AN ALTERNATIVE METHOD FOR THE SCIENTIFIC SEARCH FOR EXTRATERRESTRIAL INTELLIGENT LIFE : THE "LOCAL SETI"

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1. The SETI Project and its restrictions

The present SETI (Search for Extraterrestrial Intelligence) Project is devoted to the search for signals coming from technological civilizations living in other planets. Due to their capability to cross efficiently the interstellar medium (Cocconi and Morrison, 1959), radio frequencies have been chosen as the best method to receive and send communications from/to ET civilizations. This project is operational since a few decades and it is generally named Microwave Observing Project (MOP). The typically used frequency window ranges from 1 to 10 GHz. The goal of this investigation is to search for very narrow, possibly modulated radio signals, with a more or less marked polarization, which are presumably transmitted intentionally or unintentionally by emitters located on an extrasolar planet and characterized by a Doppler effect due to planet rotation and revolution around its star. The strategies which are currently adopted for this research are mainly: a) All Sky Survey (ASS); b) Targeted Search (TS); and c) Piggy-Back Mode Search (PBMS). Using the ASS mode (Tarter, 2001) all the celestial sphere is scanned until a suspect signal is found. According to the standard SETI procedures, such a signal must be reobserved with the same characteristics and with the same equatorial coordinates by the same observer and by all the other observers in the world. Using the TS mode (Tarter, 2001; Turnbull and Tarter, 2003a, 2003b), specific target stars having non-eruptive signatures and characteristics similar to the Sun are chosen for a detailed analysis. Using the PBMS mode (Montebugnoli et al., 2002), the SETI search works in parallel with standard radio astronomic observations wherever the antenna is pointed, without abstracting observation time to them. In order to reach the SETI goals adopting all the described strategies, the antenna used for this research is always connected to a Multi Channel Spectrum Analyzer (MCSA), which at the present time is able to scan simultaneously a few tenths of millions of channels, so that the radio spectra are obtained with a typical resolution ranging from 1 to 0.1 Hz or less. The probability to detect such a kind of signal, which is expected to be extremely weak, increases with the diameter and the type of the antenna, the sensitivity of the receiver, the power of the amplifier, and the effectiveness of the algorythm used to extract the signal from the noise. Since some years, the enormous computational needs requested for realtime data processing is also efficiently assisted by the SETI@home initiative (Korpela et al., 2004). In addition to the detection of radio waves, since a few years the SETI Project is operational in the optical range too (Horowitz et al., 2001; Kingsley, 2001). This variant, named Optical SETI (OSETI), is intended to search for very strong

and pulsed optical beacons possibly of Laser kind coming from intelligent civilizations located in extrasolar planets, using photon-counting photometers and/or high-resolution spectrographs able to reach a very high magnitude precision and temporal resolution. Alternative SETI projects involving the infrared range of the spectrum and the search for intelligent Maser signals in the microwave region, have been recently also proposed.

At the present time, no clear detection of intelligent ET signals has been obtained (Lazio et al., 2002), but many identified false alarms and/or still unidentified signals which anyway didn't show any repeater, have been reported. All of the present SETI efforts require that intelligent beacons are originated from a planet orbiting around another star having equatorial coordinates which are expected to be constant in a time lapse of many years. Therefore celestial sources that are characterized by an anomalously high proper motion, involving a more or less abrupt change of its equatorial coordinates in the lapse of a few months or days, are excluded by the SETI search strategy. In such a way, what the standard SETI project will possibly have the luck to detect in the next years, will be a pure selection effect, which in substance consists of signals emitted by ET civilizations that are at a level of technological evolution comparable with ours and that still live in their home planet. Due to the restrictive research strategy and preset technological characteristics of the standard SETI detectors and processing procedures, the detection of radio, infrared and/or optical signals coming from relatively fast moving emitters is necessarily avoided. This means that using such a sophisticated but limitative search method, alien transmitters that are located on fast moving sources cannot be detected. Is there a solid scientific reason to build up and employ a sensing strategy able to record such a peculiar kind of signals? The answer is positive. Since at least 20 years several theoretical studies (Betinis, 1978; Finney, 1985; Jones, 1981; Newman and Sagan, 1981) have shown that the migration of extraterrestrial civilizations in the galaxy, whose moving transportation devices would be necessarily characterized by a high proper motion compared with the proper motion of close stars, is a possibility that can be investigated observationally. The detection of celestial sources having an anomalously high proper motion doesn't enter into the standard SETI protocols.

If galactic civilizations, which are far more advanced than us, are able to move from a star to another, they might have visited our solar system and Earth too. At present, in addition to the possible detection outside and inside our solar system of unidentified celestial sources having high-proper motion, we have the scientifical and technological capability to investigate aseptically the possibility that Earth too is being visited. Anomalous phenomena reported in our atmosphere might be a signature of such visitations. Which ones of them are due to natural phenomena and which ones are not? In the following sections it will be shown that this difficult but important goal can be reached adding a "sieve strategy" to our well-working Galilean method.

2. Strange light phenomena on Earth and scientific inquire

If we suppose that Earth is visited by alien intelligence, we should expect to see possibly transient anomalies in our atmosphere that have a technological signature and/or a non-random behavior. The difficult task here is to distinguish very carefully

which ones of these anomalies are of natural origin, which ones are a product of advanced terrestrial technology, and which ones cannot be identified with the first two categories. Once the third category is possibly identified as an exogenous visitation, the next task consists in trying to understand how this category works in terms of the known law of physics. This involves both the investigation of possible propulsion systems, which might be identified from the mechanism of radiation emission in a wide range of wavelengths, and the investigation of how such devices are intelligently driven.

It is generally expected that such hypothesized intrusions in our atmosphere occur transiently and randomly on Earth, so that these occurrences cannot be predicted in order to permit researchers to be prepared with sensing instrumentation. In such a case scientific investigations would not be possible, even if several or many witnesses were reported. Witness reports are of no scientific relevance, because they are affected by a huge evaluation error, which cannot even be quantitatively estimated (Condon, 1969). In order to do science on this kind of investigation, it is necessary to acquire physical data using suitable measurement sensors, through which the signals of interest and the related measurement errors can be accurately evaluated. Fortunately, in addition to the transient occurrence of anomalous events on Earth, there is also a strong evidence that in some areas of Earth atmospheric anomalies occur with a remarkable regularity. Such locations can be suitably chosen as the best sites for scientific monitoring, in order to ascertain the origin of the phenomenon including a possible extraterrestrial origin too. It is possible to testify that in such locations anomalous phenomena are repeatable, therefore they are suitable for a systematic observational scientific investigation.

2.1. THE FIRST SCIENTIFIC INVESTIGATIONS

Anomalous atmospheric light phenomena reoccur in many locations of Earth, some of which have become a laboratory area for a rigorous instrumented study of the involved physics. At least 35 of these locations are documented with images and some scientific measurements (Teodorani, 2003). Such phenomena appear, both in the sky and close to the ground, as multicolor and large-sized (up to 30 meters) “light balls” characterized by irregular pulsation and erratic movements. The time correlation of light phenomena with oscillating magnetic fields is one of the most intriguing observational results that were obtained in some areas of Earth such as Hessdalen in Norway (Strand, 1984; Teodorani, 2004), Boulia in Australia (”Min-min” lights), Popocatepetl in Mexico, and Yakima in USA. The light phenomenon that is reported in the Hessdalen valley in central Norway is probably the most known in the world, as it is the only one under systematic scientific field study since over 20 years. Several kinds of measurement techniques, such as magnetometry, radar monitoring, radio and optical spectrometry, optical photography and video recording, have been employed so far. Therefore the Hessdalen location can be fit as a laboratory area for the study of this kind of atmospheric spatially reoccurring anomaly. In fact, a permanent automatic measurement station (Strand, 1998) has been installed in that area, from which since 1998 it is possible to acquire automatically and continuously video data and occasionally measurement data using electromagnetic instrumentation. The rich statistics that was obtained so far (Teodorani, 2004) from the data furnished by the Norwegian station, shows that the light phenomenon is spatially uniformly distributed and tends to appear more often in the winter season and in the

hourly interval between 09.00 p.m. and 01.00 a.m. local time. The light events do not show any correlation with daily, monthly and yearly solar activity.

2.2. THE MOST RECENT SCIENTIFIC INVESTIGATIONS

Some Italian instrumented expeditions were carried out by several groups of physicists and engineers in the Hessdalen area in the years 2000, 2001, 2002, 2003 and 2004. The first three of these missions permitted to obtain crucial measurements that furnished a physical insight into the light phenomenon's structural characteristics and variable behavior, and into its mainly geophysical nature (Teodorani, 2004). Engineers monitored constantly the Hessdalen valley using spectrometers able to survey ELF (Extra Low Frequency) and VLF (Very Low Frequency) radio frequency ranges, and a UHF (Ultra High Frequency) pulse radar. Physicists concentrated on the acquisition of conventional, digital and telescopic photographs, videos and low-resolution spectra of the light phenomenon, and on the analysis of ELF-VLF data and collected ground samples in specific areas approached by the light phenomenon. Some portable instruments such as night scopes / IR-viewers, ultrasound and electric field detectors, a high-speed optical radiometer, and data scopes for triangulations, were used as well.

More recently, photographs, video frames and spectra of similar anomalous light phenomena that reoccur in some areas of Australia and Canada, have been analyzed after training scout observers to use diffraction gratings in order to obtain digital spectroscopic images of the light phenomenon (*SpecNet* initiative). An Italian field mission has also been carried out in the Arizona desert in 2003 in collaboration with the IEA organization (Adams and Strand, 2003). Two crucial locations of the Italian Apennine mountains have been monitored in 2003 (Teodorani, 2003) and 2004, and the study of the Italian areas of interest is currently going on.

3. Data acquired in Hessdalen and their physical interpretation

In this section the main scientific results (Teodorani, 2004) that were obtained during instrumented missions in Hessdalen, Norway, are synthetically described.

3.1. THE OBSERVED PHYSICAL FEATURES

After eliminating a lot of man-made noise and well-known typical ionospheric signals, it was noticed that the ELF-VLF radio recordings showed very often unusual signals characterized by inclined lines (in a graph representing frequency vs. time) having a marked Doppler feature. The slope of the lines was almost periodically and gradually changed from negative to positive in a lapse of few seconds, showing that the source was alternately approaching and receding from the observer. From the measured frequency it was possible to determine the velocity of the emitting source, which was changing fast from 10,000 to 100,000 Km/s within several seconds. Many cycles were occurring during a time interval as long as half an hour, by starting and ending abruptly as if some transient electromagnetic event was turned on and off. In order to interpret this evidence, an ad-hoc empirical model has been proposed, according to which it is

supposed that high-energy particles are accelerated and collimated by a cylindrically symmetric magnetic field whose axis is misaligned in comparison with the rotation axis of a fast rotating body. In this framework the observer is able to register periodically blue and red-shifts. Very high energies for particles - presumably electrons - and very strong magnetic fields are necessary in order to produce the observed effect. This mechanism seems to resemble a small-scale version of the synchrotron radiation (Lang, 1998), which is observed in fast spinning objects such as pulsars in astronomy. The Doppler radio phenomenology was recorded mostly when the light phenomenon was not in sight. After scanning the sky and the top of the hills with the IR-viewer it was sometimes possible to establish that a normally invisible light phenomenon was indeed detectable when a light amplification device was used.

Observers on the field were able to confirm very often the appearance of the light phenomena. The main deduced average characteristics of such phenomena are shown in Table 1. Both visually and photographically it was verified that the most common light phenomena are always preceded by very short-lasting flashes of light that appear everywhere in the valley and that emit an intrinsic power ranging from 10 to 300 W. Very often such flashes have been reported at a very short distance (about 100 m) from observers, so that the distance parameter could be approximately evaluated.

The typical three-dimensional light-distribution of the illuminated surface of most common light phenomena, which in optimal atmospheric conditions shows to be steep and rectilinear, results to be drastically different from the one – a Gaussian and exponential distribution - that is expected from a standard plasma. Luminosity shows very often a highly time-variable feature with a pulsation rate of one second or less, and a highest radiating power up to 20 kW has been measured in one specific case in which the distance (9 Km) could be determined using triangulations, radar scanning and topographic mapping. In most of the cases in which the light phenomenon is blinking, irregular or semi-regular pulsations are typically terminated after few cycles with an average event duration of 5 seconds, in other cases many cycles are continued for a period as long as several minutes. It has been possible to ascertain that the luminosity of such light phenomena increases in a drastic way because of the sudden appearance of many smaller light balls around a larger luminous core. Due to this the highest luminosity values are caused only by the dimensional increase of the total radiating surface that is formed by a cluster of light balls. Therefore the increase of the surface area is not caused by the expansion of a single light orb. Some of the secondary light balls are often ejected from the core, this also can cause a luminosity increase of the entire lighted target as seen from far away. The phenomenon produces light by maintaining a constant color-temperature, behaving like a lamp with “on” and “off” phases. The constancy of temperature is deduced both from the unchanged features of the spectra when the light phenomenon is shifting from the lowest to the highest luminosity values, and from the empirical dimension-luminosity correlation that is derived from the analysis of unsaturated video frames. In such a specific case the classical Stefan-Boltzmann law (Lang, 1998), which describes the behavior of a plasma in thermodynamic equilibrium and emitting light as an isotropic radiator, characterizes a self-sustained isothermal plasma where the radiant power in the optical range varies only when the radiating surface varies. The obtained spectrum of a cluster of three light-balls colored in white, red and blue, shows three well-distinguished peaks that are about

500 Å wide, anyone of which resembles a spectral feature that is very similar to the one produced by LED (Light Emitting Diode) lamps. The color-temperature derived from the spectrum is consistent with the colors of the light balls as they were recorded in the photograph that was obtained at the same time as the spectrum.

Approximately 10% of the light phenomena, which were reported and recorded during three of the five Italian missions, should be considered "peculiar" compared with light phenomena that were seen most often. The peculiar events were characterized by totally lighted geometric or symmetric shapes and sometimes by translucent or low-luminosity apparently structured shapes.

The light phenomenon shows often-strong radar tracks, which transiently appear and disappear, also when it is optically faint or almost invisible. In some cases in which it is visible, it shows no radar track. Velocities can reach values up to 60,000 km/h.

Some slightly radioactive powder was collected very close to a spot where it was ascertained that the light phenomenon approached the ground. A subsequent laboratory analysis that was carried out using plasma spectroscopy, X-ray diffraction and scanning electronic microscopy, showed the evidence of sphere-like iron particles of micrometric dimensions.

This is all what came out from the most important of our expeditions to Hessdalen, in 2000, 2001 and 2002. Missions carried out in 2003 and 2004 were mainly devoted to testing new instruments. It was finally verified that a natural laboratory is just out there, inside our planet. Physical science has at its disposal a lot of sites of this kind that can be scientifically monitored by using highly sophisticated sensing instrumentation (Teodorani, 2000).

TABLE 1. Main features of the Hessdalen light phenomena

	Total Number	Clustered lights	Geometric shapes	Structured objects	Uncertain
	150	80%	5%	5%	10%
Origin		Geophysical	Unknown	Unknown	Unknown
Trigger mechanism		Piezoelectricity	Unknown	Unknown	Unknown
Characteristics		Plasma	Plasma	Unknown	Unknown
Time peak		11.30 pm	10.00 pm	Random	-
Time variability		High	High	Little	Little
Pulsation period		≤ 1 sec	≤ 1 sec	-	-
Surface variability		High	High	None	Little
Highest Luminosity		20 kW	-	-	-
Colors		W, R, B	W, Y, B, V	W, Y, G	W, B
Total duration		180 sec	240 sec	60 sec	30 sec
Velocity		60,000 km/h	-	-	-
Close to ground		70%	40%	10%	25%
Low in the sky		30%	60%	90%	75%
Radar / IR emission		Yes	Yes	Yes	Yes
VLF emission		Probably	Possibly	-	-
Reaction to Laser		-	-	-	Yes
Remnants on soil		Possibly	-	-	-

W = white, Y = yellow, R = red, B = blue, V = violet, G = grey

3.2. TOWARDS A PHYSICAL THEORY

During the last ten years, several theories and hypotheses of natural kind have been considered to try to explain the origin and the nature of the light phenomenon and of the electromagnetic field that seems to be correlated to it. Mainly the following possible causes have been considered (Teodorani & Strand, 1998): ionosphere activity, solar activity, cosmic rays, magnetic monopoles, mini-black holes, Rydberg matter, heated nanoparticles (Abrahamson and Dinniss, 2000), piezoelectricity, quantum fluctuations of the vacuum state. For none of these possible causes, except for some aspects of piezoelectricity, it was possible to find a successful proof. Very recently one more complete theory, which is able to explain most of the recorded data, has been carefully elaborated (Teodorani, 2004). Such a theory, which was originally worked out by physical chemist David Turner (2003) in order to explain the ball lightning phenomenon (Stenhoff, 1999), has demonstrated to be very suitable to explain the Hessdalen-like phenomena too. It consists of a thermo-chemical mechanism producing and maintaining light balls whose structure and radiant characteristics seem to match at least 80% of the phenomena of which measurements were carried out in Hessdalen. In a first phase – named "Tectonic Trigger Phase" - air can be ionized by tectonic stress causing simultaneously piezoelectricity and the emission of VLF and UHF waves, so that a plasma ball can be formed from the wave-particle interaction (Zou, 1995). In the specific Hessdalen area tectonic stress can be produced by river water that penetrates into the many ground cavities present in the valley and that then freezes when temperature drops down: in such a way the ice compresses the many quartz rocks which are present in the area so that the best condition for piezoelectricity is produced. The development and maintenance of this mechanism is also assisted by the presence in the valley of a large quantity of copper, having its well-known conductive property. In a second phase (Turner, 2003) – named "Thermo-Chemical Confinement Phase" - the formed plasma can bind with water vapor and aerosols, to create a hot and sharp-edged light ball with a cool water-and-ion coat, in which electrical and thermo-chemical energy exchanges occur following the mode of a heat pump. In such a way some inward forces are able to counterbalance the external pressure and the light ball is consequently self-regulated in a sort of hydrostatic equilibrium. Surface energy re-minimization can determine both ball clustering and ball ejection effects. The typical erratic motion and kinematical characteristics can be explained by asymmetries in the layer of droplets of the light balls, which can be caused by changes in either the chemical or electrical state. In the specific Hessdalen case, a possible spontaneous production of almost mono-disperse quantum dots might come from mold spores, as the main semi-conducting elements, decomposed by the central plasma of the light ball. This could explain successfully not only the recorded LED-like spectrum but also the existence of balls of distinctly different colors. Some of the radar and infrared observed behaviors can be explained using this model as well.

Turner's thermo-chemical model is able to explain as a plasma phenomenon of geophysical nature most of the data collected in Hessdalen, but not all of the data. The residual data might be potentially considered in the light of a possible ET interpretation only if all of the other possibilities (of prosaic origin and/or of artificial human nature) can be accurately excluded.

3.3. THE PROBLEM OF PECULIAR CASES AND THE "ETV" HYPOTHESIS

Other evidence that was found in Hessdalen constitutes another anomaly inside the main anomaly (Teodorani, 2003, 2004). There are not yet confirmations that the lights are really associated with Doppler-like signals in the ELF-VLF range or with the deposition of metallic particles. Therefore a sound comparison of these findings with Turner's model is not yet possible. On the other hand, Turner's model is not able to explain the geometric shapes or structures that were recorded in a small minority of cases. It is not yet known whether these manifestations are different and rarer aspects of the same "standard" light phenomena or whether they are distinct phenomena that overlap with the standard one for some unknown reasons (see Table 1). A similar unexpected mixture of "standard earth-light phenomena" and very exotic features are reported in other locations of Earth too (Teodorani, 2003). This uncomfortable side of the anomaly constitutes valuable observational evidence and must be investigated more deeply. Also, working hypotheses different from those covering natural "earth lights" should be followed up. This research must be conducted by considering how far standard physics can take us, but also with some parallel attention to those other anomalies whose possibly spurious relevance should be investigated.

While most of light phenomena in Hessdalen and elsewhere can now be successfully explained within the framework of a natural mechanism, a residual of "locally overlapping data" remains presently unexplained and largely unexplored. To investigate them also the ETV (Extraterrestrial Visitation) working hypothesis is taken into account.

The search for ETV (SETV), which is consistent with the assumption of interstellar and galactic diffusion, demands for an extension of the Drake equation (Walters et al., 1980). This equation describes the probability of the existence of intelligent extraterrestrial civilizations in our galaxy according to a set of fixed physical and astronomical parameters that are based on stellar and planetary evolution. The assumption of interstellar diffusion means that galactic civilizations are able to migrate throughout the galaxy. This adds one more parameter to the Drake equation.

The verification of possible ET visitations that are consequent to interstellar migration, can be carried out only doing a rigorous screening of data coming originally from the study of natural and/or celestial phenomena located both in the solar system in its entirety and on Earth where anomalous phenomena are often reported. Therefore the main strategy that is being adopted in studying some anomalies acquires the character of a sieve. Such a "sieve strategy" can allow scientists to distinguish "the stones from the nuggets". In the first case it is possible to expand our physical knowledge of natural anomalies that have not been studied enough so far but that, if fully understood, could be of basic help to brindle new energy sources. On the other side, the extreme carefulness with which scientific monitorings are carried out, can help physical scientists to establish some discrepant facts that might bring to the discovery of a possible extraterrestrial visitation both in the form of exotic technology and in the form of possible electromagnetic intelligent manifestations of endogenous or exogenous origin that have so far excaped scientific detection. A possible interaction between some anomalous phenomena of ascertained geophysical origin and an hypothetical "alien" intelligence is considered as well. Therefore, such a sieve strategy can help us to expand

several aspects of our science simultaneously, involving fundamental physics, plasma and particle physics, physics based on some technological products of possible exogenous origin, bio physics, and some intriguing aspects of quantum mechanics.

4. The hypothesis of interstellar migration and the SETV Project

The hypothesis that Earth is visited by exogenous intelligences is based on the possibility that alien civilizations are able to migrate throughout the galaxy.

By using appropriate "diffusion equations" it is possible to predict the interstellar expansion of galactic civilizations as a process that is expanding like a wave (Bainbridge, 1984; Betinis, 1978; Deardorff 1986; Finney, 1985; Jones, 1981; Newman and Sagan, 1981; Walters et al., 1980; Zuckerman, 1985). According to the most recent evaluations (Principia homepage, 2004) the wave speed comes out at $\sim 10^{-3}$ light years per year. This implies that intelligent civilization could settle the entire galaxy in only 60 million years. Compared with the age of our galaxy ($\tau = 10^{10}$ yrs), this means that galactic post-migration colonization would be completed during a time interval that is at least 150 times smaller. Earth itself may have been visited numerous times since the arrival of Homo sapiens and much before. This possibility raised, sixty years ago, the famous question by physicist Enrico Fermi, who since that time posed as a problem the well-known "Fermi Paradox", according to which the apparent absence of extraterrestrials on Earth is a proof of their non-existence (Freitas, 1983a, 1983c, 1985a; Tipler, 1980).

4.1. MOTIVATION FOR INTERSTELLAR MIGRATION

The possibility of extraterrestrial migration necessarily involves an extension of the Drake equation (Walters et al., 1980), so that this equation assumes a more dynamic character. Extraterrestrial migration is also justified by the hypothetic arrival methods and propulsion systems that extraterrestrial migrants would use. Three possible systems have been mainly hypothesized and theorized so far: a) vectored huge space stations inhabited by self-sustained biological intelligences, hibernated embryos or self-reproducing robots and/or automatic probes, which after an interstellar travel lasting centuries or millennia might have been settled on energetically favourable zones of our solar system (Freitas, 1980, 1983b, 1985b; Freitas and Valdes, 1980; Freitas and Valdes, 1985; Jones 1985; Papagiannis, 1983; Rose and Wright, 2004; Valdes and Freitas, 1983); b) spacecrafts that use relativistic wormholes to jump very rapidly from a place to another of the galaxy (Crawford, 1995; Davis, 2004; Kaku, 1994; Krasnikov, 2000; Maccone, 1995, 2000; Morris et al., 1988); c) exotic transfer methods involving some concepts of quantum mechanics in the framework of a holographic universe with resonant and non-local effects (Bohm, 1980; Davis, 2004; Jahn and Dunne, 1986).

The existence of long-lived, and presumably highly technologically evolved, ET civilizations, can be indirectly predicted by the current theories of stellar evolution (Clayton, 1983; Zuckerman, 1985), especially when one considers the very long duration of a low-mass solar-type star, around which terrestrial-like planets might be orbiting. The end of the main-sequence phase (hydrogen burning) of their star and the

beginning of the giant-expansion phase (stellar envelope ejection) could be one of the most logical reasons of the migration of such civilizations. In such a case the expansion of the envelope of the star towards the giant phase would encapsulate all the inner planets, where extraterrestrial civilizations would live most probably. There are good reasons to hypothesize that civilizations that are highly evolved scientifically and technologically are able to predict with high time accuracy the onset of the giant phase, in order to be able to build in time and launch large spacecrafts containing a big number of individuals that are destined to leave their stellar system, and to choose a new solar system that is most favourable for life. Otherwise, an alien civilization might decide to send automatic probes to our solar system for purely scientific purposes, or, alternatively, it might have found the way to carry out visitations directly and fast using the properties of wormholes or more exotic systems.

Therefore, together with the quantitative predictions coming from the diffusion equations, which are in their turn an application of stellar statistics merged with bio astronomy, there are sound theoretical motivations to search systematically for proofs of extraterrestrial visitation inside the solar system. Even if so far concrete evidences have not been found at all, our planet too might be a possible target of alien visitation: this possibility can be investigated as well following the "sieve strategy" that was discussed in the previous sections.

4.2. THE "SETV" PROJECT

In the general context of the SETI project a new branch named SETV (SETV homepage, 2003) was officially born at the end of the previous century and has been very recently developed (Ansbro, 2001; Cornet and Stride, 2003; Stride, 2001; Teodorani, 2000, 2001, 2003). The goal of this research, also named "Local SETI", is to study the possible evidence of visitation of "exogenous probes" inside our solar system. The SETV general strategy (Stride, 2001) is devoted to the monitoring of the entire solar system, including Earth, inside an ideal sphere having a radius of 50 astronomical units. This project requires the use in the very next future of the following measurement facilities: a) space satellites equipped with specific photon detectors such as high-sensitivity infrared CCD cameras and/or sensors for the detection of ultraviolet, X-ray and Gamma-ray sources; b) ground-based observing stations equipped with high-power radars and radio telescopes and/or new generation radio interferometer arrays connected with multi-channel spectrum analyzers; c) ground-based observing stations equipped with wide-field and small-aperture optical photometric and astrometric telescopes used for target search and measurement of anomalous proper motions; d) ground-based observing stations equipped with large-aperture optical photometric and spectroscopic telescopes used for the search for very low-luminosity targets and for the analysis of relatively high-luminosity targets. Most importantly, these planned monitoring operations may allow researchers to search for the possible evidence of anomalous celestial objects associated with low-luminosity probes of presumably exogenous origin that are expected to show an infrared excess (Matloff, 1994) and/or transient manifestations of high-energy propulsion (Harris, 1986). This possible detection includes huge space arks, which, if really existent, are presumably located, according to predictions, on energetically favorable zones such as the Earth-Moon libration points

(Valdes and Freitas, 1983) and the asteroid belt (Papagiannis, 1983). A high-resolution monitor of the Moon (Arkhipov, 1998) and radar scanning of the lunar and terrestrial circum-planetary space is planned as well.

4.3. MONITORING EARTH

Even if it is unanimously recognized that at present no scientific proofs of extraterrestrial visitation exist (Teodorani, 2004; Tipler, 1980), the SETV project considers also the possibility to monitor some crucial areas of Earth using appropriate instrumentation (Teodorani, 2000; Stride, 2001). The presence on Earth of explorative devices of possible exogenous origin would appear necessarily like an anomaly in our atmosphere. Such an anomaly might be possibly reported in the form of luminous phenomena in the skies of some areas of Earth, both as a transient occurrence and as a spatial and temporal recurrence. If the visiting spacecrafts or automatic probes come from civilizations that are highly more advanced than ours the anomaly that they would be able to create in our atmosphere might be of a nature that cannot be predicted at all. What presumably comes from a highly evolved science, possibly possessed by a civilization that could have earned one million of years of advantage in comparison to us, might appear like “magic” even to the eyes of our present science. An exogenous probe might not be necessarily something “mechanical” as we expect from our technology, but something much more exotic. Therefore, even if we are not in a condition to extrapolate the future point of a super-civilization starting from ours, we can maybe speculate on what we could see. For instance, we cannot exclude the possibility that such a master civilization is able to instruct a “plasma ball” to acquire the functions of an “intelligent probe” based on a particle neural network that is planned to work both as a multi-sensing device and as a computer. After all, our own technology, which substantially was born only two centuries ago, is starting already now to plan a new generation of computers based both on the DNA and on quantum mechanics and it is already starting to use the very sophisticated science of nano-technology.

On the basis of the working hypothesis that ET is able to visit Earth too, in the next future we plan to employ a network of instrumented and possibly automatic sensing stations in specific areas of Earth where anomalous atmospheric events are reported very often (Teodorani, 2003). Instruments such as small automated telescopes of both photometric and spectroscopic kind connected with high quantum-efficiency CCD detectors, photometric radiometers, high-resolution optical spectrographs, sensors operating in the near infrared and near ultraviolet wavelength windows, detectors of high-energy events, radio spectrum analyzers operating both in the ultra-low frequencies (ELF-ULF) and in the microwaves (UHF), magnetometers, radars for searching and tracking any suspect target, electrostatic detectors, and gravimeters, are intended to be used as a complete instrumentation able to monitor a presumably multi-wavelength phenomenon. A pilot project is already operational (Teodorani, 2000, 2004), even if the search for ET visitation is only a corollary of a bigger research project aimed at studying the physics of anomalous light phenomena in general. In the ambit of the current investigation at present only simple and basic sensors are used. In particular, low-resolution spectrographs are employed in areas of recurrence of anomalous light

phenomena. In such a way it has been already possible to exclude an alien origin in most of the investigated cases and to confirm a terrestrial origin of light phenomena both in terms of new aeronautic technology and in terms of poorly known geophysical and atmospheric phenomena (Teodorani, 2004). Projects of mathematical and cryptographic character to decode possible intentional and/or unintentional intelligent signatures coming from atmospheric and/or geophysical light sources of plasma-like kind that do not show any apparent technological behavior but that cannot be identified as a known natural phenomenon are being prepared too.

We are now in a condition to ascertain (Condon, 1969; Sturrock, 1999; Teodorani, 2004) that most of the anomalies on Earth's atmosphere are caused by natural phenomena similar to ball lightning, by the recent products of our aerospace technology and by the misidentification of known celestial and atmospheric natural phenomena. But some residual does remain, and we do not know yet where and how it comes from and what is the physical mechanism producing the related emission of radiation, but we do know that our present physical science and sensor technology might furnish the answer to the specific anomalies that might be crucial for the search for extraterrestrial intelligence, and maybe open new chapters of the book of physics. If our science will not take the control of the situation investigating anomalies in general and systematically, humanity will run the risk to fall into the a-critical and dogmatic style of thought that some "ufology" and pseudo science seem to diffuse everywhere right now. Therefore a clear and rational style of thought should be applied to any aspect of the physically observable reality, especially when the occurrence of some apparently anomalous reality is almost predictable due to the recurrence of strange light phenomena in very specific and recognizable laboratory areas present on our planet.

5. References

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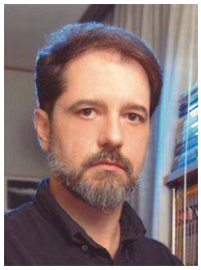

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