”. The precise position (azimuth and altitude)

and times of anomalous phenomena was determined by using sky maps showing the visible stars which were close to the phenomenon in the sky. The diagnostics of low-resolution spectra is presented too by showing that almost all of the obtained spectra are due to well-known artificial lights. Finally, tests with a high-resolution spectrograph and optical tests with a reflector telescope are described.

In general the optical part of this scientific mission permitted to record unexpected anomalous light-events with the following main characteristics:

- a. Presumably short-duration light-events (less than 8 seconds) which were occasionally impressed by the digital camera, with globular, elliptical, elongated and complex shapes, with several colors and with some nebulosity and/or surrounding glow in some cases.
- b. Possibly longer duration light-events which were occasionally impressed by the reflex camera, with marked characteristics of rectilinear, helicoidal and curved motion.
- c. After a careful PSF 3-D analysis, many of the light-anomalies showed characteristics of an illuminated solid body surrounded by a plasma-like glow.
- d. Ondulating and irregularly intermittent tracks in the sky.

Some other light-events which so far remain unidentified, may be suspected to be known phenomena, even if this cannot be ascertained yet.

This part of the mission, even if physical parameters could not be derived due to the lack of knowledge of distance and to the lack of crucial spectra, permitted to demonstrate that a light-phenomenon exists indeed in the Arizona desert. Nevertheless this phenomenon in most cases occurs as a very short-duration event, in other cases it is generally unnoticed by the sight. This behaviour demonstrated that taking a large number of high-resolution panoramic digital photographs is probably the most efficacious way to record these kinds of light-phenomena. Moreover, sophisticated techniques of image processing have demonstrated to be able to strongly enhance very weak light-sources such as field-stars, or other light-phenomena whose nature can be promptly eventually identified.

• The SIBILLA 2003 Mission. A one-week scientific expedition to the Sibillini Mountains (central Italy), was carried out in August 2003 by physicist Gloria Nobili and myself. Obtained results are presented as follows:

- a. A luminous phenomenon exists. Reports have been done of very luminous objects which are uniformly moving in the sky and sometimes of stationary flashes in the sky and on the top of the mountains. The moving objects change every day time of arrival of 20-30 minutes, and their direction of 15-30 deg. In some case they disappear abruptly, while in other cases they do not appear at all even if in a totally clear sky.
- b. The phenomenon mostly produces luminous trails in the sky and at present it cannot be tracked.
- c. The presence of possible geomagnetic anomalies increases the threshold of the magnetic noise (up to 10 microtesla).

Procedures for data acquisition and analysis. In order to carry out all the described researches I have used the following techniques and procedures:

1. Conventional and digital photography.
2. CCD and video imaging.
3. Low-resolution optical spectroscopy of known and unknown light-sources.
4. High-resolution optical spectroscopy (tests).
5. Magnetometric and microwave readings.
6. Analysis of data extracted from literature databases.
7. Construction of histograms.
8. Data tabulation and construction of diagrams in Julian date and in UT.
9. Correlation analysis.
10. Image processing and analysis and photographic photometry.
11. Spectra processing, calibration and analysis.
12. Signal processing.
13. Numerical calculations and modelling.
14. Construction of flow-charts.
15. Use of sky maps for position determination (astrometry).
16. Ground sample collection and radioactivity measurements.
17. Telescopic operations.

2. Abstracts of published technical reports and papers

DEVELOPMENT AND USE OF ASTRONOMY-LIKE DEVICES FOR UFO MONITORING: A RESEARCH PROJECT FOR THE STUDY OF UFO PHYSICS

Massimo Teodorani (1994)

A research project aimed at studying unidentified atmospheric 'nocturnal lights' in world areas of recurrence is presented. In such a context targets are considered and treated on a par with celestial and/or atmospheric objects having no fixed coordinates. Such a project involves the use of a battery of 20 mini-telescopes which can be interchangeable with wide-field lenses. Both types of light collectors, which are intended to work in the near-IR, optical and near-UV ranges, are planned to be connected to detectors for CCD imaging and fast photon-counting photometry, to objective-prisms for low-resolution spectroscopy and to grism-slit spectrographs for high-resolution spectroscopy. The overall measurement instrumented platform is intended to be guided simultaneously by a radar, by an IR alarm sensor and by a laser telemetric device in order to allow physical scientists to search, point and track a given bright flying object which is characterized supposedly by random motions. Finally, physical informations which are expected to come out from data analysis are presented and discussed in detail.

Scientific Monograph (versions in Italian and in English), Società Editrice Andromeda - "Inediti", n. 76, pp. 1-100.

THE HESSDALEN LUMINOUS PHENOMENON: A DATA ANALYSIS

Massimo Teodorani & Erling P. Strand (1998)

In the period 21 January - 26 February 1984, a group of research engineers belonging to "Project Hessdalen", carried out instrumented investigations on a luminous atmospheric phenomenon occurring with strong recurrence in the area of Hessdalen in Norway. Several multi-mode instruments were used in order to monitor the phenomenon. In the present work, an analytical attempt, based on the data achieved during the 1984 investigation period, has been done in order to explain such a phenomenon. The following main results are presented: (1) the luminous phenomenon occurs with a periodicity of about one day and is approximately coincident with some peculiar magnetic pulsations and, more scarcely, with some components of radio emission; (2) magnetometric data, radar data and some components of radiometric data show some slight correlation with daily solar activity. Hypothesis regarding formation of solar-driven plasmoids acquiring self-governing EM and magnetic fields, is further ventured and discussed. Technical requirements for future instrumental research are presented as well.

Ufodatanet (web site: <http://www.ufodatanet.org>) Reports, http://www.ufodatanet.org/report/Hessindex_e.htm

EXPERIMENTAL METHODS FOR STUDYING THE HESSDALEN-PHENOMENON IN THE LIGHT OF THE PROPOSED THEORIES: A COMPARATIVE OVERVIEW

Massimo Teodorani & Erling Strand (1998)

Unexplained plasma-like atmospheric 'light balls' are observed at very low altitudes during alternate phases of maximum and minimum in the Hessdalen area, located in central Norway. Several theories are presented in order to explain the observed phenomenon; among these: piezo-electricity from rocks, atmospheric ionization triggered by solar activity and cosmic rays. The presented study is aimed at proposing the use of a dedicated instrumental set-up, research experimental procedures and methods in order to prove or disprove every single theory: in this context several kinds of observational techniques, measurement strategies and physical tests of tactical relevance are discussed in detail. An introduction on any considered theory is presented together with a detailed discussion regarding the subsequent experimental phase. For each specific theory brief descriptions of the observable parameters and of the essential instrumental choices and a detailed discussion of measurement procedures coupled with suitable flow-charts, are presented.

ØIH Rapport, 1998:5, Høgskolen i Østfold (Norway), pp. 1-93 (University booklet).

LUMINOUS PHENOMENA IN THE ATMOSPHERE. A NEW FRONTIER OF NEW PHYSICS?

Massimo Teodorani (1999)

A main geographic list of anomalous atmospheric light phenomena which are reoccurring in several areas of the world is presented. In particular, the Norwegian light-phenomenon occurring in Hessdalen, a prototypical event of this class, is described in great detail. Results obtained in 1984 by the Norwegian scientific organization named 'Project Hessdalen' are discussed. Moreover, the present status and future projects of this organization are presented. It is also shown how the philosophy of research of Project Hessdalen can be adapted to the quantitative investigation of similar light phenomena in other parts of the world. Subsequently, the numerical analysis carried out by the author on the Project Hessdalen 1984 data is shown in detail. After illustrating the several physical theories which have been proposed so far to explain the light phenomenon, a strong emphasis is given on the quantitative definition of instrumental prerequisites and measurable physical parameters. A strategy aimed at defining the investigation methodology and instrumented monitoring in Italian areas of recurrence of the light phenomenon, is presented. An introduction is also given on the documented effects of interaction of the electromagnetic field produced by the light phenomenon with the brain electrical activity of people, by suggesting possible biophysical causes.

Invited Paper (in Italian). Primo Convegno Internazionale su: LE TERRE DELLA SIBILLA APPENNINICA: UN ANTICO CROCEVIA DI IDEE, SCIENZA E CULTURA (Sezione Scientifico-Sperimentale), Amandola (AP) Italy, 6-8 Novembre 1998, ed. Miriamica., pp. 209-237.

THE MYSTERIOUS HESSDALEN LIGHTS

Massimo Teodorani (1999)

The Hessdalen valley in Norway represents today the ideal world laboratory for the instrumented study of luminous plasma phenomena which are occurring in the low atmosphere. After describing the multiform morphologic and dynamic features of the luminous component of the phenomenon, as they are deduced from visual and photographic witnesses, the results of the magnetometric, radiometric and radar monitoring, which were carried out by Project Hessdalen in 1984, are shown. Subsequently the author presents his own posthumous analysis of these data, by showing in particular the clear evidence of the coexistence of a magnetic and an optical phenomenon, and the apparent correlation between the magnetic component of the phenomenon and solar activity maxima. Afterwards, the most accredited physical theories which have been proposed in order to explain the nature of the phenomenon, are presented and discussed. Finally, the physical parameters which are expected to be measured with new instrumentation and the tactics and strategies to obtain them are introduced by showing the strict analogy with the methodology which is currently used during astrophysical observations.

Invited Paper (in Italian). Atti del VI Meeting Nazionale del CICAP sul tema: "Scienza, Paranormale e Massmedia: 10 Anni di Investigazioni ai Confini della Realtà", Decimo Anniversario del CICAP, Teatro Verdi - Padova University, 29-31 Ottobre 1999, pp. 59-65.

UFOS AND PHYSICAL SCIENCES: A POSSIBLE APPROACH TO THE PROBLEM

Massimo Teodorani (1999)

The psycho-sociological reasons why the academic science is not willing to face operatively and officially a hard problem such as the 'UFO phenomenon', are introduced in the ambit of an epistemological discussion. It is shown how such a phenomenon, due to his peculiar nature, might impose a drastic revision of the laws of physics which are commonly accepted. It is demonstrated how a strict application of the measurement methods which are normally adopted by physics can permit to obtain relevant quantitative results, whatever they are. As an example of such a procedure, the anomalous light phenomenology which reoccurs in the Hessdalen valley in Norway is presented, by showing that it represents so far the ideal worldly physical laboratory for the study of luminous phenomena in the low atmosphere. After describing the multiform morphologic and dynamic characteristics of the luminous component of the phenomenon as they are deduced from visual and photographic reports, the results coming out from the magnetometric, radiometric and radar monitoring operations which were carried out by Project Hessdalen in 1984, are presented in

detail. Subsequently, the posthumous analysis carried out by the author is shown, by pointing out the clear coexistence of the magnetic and the optical phenomenology and the apparent correlation of the magnetic component of the phenomenon with maxima of solar activity. In a subsequent phase, the most accredited physical theories, which have been proposed so far in order to interpret the phenomenon, are described and discussed, together with 'non-canonical hypotheses'. Finally, it is pointed out how the physical parameters which are expected to be measured with the proper instrumented equipment and aimed tactics and strategies, resemble strictly the methodology which is normally used during astrophysical observations.

Società Editrice Andromeda, Inediti, n. 130, pp. 1-43.

PHYSICAL DATA ACQUISITION AND ANALYSIS OF POSSIBLE FLYING EXTRATERRESTRIAL PROBES BY USING OPTO-ELECTRONIC DEVICES

Massimo Teodorani (2000)

A technical research project regarding the search for evidence of the extraterrestrial origin of UFO phenomena is proposed. After showing the main results from the analysis of an earlier Norwegian instrumental project, specific monitoring techniques and strategies based on magnetometers, radio spectrum analyzers and radar-assisted sensors for the detection and analysis of UFO optical and infrared light are presented together with calculations of exposure times for optical observations. Physical parameters which are expected to be determinable from subsequent data analysis are described in detail. Finally, crucial tests in order to prove or confute a non-natural origin of the UFO phenomenon are proposed and discussed.

Extraterrestrial Physics Review, Vol. 1, No. 3, pp. 32-37.

THE EMBLA 2000 MISSION IN HESSDALEN

Massimo Teodorani, Stelio Montebugnoli & Jader Monari (2000)

In August 2000 a team of Italian physical scientists, working in collaboration with Norwegian colleagues from Østfold College, carried out an instrumented expedition in Hessdalen (Norway), which was just the first of a series of future scientific missions planned by the joint Italian-Norwegian EMBLA Project. The mission was aimed at studying unexplained anomalous atmospheric luminous phenomena occurring in the Hessdalen valley since about 20 years, and it was firstly devoted to the monitor of the radio spectrum in the UHF, VLF and ELF wavelength ranges, secondly to the study of the typology of luminous phenomena. This paper presents an ample introduction describing the analysis of the data acquired in the period 1998-2000 by means of the Norwegian automatic videocamera of the Hessdalen Interactive Observatory: the hourly and monthly statistics of the luminous phenomenon and its spatial distribution over the celestial sphere are shown. The paper is then focussed into the results which were obtained with the employed radio spectrum analyzers of the EMBLA team, in particular the discovery of highly anomalous periodic signals of unknown origin which were characterized by a spike-like and a Doppler-like morphology and which were mostly detected in the VLF radio range. It is shown that the Doppler shift, supposed to be due to a 'particle-like' emitting source, ranges in a very short time from 10.000 up-to 100.000 km/sec with a frequency shift which is both red-wards and blue-wards, by changing periodically. Subsequently the physical interpretation is presented and discussed: (a) the occurrence of spike-like signals may be due to the pulsation of a radio-emitting source or alternatively to the rotation of a spheroidal source with a radio-emitting spot on its surface; (b) the very high measured velocities involved in the Doppler-like signals, together with the periodic inversion of the Doppler shift, are hypothesized to be due to a physical mechanism involving the magnetically collimated acceleration of high-energy particles modulated by the rotation of a self-contained 'plasma spheroid' whose magnetic axis is misaligned in comparison with its rotation axis. Moreover, a detailed description of the luminous phenomena which were sighted during the many planned skywatching sessions, is presented, together with photo-analysis and point-spread functions of enhanced frames. Finally, a detailed plan for future optical observations and analysis is shown in the appendix, in which photometric and spectroscopic techniques by means of portable scout instrumentation are described.

NIDS (web site: <http://www.nidsci.org>) Articles, <http://www.nidsci.org/articles/articles1.html#teodorani>

CIPH (web site: <http://www.itacomm.net/PH/>), Articles, http://www.itacomm.net/PH/embla2000/embla2000_e.htm

European Journal of UFO and Abduction Studies, Vol. 2 (1), pp. 3-24, 2001.

PHYSICS FROM UFO DATA

Massimo Teodorani (2001)

A research project concerning the instrumented investigation on atmospheric plasma-like luminous phenomena is proposed. Considered targets are treated on a par with astronomical objects having no fixed coordinates. Specifically oriented radar-assisted monitoring techniques and strategies involving small telescopes which are connected to CCD detectors, spectrographs and photon-counting photometers are presented. Expected exposure-times for acquiring an optimum signal-to-noise ratio of the target by using all the proposed instruments is also evaluated. Finally, physical parameters which are expected to be inferred from data analysis are presented and discussed in detail.

CIPH (web site: <http://www.itacomm.net/PH/>), Articles, http://www.itacomm.net/ph/phdata_e.pdf

European Journal of UFO and Abduction Studies, Vol. 1 (1), pp. 2-25, 2000.

DATA ANALYSIS OF ANOMALOUS LUMINOUS PHENOMENA IN HESSDALEN

Massimo Teodorani & Erling P. Strand (2001)

In the beginning of 1984 a group of Norwegian researchers, supported by external physical scientists, carried out investigations on a luminous phenomenon which was occurring with strong recurrence in the area of Hessdalen in Norway. Such a phenomenon, which was monitored without interruption for 36 days, also by employing several types of instruments, allowed researchers to obtain a precious set of data. At the present time a new station, which has been installed in 1998 in the Hessdalen area and which is supplied with an automatic videocamera, is currently furnishing data in real time. The present paper is devoted to the presentation and discussion of the data analysis and interpretation which have been attempted in order to try to understand the nature of such a phenomenon. The following main results are presented: a) the luminous phenomenon, which appears mostly during the night time and during the winter season, shows a marked radar signature and occurs approximately in concomitance with some peculiar magnetic disturbances and sometimes with unexplained radio emission, b) magnetometric data, radar data and some components of radiometric data show some slight correlation with daily solar activity. The hypothesis regarding the formation of solar-driven plasmoids which acquire self-governing EM and magnetic fields, is ventured and discussed. The alternative possibility that solar activity is interfering with a still unknown EM behavior due to the luminous phenomenon is further discussed.

CIPH (web site: <http://www.itacomm.net/PH/>), Articles, http://www.itacomm.net/ph/hess_e.pdf

European Journal of UFO and Abduction Studies, Vol. 1 (2), pp. 64-82, 2000.

INSTRUMENTED SEARCH FOR EXOGENOUS ROBOTIC PROBES ON EARTH

Massimo Teodorani (2001)

Anomalous luminous atmospheric phenomena, which are related with perturbations of the electromagnetic field, are recurrently sighted in several areas of the world. Previous and present results on this research are introduced by showing that radiating events with a peculiar behaviour can be measured systematically by following the standard galilean method. A work hypothesis regarding the possibility, in addition to the possible natural causes, that the phenomenon is due to probes of exogenous origin is ventured on the bases of the existing SETI literature. It is finally shown that this research is aimed at the attempt of understanding the physical laws governing such phenomenology, in particular the "energy problem", whatever its origin may be.

Conf. Proc. on "FIRST EUROPEAN WORKSHOP ON EXO-/ASTROBIOLOGY", Frascati, 21-23 Maggio 2001, Poster Session (poster di 60-pagine). Expanded abstract published in "Astrobiology", 2001, Vol. 1, N. 2, p. 185. Article published in: *ESA SP-496*, pp. 413-416.

EMBLA 2001: THE OPTICAL MISSION

Massimo Teodorani, Erling P. Strand & Bjorn G. Hauge (2001)

In August 2001 a new joint collaboration between Italian physicists and Norwegian engineers was successfully carried into effect with a new mission to Norway, in order to further investigate a luminous phenomenon which is occurring recurrently in the valley of Hessdalen. The Italian research-activity of this year was concentrated in the acquisition of optical data coming from conventional photography, video imaging and video-spectroscopy. Many photographs, videos and some spectra were obtained of the phenomenon. The results coming from the subsequent analysis are synthesized in seven points. A) On the basis of a photometric (point spread function) and spectroscopic (low-resolution spectra) analysis, the luminous phenomenon appears to be, in the very most part of the cases, a thermal plasma. From the maximum of the Planck curve a temperature $T \sim 6500$ deg K is measured, which remains approximately constant for all the duration of the luminous phenomenon (sometimes up to 3 minutes), in spite of the sharp luminosity variations. B) The light-phenomenon is subject to luminosity variations on a time-scale of the order of seconds and ten seconds. A light-curve shows characteristics of semi-pulsation (about ten seconds) of the 'on-off' type in the primary phase, while in the secondary phase it presents a semi-stable behaviour which is settled at the maximum luminosity and with small semi-periodic oscillations (1 second). The luminosity maxima are reached only when the radiating surface reaches the largest dimensions, by remaining the flux approximately constant. C) The luminous phenomenon when seen by naked eye appears like 'light orbs', while an instrumental analysis (both video and photographic) demonstrates that the light-orbs are often constituted of many smaller orbs which appear to vibrate around a common barycenter which coincides with a larger central body, and it is evident that the central body is sometimes able to eject smaller orbs on a time-scale of the order of 1 second. The increase of the radiating surface is often due to an integrated effect which is caused by the presence of many light-components which are occasionally located just outside of the central body. D) The luminous phenomenon is able to acquire any kind of shape, sometimes also sharply geometric. E) In spite of the fact that it looks like a thermal plasma, the luminous phenomenon doesn't present, from a thermodynamic point of view, any adiabatic behaviour. This is demonstrated by the missing of an anti-correlation between the diameter of the luminous body and the flux peak-value. F) A qualitative model is presented. It is hypothesized that the luminous orbs are thermal plasma structures which are triggered by a 'central force' which simulates a mini-black hole and which are internally confined by a magnetic cage. The verified missing of heat production is hypothesized to be due to a blocking of the electrons of conduction. Other models, involving the presence of magnetic monopoles, and the photoionization of low-energy plasmas by cosmic rays, are considered too. G) Once more it has been possible to demonstrate that the Hessdalen area is also featured by other targets with anomalous characteristics which seem to overlap on the more 'standard luminous phenomenon', from the analysis of two of which no plasma signature was found. One of these objects presents sharply 'metal-like' characteristics, whose appearance in the photo after a flash exposure is interpreted to be due to an effect of stimulated emission on a substance of semiconductive kind.

CIPH (web site: <http://www.itacomm.net/PH/>), Articles, http://www.itacomm.net/ph/EMBLA2001/EMBLA2001_e.pdf

THE PHYSICAL STUDY OF ATMOSPHERIC LUMINOUS ANOMALIES AND THE SETV HYPOTHESIS

Massimo Teodorani (2002)

On the basis of statistical calculations on galactic migration which bring the necessity of insertion of a new parameter inside the Drake formula, the work-hypothesis named SETV predicts that exogenous vehicles and/or probes may have reached the Solar System too, including Earth. The technology which is now available is able to allow sensing operations both in the extreme borders of the solar system and on our own planet. The possible presence of probes of possible extraterrestrial origin on our planet may be ascertained by using a network of sensing stations which are placed in critical areas. One of them is the Norwegian area of Hessdalen, where the two scientific explorative missions of "Project EMBLA" have carried out measurements which demonstrate the existence of all the anomalies of the luminous phenomenon which is present there. At present nothing proves scientifically that our planet is being visited by alien intelligences, nevertheless the remarkable peculiarity which was learnt in some areas of recurrence demonstrate that the verified phenomenology, of extreme importance for fundamental physics, presents characteristics which deserve a further investigation with highly sophisticated instrumentation.

Open SETI (web site: <http://www.zeitlin.net/OpenSETI/Opening.shtml>), Articles, http://www.zeitlin.net/OpenSETI/Docs/EuroSETI2002_OSI.htm

EMBLA 2002: AN OPTICAL AND GROUND SURVEY IN HESSDALEN

Massimo Teodorani & Gloria Nobili (2002)

A two-weeks scientific expedition to Hessdalen, aimed at investigating on field mysterious atmospheric light-phenomena, was carried out in August 2002 by the physics section of an Italian team of scientists. Results are presented and discussed. Photometric analysis shows that the light-phenomenon is able to produce a luminous power of up-to 100 kW. A 3-D analysis of photo frames shows that the luminous phenomenon doesn't resemble canonical plasma features (a sharply gaussian PSF) unless the light phenomenon is caused by one recently discovered natural light-ball of BL type whose light-distribution (PSF) might be able to simulate an uniformly illuminated solid. A comparison of the light-distribution in different time-sequential frames shows that apparent slightly exponential wings of the PSF features are probably due to variations of atmospheric turbulence and transparency and not to intrinsic properties. Maximum phases of luminosity of the radiating surface are demonstrated to be due to the sudden apparition of a cluster of co-existing light-balls at constant temperature, while the inflation of light-balls is ruled out. Spectra show no resolved lines but a three-peaked feature which might be attributed both to some kind of artificial illumination system and to a mixture of many blended lines due to several chemical elements (more possibly: silicon). The results of a lab analysis of ground samples shows that some powder which was collected near a river contains an anomalous iron sphere of micrometric dimensions. A biophysical research-proposal aimed at studying the relation between the EM field produced by the phenomenon and the electrical activity of the human body is also presented. On the basis of this third explorative experience, the importance of having at disposal a sophisticated opto-electronic portable station (missing at present) is stressed for the future.

Project Hessdalen (web site: <http://hessdalen.hiof.no>) Articles and Reports, http://hessdalen.hiof.no/reports/EMBLA_2002_2.pdf

SETV: AN EXTENSION OF SETI?

Massimo Teodorani (2003)

In the ambit of the SETI Project, a new branch named "SETV" (Search for Extraterrestrial Visitation) was born very recently due to the international effort of some engineers, astronomers and other researchers, and it is now in a development phase with several monitoring projects. SETV is aimed at investigating, by using well-tested means of physical and technological sciences, the possible evidence of extraterrestrial visitations inside our solar system. On the basis of statistical calculations of galactic migration, and of models coming from standard stellar evolution, Dyson theory and advanced possibilities invoked by theoretical physics, the historical excursus which turned the SETA hypothesis (Search for Extraterrestrial Artifacts), developed in the 80', into the present SETV definition, is presented in detail. The possibility that extraterrestrial intelligences are present inside our solar system with inhabited and/or robotic probes is discussed, including the possibility that our planet is one of their targets. A proposal concerning instrumented multi-wavelength surveys and identification of such exogenous probes is presented.

SETI-Italia (web site: <http://www.seti-italia.cnr.it/>), Articles, <http://www.seti-italia.cnr.it/Pagina%20Articoli/SETV.pdf> (in Italian)

A LONG-TERM SCIENTIFIC SURVEY OF THE HESSDALEN PHENOMENON

Massimo Teodorani (2003)

The balls of light which appear in the Hessdalen valley in Norway are exemplary of anomalous atmospheric luminous phenomena that occur frequently at some locations on Earth. The recurrence of the phenomenon and the existence of an instrumented observation station makes this area an ideal laboratory for scientific study. The apparent correlation of luminous phenomena with magnetic perturbations, radio emission and radar tracks that were found by Norwegian researchers, led some Italian physicists and engineers of the EMBLA Project to reanalyze the acquired Norwegian data. The second step was three explorative instrumented field study expeditions. The behavior of the phenomenon was monitored with optical, radio and radar techniques. The global picture of the phenomenon obtained so far by the EMBLA Project shows that

the phenomenon's luminosity varies reaching values of up to 100 kW. These changes may be caused by sudden surface variations of the illuminated area due to the apparition of clusters of light balls that behave in a thermally self-regulated way. Apparent characteristics consistent with a solid are strongly suspected from the study of luminosity distributions. Other anomalous characteristics include the capability to eject smaller light balls, Doppler shifting VLF emissions, and possible deposition of metallic particles. Finally, it is shown that a self-consistent definitive theory on the phenomenon's nature and origin in all its aspects cannot be constructed on the basis of pre-existing physical theories, but only directly from the data once more sophisticated instrumentation is available.

Journal of Scientific Exploration. Submitted in September 2003 .

OPTICAL INVESTIGATION OF ANOMALOUS LIGHT PHENOMENA IN THE ARIZONA DESERT

Massimo Teodorani (2003)

A scientific mission to the Arizona desert was organized in April 2003 by a group composed by geophysicist Marsha Adams, technological scientist Erling Strand and myself. The goal of this expedition was of testing on-field team-work in difficult areas where anomalous light-phenomena are seen very often, and of acquiring data with several instruments including magnetometers, VLF receivers, radioactivity detectors, a weather station and optical tools for photography and spectroscopy. This report is the description of the results which came out from the analysis of optical data. The analysis of digital and film photographs is presented in detail, by distinguishing all the conventional light-events which have been identified, from the unidentified ones and the ones which can be definitively considered as "anomalous cases". The diagnostics of low-resolution spectra is presented too by showing that almost all of the obtained spectra are due to well-known artificial lights. Finally, tests with a high-resolution spectrograph and optical tests with a reflector telescope are described.

Submitted in July 2003 to "International Earthlight Alliance" (IEA: <http://www.earthlights.org/>).

NOTE. All of these abstracts are cited in the [NASA ADS](#) (Astrophysics Data System) Query Form for the "Physics/Geophysics" database: http://cdsads.u-strasbg.fr/abstract_service.html

⊕ All the most important internet links are written in blue.

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5. Synthetic biography



Massimo Teodorani is an astrophysicist. He was born (October 31, 1956) and lives in Emilia-Romagna (North Italy). He got his Masters Degree in Astronomy at the Bologna University (Italy). Later, at the same university he worked for his doctoral dissertation by obtaining a Ph.D. in Stellar Physics. He worked at the astronomical observatories in Bologna and in Napoli, as a specialist in the observational and interpretative study of stars which present eruptive behaviour of various kinds, such as supernovae, interacting binaries, and protostars. He has been using several kinds of optical telescopes, including the IUE ultraviolet satellite. At present he works at the CNR radioastronomic station in Medicina (Bologna, Italy) where, by using a 32 m parabolic radiotelescope and a high-resolution multi-channel spectrometer, carries out researches on the 22 GHz water spectral line in exoplanet candidates and in comets. Since 1994, parallelly with astrophysics, he studies from a physical point of view anomalous atmospheric luminous phenomena in strict collaboration with several foreigner researchers. After preparing several technical research proposals in order to study the phenomenon by using the most sophisticated means of astronomical kind and after analyzing the data which were acquired by the Project Hessdalen researchers, he has been the scientific director of three italian explorative missions in Hessdalen (Norway), which have permitted to describe precisely some aspects of the physics of the light-phenomenon. He is a member of SETI in Italy, and the Italian responsible of the SETV variant. He is author and co-author of many technical and divulging scientific works regarding both astrophysical matters and anomalous atmospheric luminous phenomena. He is a member of several scientific societies and since 2003 his name is cited in the "Contemporary Who is Who".