Hipparchos

The Hellenic Astronomical Society Newsletter

Hellenic Astronomical Society

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Message from the President

Recently, I have been wondering if there are any limits to scientific exploration. Will science ever reach a stalemate? Expanding Carl Popper's definition ("a scientific theory should live dangerously"), I would like to propose that science should have three aims, when dealing with a phenomenon: Comprehension, Exploration and Prediction. Comprehension implies a de-mystification of the part of the natural world to which the phenomenon belongs. Explanation goes further: it reveals the mechanism by which the phenomenon occurs. Prediction goes even further: assuming the phenomenon is well organised and given a set of initial conditions, it tells us what will happen in the future.

It must be pointed out that science itself has its roots and origins outside its own rational realm of thinking. Somehow, science seems to be restricted by a Gödel-like theorem ("a system of axioms can never be based on itself". In order to prove consistency, statements from outside the system must be used). In a similar manner the activities of science are necessarily embedded in a much wider range of human experience.

Science and technology comprise some of the most powerful tools for deeper insight and for solving the problems we face. However, often, when a bright insight crosses our mind, it sheds such glaring light on some aspects of our life, that all the rest are pushed into greater darkness. Some of the darkest sides of science, indeed, were created by thoughtless application of these very tools, such as the pollution of our environment and the proliferation of mass-destruction weapons.

The recent terrorist attacks in the United States have led us into a new era of uncertainty, where survival may dictate new ways of life, including new methods of city planning and new relations to our fellow men. Most of all, the imminent danger of nuclear or (even worse) biological catastrophes has become closer. Will scientific exploration ever reach a limit dictated by our basic instincts and the wider realm of human experience? Will we ever realize that our own happiness and existence depends on those of our fellow beings, many of which, at the moment, are not having a life worth living? Unless science manages to unite the world and smooth the differences between the poor and the rich, the black and white, the social and religious variants, then, indeed, one day, it may reach a limit, when it is realized that it is not the only avenue towards reality. Prediction, being the most controversial aspect of science, will be limited first, followed by Explanation and then by Comprehension.

The President of Hel.A.S.
J.H. Seiradakis

Inside this issue:

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Hellenic Astronomical Society

1. New Agreement between ESA and the Greek Government – Space Science ousted?

Last January the Greek Government signed in Athens the cooperation Agreement with ESA, which was ratified by the Greek parliament last October. In an attempt to inform the Greek interest groups of the aims, structure and management of ESA programs, the General Secretariat of Research & Technology (GSRT), in co-operation with ESA organized, last March, a workshop, where representatives of research establishments, Universities and industry were invited and asked to put forward their views. Different panels and round tables were organized, views were exchanged and recommendations were put forward. In the case of the “Space Science” round table the main recommendation of the panel, in which Greek scientists and the ESA representative, Dr. H. Olthof, participated was that Greece should participate in the PRODEX Program. This program would enable the Greek Space Science community to take advantage of ESA’s main activity, which is Space Science. To our surprise, GSRT chose to participate only in 3 ESA programs (*ARTES* related to telecommunications, *Earth Observations* and *General Support Technology-GSTP*), non of which is directly related to the main ESA scope, ie, the advancement of Space Science. Furthermore, GSRT is establishing committees, which will be responsible for carving the Space-related policies of Greece. In none has there been an invitation for the participation of astrophysicists or space scientists, even though quite a few are members of the scientific panels responsible for the preparation of some of ESA’s space missions (eg. E. Sarris in the *Cluster* project, I. Georgantopoulos in the *XEUS* project, I. Daglis in the *BepiColombo* project). These decisions seem to indicate that GSRT is completely ignoring what is the main scope of ESA, ie., the exploration of Space. Indeed the only obligatory programs for ESA full-member states is the Space Science programs.

2. New Members of the Greek National Committee for Astronomy

Last August the Minister of Development appointed new members to the Greek National Committee for Astronomy. See the relevant article in page 10 and check the GNCA web-page: www.astro.noa.gr/gnca/

3. New Director of the Institute of Astronomy & Astrophysics of the N.O.A.

The newly elected director of the Institute of Astronomy and Astrophysics of the National Observatory of Athens, Professor Christos Goudis from the University of Patras, took office in late July 2001.

4. New Members of Hel.A.S.

18 new members of Hel.A.S. were elected during the General Assembly of our Society, which took place on September 21, 2001. The new Ordinary Members are:

- Dr. Alexandros Georgakilas (California Institute of Technology, USA)
- Dr. Konstantinos Dimopoulos (University of Valenzia, Spain)
- Dr. Spiros Kanavos (University of Patras)
- Dr. Pantelis Papadopoulos (ESA, The Nederlands)
- Dr. Zacharias Protogeros (ICS-FORTH)
- Dr. Christos Tsagas (University of Portsmouth, UK)
- Dr. Athanassios Geranios (University of Athens)
- Dr. Iosif Papadakis (ITE)
- Dr. Athanassios Katsigiannis (Queen's University, UK)

The Junior Members are:

- Nikiforos Georgiadis (University Athens)
- Ioannis Giannikakis (University Athens)
- Angelos Missiriotis (Observatory of Marseille, France)
- Sotirios Tsantilas (University of Athens)
- Olga Malandraki (National Observatory of Athens)
- Christos Papadimitriou (N.O.A.)
- Evagelia Liratzi (University of Athens)
- Emmanouil Rovilos (Jodrell Bank, UK)
- Omiros Giannakis (N.O.A.)

The following Junior members moved to the Ordinary status, having fulfilled the requirements described in the constitution:

Dr. Spyros Basilakos, Imperial College, UK
Dr. Emmanuel Bratsolis, Ecole Nationale Superieure de Telecommunications, France
Dr. Manolis Georgoulis, Johns Hopkins University, USA
Dr. Dimitrios Gouliermis, University of Bonn, Germany
Dr. Evanthia Hatziminaoglou, ESO, Germany

Finally the General Assembly changed the status of our Junior member, Mr. Emmanouil Lazaridis, to Associate member.

Presently our Society has 238 members (189 Ordinary, 44 Junior and 5 Associate members).

5. The Next Hellenic Astronomical Conference

The general assembly of HelAS, during the 5th Hellenic Astronomical Conference in Fodele-Crete, decided that the 6th Hellenic Astronomical Conference will be organized by the Institute of Astronomy & Astrophysics of the National Observatory of Athens. It will be held in September 2003, probably in Athens.

6. HelAS Prizes for the Best PhD

During the 5th Hellenic Astronomical Conference, the awards for the "Best PhD in Astronomy among the junior members of HEL.A.S." for the years 1999 and 2000 were presented, respectively, to Drs E. Xilouris (University of Crete) and S. Basilakos (Imperial College). Dr. Xilouris gave a talk on "*Dust lanes in*

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Review Article: Of Pulsars, their Winds, their Nebulae and Gamma-Rays

by Demos Kazanas, GSFC,USA

The issue of the structure of pulsar magnetospheres and the associated magneto-hydrodynamic (MHD) winds has remained open since their discovery, mainly because of our inability to construct solutions which would cross smoothly the Light Cylinder and would, thereby, connect the near and far field geometries. A recent solution has achieved precisely that, indicating that the resulting far field geometry is that of a magnetic (split) monopole. It was also shown that the same geometry can, in addition, resolve the issue of conversion of magnetic to particle energy in the associated MHD winds.

It is well accepted now that pulsars are rotating neutron stars with magnetic fields B ~ 10^{12} Gauss, which are responsible for their pulsed emission (from radio to gamma rays) and also their slow-down through the action of electromagnetic torques. The text-book pulsar picture is thus that of a neutron star with a magnetic dipole perpendicular to (or simply tilted) with respect to its rotation axis by an angle θ, and must therefore emit magnetic dipole radiation of frequency equal to that of the pulsar's rotation frequency. The energy lost in this emission comes from the rotational energy of the neutron star which is found to slow down. In many instances nebular emission of varying extent is found surrounding the pulsar, powered presumably by its slow-down power. The most notable such case is the Crab nebula whose expansion and radiation emission are thought to be driven by the rotating pulsar at its center.

While in this text book picture the pulsar is considered surrounded by vacuum, this is far from being a realistic case. A rotating magnetic dipole induces electric fields that neutralize themselves by pulling charges from the neutron star. These charges (a plasma) fill the space surrounding the neutron star making up a magnetosphere. The charge density necessary to cancel the component of the induced electric field that is parallel to the magnetic field is proportional to the pulsar rotation frequency and magnetic field and it is known as the Goldreich-Julian density (*Goldreich, P. and Julian, W. H. 1969, ApJ, 157, 869*). The presence of plasma in the pulsar magnetosphere changes completely its dynamics. The plasma (electrons and positrons) behaves like fluid (a magneto-hydrodynamic or MHD fluid), with the charges flowing along the magnetic field lines, just like "beads on a moving wire". Near the pulsar, this fluid co-rotates with it; however, at a distance R_{LC} (called the "Light Cylinder") such that $2\pi R_{LC} > P c$ (P is the pulsar period), the inertial forces acting on the plasma become so strong that the magnetic dipole lines which reach this radius cannot remain closed. They open-up allowing the plasma to flow out in the form of an MHD wind which carries away the pulsar slow-down energy and uses it to power the expansion and radiation of the supernova remnant This MHD wind, driven entirely by the pulsar rotation, is supposed to also be relativistic, with the electrons (and positrons) that make up the wind, acquiring Lorentz factors γ_e~ 10^6 values necessary to account for the observed high energy gamma rays from these objects.

The presence of the magnetospheric plasma can change qualitative the torques acting on the pulsar and hence its slow-down rate. Thus, while *in vacuo* the pulsar slow-down power is proportional to $\sin^2\theta$ (the angle between the magnetic and rotation axes) and must therefore go to zero for an aligned rotator, it is not so for a charged-filled magnetosphere: One can easily show that the expression giving the slow-down of an aligned rotator in the case of a pulsar with a plasma filled magnetosphere is the same as that of a perpendicular vacuum rotator, i.e. the standard dipole formula with $\sin^2\theta$ =1. This is comforting because there is observational evidence arguing in favor of an aligned rotator being the geometry appropriate to the Crab pulsar and a reduced (or zero) slow-down power would be in disagreement with observation.

The entirely electromagnetic character of the pulsar MHD winds suggests that, at least for the simplified case an aligned rotator, an exact solution of its geometry should be reasonably easy to obtain (electromagnetism is supposed to be a well understood theory). Such a solution would also be quite useful because it would fix the configuration within which the pulsar emission operates and would likely help understand its effects on the dynamics of the overlying supernova remnant. However, despite expectations, the problem of the detailed determination of the structure of the axisymmetric pulsar magnetosphere has eluded solution for over 30 years. The basic difficulty to the problem was the existence of the "Light Cylinder", i.e. the (mathematical) surface at which the velocity of a particle rotating with the pulsar (this is what the plasma near the pulsar does) would be the speed of light. This surface presents a severe mathematical singularity in the equation that determines the poloidal geometry of the magnetic field (the Grad-Safranov equation). Attempts to obtain a complete solution to this equation by many researchers over the past 30 years were proven unsuccessful. Solutions interior or exterior to the light cylinder were indeed found through the use various simplifying assumptions concerning the current distribution on the Light Cylinder; however the equations resisted attempts at solutions that would extend across this surface. Such solutions are extremely important in matching the asymptotic geometry and properties of the MHD wind to those of the pulsar; in their absence one cannot relate convincingly the geometry and dynamics of the nebula and its non-thermal radiation to those of the slowing-down pulsar.

The inability to produce such a solution led to the conjecture that it does not exit and that the MHD wind must become dissipative past the light cylinder, i.e. a great deal of the pulsar energy can be converted into radiation there. However, a solution with the required properties has been recently found by Contopoulos, Ka

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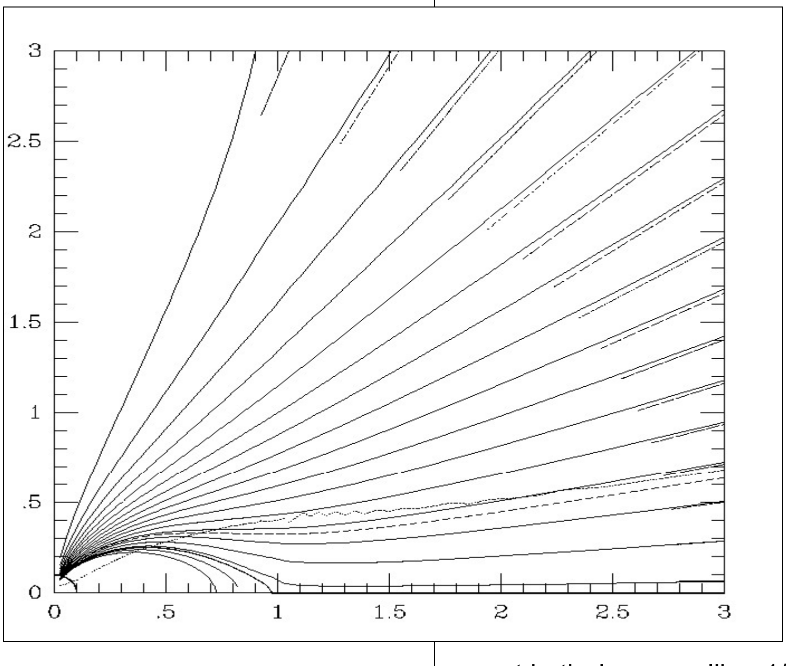
zanas and Fendt (*1999, ApJ, 511, 351).*

The fundamental point behind this solution was the realization by J.Contopoulos that the light cylinder represents a surface at which two different boundary value problems meet: these are the problems of the magnetic field structure interior and exterior to the light cylinder. Each problem is, in principle, independent of the other and it is effectively determined by the distribution of electric current on this boundary, with the two distributions being generally different. Iterating between these two distributions, J.Contopoulos was able to determine a unique current distribution on the light cylinder which satisfied simultaneously both the interior and the exterior problems. This "correct" current distribution produced, then, the (unique) geometry of the magnetic field across the light cylinder with no "kinks" in the field structure.

The solution of the corresponding magnetosphere is shown in figure 1, which exhibits the corresponding magnetic field geometry in the poloidal plane. The lines originating at latitudes smaller than that of the thick line do not cross the light cylinder. They remain closed and the plasma there co-rotates with the pulsar. Lines originating at larger latitudes cross the light cylinder and have to open-up to form the structure shown in the figure. The region between the last closed field line and the pole is known as the "polar cap". Charges which happen to "thread" these lines cannot remain static but must flow out along the lines "like beads on a rotating wire" under the action of the rotating pulsar, carrying in effect "the wire" (i.e. the magnetic field lines) with them to form the pulsar MHD wind.

The construction of such a solution is a fundamental achievement in understanding the geometry and the physics of pulsar magnetospheres. In the words of V. Beskin of Ioffe Institute, it "was one of the most important (papers) within the last decade". Besides exhibiting that such solutions exist, it provided at the same time the asymptotic structure of the pulsar winds: These winds become asymptotically (that is for radii a few times the light cylinder radius) monopolar, i.e. almost radial in the poloidal plane (i.e. the poloidal field drops like $1/r^2$, while there exists also a toroidal component to the magnetic field due to the rotation of the pulsar, which asymptotically drops like $1/r$). At the same time they indicate that nothing special happens near the light cylinder. This surface, while very hard to treat mathematically, seems to present no apparent physical significance. The electrons of the magnetosphere cross it without any problem: The magnetic field lines bend in the azimouthal direction and slide along the particles so that their velocity in the azimouthal direction remains always smaller than that of light.



On the contrary, one expects physically interesting effects along the "dotted" line in the figure. This line separates regions of positive and negative charges in the magnetosphere. Charges of different sign are needed to cancel the corresponding different values of the electric field induced by the rotating dipole. One should note that this "dotted" line crosses open field lines. That means that while overall, say, negative charges flow along an open field line interior to the dotted line, they should convert to positive across this line. This can only happen if a charge source exists there. The most obvious such source is pair production by electrons accelerated in the strong, induced electric field. Along with the production of pairs one expects in addition the production of similar energy (MeV) photons. Indeed, pulsars are known to be emitters of gamma-rays of similar or larger (100 MeV) energies.

Besides the structure of the wind in the vicinity of the pulsar, the energy and momentum carried by this wind can affect, in addition, the dynamics and radiation emission of the supernova remnant into which the pulsar resides. This effect is most prominent in the best studied such remnant, namely the Crab Nebula. It is well known that the expansion of the Crab Nebula is powered by the pulsar MHD wind, while, in addition, the nebula is the source of very broad band emission, extending from radio to TeV energies, a fact implying the presence of electrons with Lorentz factor $\gamma_e \sim 10^6$. Instrumental for the efficient production of the observed TeV gamma-rays is the randomization of the energy of the the MHD wind, which is presumably relativistic with Lorentz factor similar to that of the electrons. The randomization of the wind's kinetic energy takes place at a shock, located at R ~ 10^{17} cm from the pulsar. The existence of this shock suggests that the flow at these distances is dominated by the particles rather than the magnetic field. This, however, raises the following problem: For the (almost) monopolar MHD wind of the Crab (and likely other pulsars), implied by the solution of Contopoulos, Kazanas & Fendt, the particle ram pressure and the magnetic field energy density must both decrease like $1/r^2$ ($rv^2 \sim 1/r^2 \sim B_f^2/8\pi$); therefore their ratio, $\sigma = B_f^2/8\pi r v^2$, which determines the

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PROGRESS REPORT ON THE 2.3m ARISTARCHOS TELESCOPE PROJECT

Since the last HIPPARCHOS article (page 5 of 9th issue, 3rd Year), the 2.3m *Aristarchos* telescope and building are taking shape! NOA has performed three inspections (19-20 April, 12-13 June and 24-27 September 2001) in order to monitor the progress and provide engineering feedback at CARL ZEISS Jena. The telescope was demonstrated to move under computer control for the first time. Engineering tests have started and first results of the azimuth movement were presented to NOA for assessment. The primary (seen below) and secondary mirror mounts are in their final stages for integration with the telescope. In September, the newly-elected Director of the Institute, Prof. C. Goudis, had his first visit to the factory.

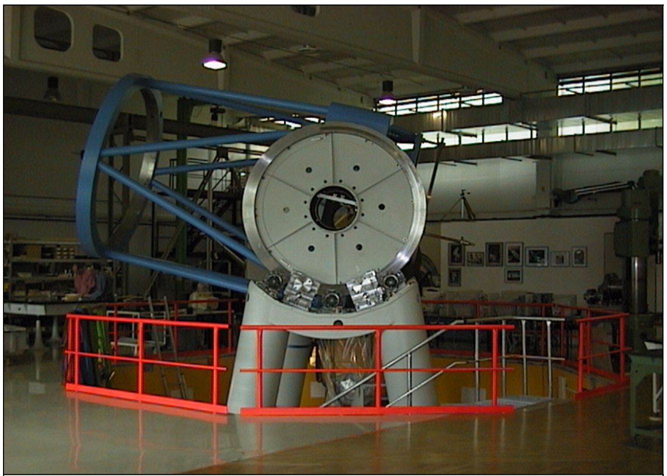

***Figure 1:* The assembly of the *Aristarchos* telescope at the factory:** The image shows the telescope under mechanical assembly during the September 2001 inspection, by Christos Goudis, Emilios Harlaftis, Martin Fisher and Sue Worswick. The telescope moved under computer control.

***Figure 2*:** Christos Goudis, Emilios Harlaftis, Martin Fisher and Sue Worswick (from left to right) during the September 2001 inspection in Jena.

The study for matching the visiting instrument ULTRACAM (an ultra-fast triple-beam CCD camera) on *Aristarchos* finished in June 2001 (optical design, mechanical design and specification of cables). The optical collimator is under manufacture and the cables were sent to the factory for integration with the telescope. The instrument will be commissioned at the 4.2m WHT, La Palma in summer 2002 and then it will be shipped to Greece in autumn 2002.

Regarding international collaborations, the interests of *Aristarchos* in the OPTICON working group of middle-size telescopes were represented by E. Harlaftis at the Almeria, Spain meeting (15-17 March) and by C. Goudis and E. Harlaftis at the Toulouse meeting (21-22 September, France). The telescope has been included in the government protocol for Research and Technology cooperation between the countries of Greece and Slovakia.

Emilios Harlaftis
Principal Investigator for telescope contract with Zeiss

The Telescope Building at Chelmos

The contract for the telescope building and peripheral buildings was awarded to the company PROTER (Heraklion) who made the best and most professional offer. PROTER has also built the Skinakas observatory building and have been partially involved with the construction of the University of Crete. The contractor was selected by a joint NOA-GSRT committee among 4 companies (in total 9 companies expressed interest-of-intent). Excavation started on July 9th and the main structure of the building was finished by the end of September. All the necessary equipment for the site infrastructure have been purchased and is currently under delivery, or installation and testing (microwave link, generators, meteo station, computers).

Figure 3: The construction site at the top of mount Chelmos. The photograph in the left was taken on July 30th, while that in right on August 27th.

Panajiotis Hantzios,
Principal Investigator for telescope building and related equipment

EDITOR'S COMMENT

The recent evaluation of the state research Institutes by international committees of experts has once more brought up the issue of the quality assessment of research. It is necessary, for the advancement of science but also in order to make the tax-payers money worth their value, the continuous assessment of the research produced in Institutes and Universities. The state has already initiated such a procedure for the state controlled Institutes. In the case of Universities, where such an evaluation has been partially initiated (eg. Department of Physics at the Universities of Thessaloniki and Crete), one should always take into account their very important mission of teaching and training students. But again, research and teaching are strongly interlinked and one cannot effectively train the young generation without being in the research forefront. Most Astronomy & Astrophysics Sections should welcome such evaluation since the quality and quantity of the research they produce is high, and in some occasions exceptional. Below, I present the number of refereed publications per staff member per indicated period of the various Greek University Sections and institutes. The results are based on the following criteria:

1. The Science Citation Index was used. Therefore journals not listed in this system obviously have not been accounted for.
2. Only refereed journals with Impact Factor greater than 1 were used. Although this limit is rather arbitrary, it is necessary to set a lower limit in order to ensure the quality of research.
3. The recent moves of a few colleagues were not taken into account (eg. Professor Tsinganos was counted with the University of Crete, Professor Voglis with the University of Athens, Dr. Rovithis was counted with the IAA-NOA).
4. Publications only for two recent periods of 2 years each were used (2000-2001 & 1998-1999).
5. Publications that have more than one co-author from the same institute count once in the calculation of the mean.

The results are tabulated in the following table:

	2000-2001	**1998-1999**
Univ. of Athens	1.80	1.35
Athens Academy	1.67	1.33
IAA-Athens Observatory	4.57	4.14
Univ. of Thessaloniki	3.45	3.00
Univ. of Ioannina	3.25	3.00
Univ. of Crete	4.50	2.83

The first thing to notice is that there is an increase of the publication rate in all the institutions. This is a very positive result which indicates an active and healthy research community. Note, however, that small fluctuations between the two periods are not necessarily significant and could be expected purely due to small number statistics. For example Poissonian uncertainty in the case of IAA is 0.8 and thus the increase of 0.4 is not significant. On the other hand the increase of 1.7 in the case of the University of Crete is quite significant since the Poissonian uncertainty in this case is ~0.86 and for the University of Athens case, the increase of 0.45 is marginally significant since the its Poissonian error is 0.3.

The previous discussion is not meant to be a judgment of the quality of the University Sections and research Institutes, since for such a task many other factors, beyond the number of refereed publications, should be taken into account. For example the quality of the teaching and training effort that takes place in University Astronomy & Astrophysics Sections, the number of citations per publication, etc. However, it does mean to open a discussion and to activate our sensitivities on important issues that will help Greek Astrophysics carve a modern path and establish itself as an equal partner in the European and International setting.

Exploring the Web with Hipparchos

http://www.lmsal.com/~aschwand/lit.html:

A very well organized, useful and currently update database of solar physics literature is maintained by a well known to the solar physics community scientist, Dr. Markus Aschwanden. The database provides the complete reference of publications related to solar physics and in some categories goes back as to 1964. Markus who is an Astrophysicist at the Lockheed Martin, Advanced Technology Center, Solar & Astrophysics Laboratory at Palo Alto has organized the database in the following categories: Solar Phenomena (Solar Flares, CMEs, Sunspots etc), Physical Processes (Particle acceleration, MHD, Reconnection etc), Solar Observations by Wavelengths (Optical, Radio, X-rays etc), Solar Observations by Missions (TRACE, Yohkoh, SOHO etc), Data Analysis Methods (Time series and Wavelet Analysis, Numerical Simulations etc). There is also a general category containing Textbooks, Reviews, Proceedings and PhD Thesis.

A.Anastasiadis (anastasi@space.noa.gr)
ISARS, National Observatory of Athens

ONE YEAR OF CONTINUOUS OPERATION OF ATHENS DIGISONDE IN THE NATIONAL OBSERVATORY OF ATHENS

The Ionospheric Physics Group of the Institute for Space Applications and Remote Sensing (SARS/NOA) installed and operates since September 2000 an advanced digital high frequency Doppler radar system, for probing the Earth's ionosphere from the E region to the peak of the F2 layer. The station is a Digisonde Portable Sounder with 4 receivers (DPS-4), capable of providing real-time on-site processing and analysis of the ionospheric measurements to characterize radio signal propagation conditions for communications or surveillance operations. The DPS-4 supports four different modes of operation, scanning, high resolution - Doppler, drift and oblique ionograms. The system consists of a low power transmitter (300W) with two crossed-delta transmission antennas built on a 30m tower and four crossed-dipole receiving antennas. Polarisation switching and multibeam forming are applied for successful autoscale under disturbed and undisturbed conditions. The system performs regular vertical soundings usually every 15 minutes in routine mode. The highest possible resolution that can be achieved for vertical sounding operation is 2 min. The ionograms with the results of the automatic scaling are available on the Internet in real

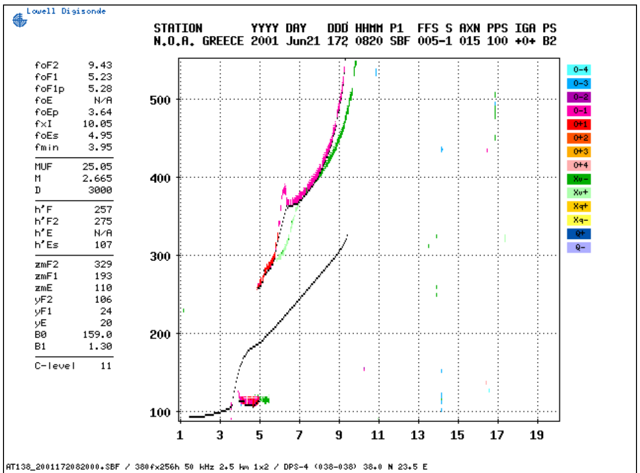

Figure 1: A vertical sounding ionogram as appears on the Internet in real-time. In this case the F1 and F2 ionospheric layers can be clearly defined. A sporadic Es layer is also formed at 120km height.

time (http://www.iono.noa.gr). An innovative feature of Athens Digisonde is the application of a new technique for calculating the vertical total electron content (TEC) from ground-based ionograms of vertical incidence. The ionogram provides the information to directly calculate the vertical electron density profile up to the peak of the F2 layer. The profile above the peak is approximated by an α-Chapman function with a scale height that is derived from the profile shape at the F2 peak. The ionosonde TEC is then calculated as an integral from 0 to ∞ over the entire profile. Real-time measurements for nowcasting, forecasting and warning purposes are available through the web-based facilities installed to support the DPS-4 operation:

- HF communication frequencies in real-time (http://www.iono.noa.gr)
- Near real-time TEC estimates up to 1000 km
- Automatic transfer of all data files produced after each sounding to Rutherford Appleton Laboratory World Data Center, WDC C2 for archiving and distribution to the scientific community.
- On-line generation of time plots and ASCII files of the most important ionospheric parameters available through the SAO Explorer Data Base (http://www.iono.noa.gr/data_retrival.htm).

The scientific and operational benefits from the use of these ionospheric observations include membership in the European Network of Ionospheric Stations for real-time mapping of the Earth's ionosphere and the significant improvement in the forecasting of the ionospheric space weather over the Southern Europe and the east part of the Mediterranean Sea. Athens Digisonde currently participates in three international networks, providing with real-time data for scientific and operational use:

(1) Ionospheric Prediction Service, operated by the Australian Forecast Center, to provide forecast of ionospheric conditions in the European Region (see the maps of TEC and foF2 over Europe in http://www.ips.gov.au/asfc/euro_hf).

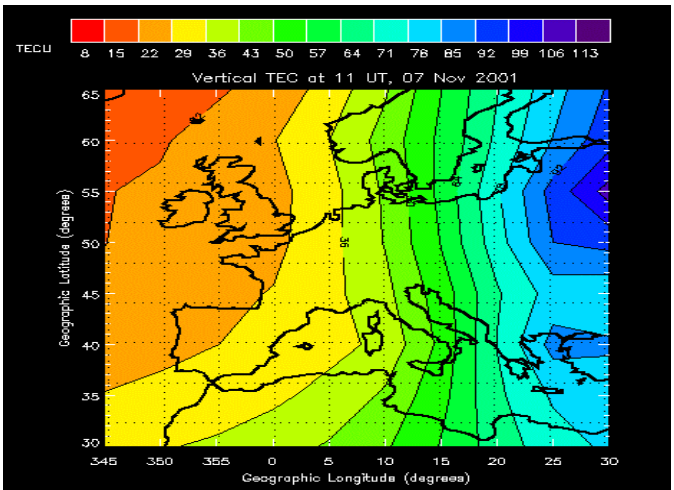

Figure 2: The near real-time ionospheric total electron content (TEC) map produced at IPS by using the IRI-90 ionospheric model with real-time foF2 data obtained from the four Digisonde stations in Greece (NOA), in Italy (INGV), in United Kingdom (RAL) and in Sweden (IRF).

(2) Cooperation with the Northwest Research Associates, Inc. for the calculation of the Effective Sunspot Number Index SSNe for space weather monitoring (http://www.nwra-az.com/spawx/foF2/foF2_Athe.html)
(3) Cooperation with the Institute of Terrestrial Magnetism, Ionosphere and Radio Wave Propagation

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WHY GREECE SHOULD JOIN ESO

In many developing countries the significant investment in education is not bearing the desired fruits. This is closely associated with the fact that participation in advanced science functions efficiently in the industrialized world only. Consequently, investment in education often results only in the creation of a consumer market, while a professional, intellectually identifiable and academically oriented cadre of scientists is necessary for sustainable development. It is clear that there exists a strong need for a fruitful interplay between the academic and the commercial sector, which should not be the only driving force.

Greece is currently enjoying unprecedented economic growth. The big challenge for Greece is to sustain this growth by increasing expenditure, both by government and by industry, on R&D. Greece is a small economy on the EU scale and one cannot expect it to become world leader in research. On the other hand, Greeks have already demonstrated that they can develop expertise in a number of key areas. In the global research market of today, it is unlikely that we will achieve anything in isolation, so we see our membership in international research organizations as crucial to the policy of growing our R&D base.

The Greek domestic research effort is one of the weakest in Europe: the Gross Expenditure for R&D in Greece is estimated to be less than 0,5% of the GNP. The technological development is further hampered by the small contribution of business firms to the domestic gross expenditure: ~25% of the total amount comes from business expenditure. This is due to the strategic orientation of the firms, their size and their capital structure. Consequently, the public research institutes are isolated from their socio-economic environment, making the linkage between academia and the productive sector more difficult than elsewhere in Europe.

The European Southern Observatory, ESO, is a world leading research center, which successfully competes with USA and Japan. These two countries, with tradition in high tech, are willing to collaborate with ESO for new projects. ESO' s main mission, laid down in the 1962 convention, is to provide state-of-the-art research facilities to European astronomers and astrophysicists, allowing them to conduct front-line science in the best conditions. Whilst La Silla remains one of the scientifically most productive observatories in the world, the most prominent new facility is the Very Large Telescope Array (VLT) at the Paranal Observatory. The implementation of the VLT interferometer (VLTI) will enhance the capabilities of this unique facility even further.

At the beginning of the 3rd millennium, European astronomy is facing a future full of challenges and opportunities. Among the new projects is the Atacama Large Millimeter Array (ALMA), based on intercontinental collaboration. In fact, the ALMA may develop into the first true "world facility" in astronomy. Another project is the 100-m class "Overwhelmingly Large Telescope" (OWL).

ESO is an intergovernmental organization supported by Belgium, Denmark, France, Germany, Italy, the Netherlands, Sweden, Switzerland and Portugal (which joined ESO in 2001) while several other countries (most notably the UK) have expressed a strong interest in joining ESO as well.

The case of Portugal is particularly interesting, since this country has many similarities with Greece. In 1990 Portugal and ESO signed a Co-operation Agreement, which allowed Portuguese astronomers access to ESO facilities. At that time, there was only a handful of professional Portuguese astronomers. An Advisory Body was set up to monitor the development of Portuguese astronomy and its interaction with ESO. Over the years, an increasing number of measures to strengthen the Portuguese astronomy were funded. Now, ten years later, the Portuguese astronomical community has increased many-fold and is the youngest in Europe. The access to ESO facilities has proven to be a great incentive to the Portuguese scientists.

The case of UK is different. Initially, UK decided not to participate in the establishment of ESO because it had its own facilities in the Southern Hemisphere. But now ESO has developed into a major astronomical organization, so joining ESO was considered a top priority for UK astronomy in the recent Long Term Science Review. Under current proposals, the UK will become a member of ESO in 2002, at a cost of £12M per year plus a joining fee of around £70M to be paid within the next 10-15 years.

Greece must pursue the path to join ESO in order to develop observational and instrumental astronomy at an international level and broaden the training of students and post-doctoral researchers.

At present, the key element in an overall strategy for modernizing Greek astronomy is the installation of the new 2.3m *Aristarchos* telescope, planned in 1997. The new telescope, at a competitive site like Chelmos, should be the proper vehicle for developing both observing and instrumental skills that will enable Greek astronomers to take full advantage of ESO membership.

A few years ago, the Greek National Committee for Astronomy (GNCA) discussed the prospect of Greece joining ESO with the General Secretariat for Research & Technology (GSRT). Their proposal met a positive attitude. Pursuing this path, the GNCA initiated a meeting at ESO in Garching, in order to discuss the prospect of Greece joining ESO. In this meeting, which took place in November 2000, the Greek side was represented by Dr. E.Kontizas, Prof. M. Kontadakis, and Prof. J.Ventura whereas ESO was represented by its Director, Dr. Catherin Cesarsky, Dr. Nobert Konig, Head of Administration and Richard West, Head of Public Relations. The importance and strength of the astronomical community in Greece particularly impressed the ESO officials. They were also impressed by our plans to strengthen astronomy in Greece, as exposed in the report: "Astronomy in

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The biannual meeting of the Hellenic Astronomical Society was held this year at the Fodele Beach Hotel, near Heraklion, in Crete, between the 20th and 22nd of September 2001.

It was hosted by the Department of Physics of the University of Crete and sponsored by the University of Crete, the Hellenic Astronomical Society, the Greek Telecommunications Company (OTE, Heraklion Branch), the Association of Greek Physicists (Heraklion Branch), the Local Union of High School Teachers (ELME), the Crete University Press, and the Municipality of Heraklion.

The scientific program was divided into eight sessions, namely "Dynamical Astronomy and Celestial Mechanics", "Solar, Planetary and Space Physics", "Stellar Astrophysics", "Our Galaxy and other galaxies", "High Energy Astrophysics", "Cosmology and Relativity", "Observational Astronomy", and "Infrastructure, History and Teaching of Astronomy".

The Conference was attended by 114 scientists and students from 13 countries. There were 61 oral presentations and 100 poster papers, which covered most of the areas of current active research in Astronomy, worldwide. Unfortunately, due to the tragic September 11 events in New York almost all our colleagues from the US were not able to participate.

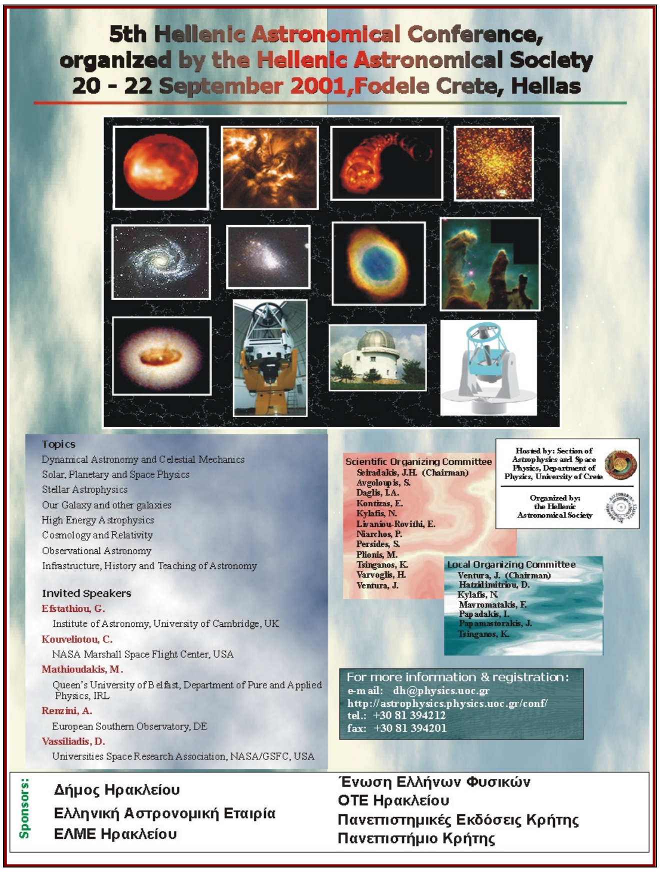
At the opening of the Conference, Prof. Christos Goudis, the newly appointed director of the Institute of Astronomy & Astrophysics of the National Observatory of Athens reviewed the current status of the 2.3m *Aristarchos* Telescope.

The invited discourses and main session presentations delineated the recent highlights in a large range of subjects from solar physics to cosmology. The invited speakers and the title of their talks are shown in the table. The main session speakers were S. Antiochos of the Naval Research Laboratory, Washington DC, whose talk was about the magnetic origins of coronal mass ejections and was presented by Professor K. Tsinganos, M.Blanc of the Observatoire Astronomique de Marseille, who talked about exploring Saturn's magnetosphere with Cassini-Huygens, M. Georganopoulos of the Max Planck Institute for Kernphysik who talked about high energy emission of galactic microquasars, Z. Knezevic of Belgrade Observatory, who talked about chaos in the motion of asteroids, R. Rebolo of the Instituto de Astrofisica de Canarias, who talked about brown dwarfs and isolated planetary-mass objects, R. Schilizzi of the Joint Institute for VLBI in Europe VLBI, who talked about the sharpest view of the Universe, C. Tsagas of Portsmouth University, who talked about magnetic tension and the geometry of the Universe, R. Tuffs of the Max Planck Institute for Kernphysik in Heidelberg, who talked about modelling the spectral energy distribution of galaxies and R. Wielebinski of the Max Planck Institute for Radioastronomy, who talked about the radio sky.

The special guest speaker of the conference was Dr. H. Olthoff (head of the PRODEX project, ESA) who spoke about the ESA Science Program.

The LOC of the Conference

Invited Speakers		
G. Efstathiou	Institute of Astronomy, Cambridge	*The Cosmological parameters of our Universe*
C. Kouveliotou	NASA/MSFC	Not presented
M. Mathioudakis	Queen's University of Belfast	*The solar-stellar connection*
A. Renzini	ESO	*Science with VLT*
D. Vassiliadis	Universities Space Research Association, NASA/GSFC	*Solar wind magnetosphere interaction.* (presented by the convenor of the session)



The Poster of the Conference

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Mach number of the flow (and hence the possibility of existence of a shock) ought to be independent of the distance from the pulsar (more precisely from the Light Cylinder). On the other hand, at the Light Cylinder the magnetic field pressure is known to dominate that of the particle ram pressure by many orders of magnitude, thus leading to an inconsistency of the entire picture. A way out would be a very fast acceleration of the wind near the light cylinder, but the smoothness of the magnetosphere there, implied by the new exact solution precludes such an acceleration. Consistency between model and observation, then, implies acceleration of the wind somewhere between the light cylinder and the nebular shock. The conversion of wind energy density from magnetic to particle one became known over the past years as the **σ-problem** of pulsar winds. Several attempts have been made to provide a solution to this problem, the most obvious being annihilation of the wind magnetic field. This might have been possible for a perpendicular rotator (because the field polarity would then oscillate providing at least the possibility of such a process). However, as mentioned above, at least the Crab seems to be an aligned (rather than perpendicular) rotator and, moreover, it was shown recently (*Lybarskii, Y. and Kirk, J.G. 2001, 547, 437)* that such an annihilation would not be fast enough to account for the observations.

A resolution to the σ-problem has been proposed very recently by Contopoulos & Kazanas (*2002, ApJ, in press).* This relies on the monopolar asymptotic magnetic field geometry provided in the exact solution to the axisymmetric magnetosphere. It was shown that for this exact geometry the angular momentum and energy conservation equations lead to a *linear* increase in the wind Lorentz factor, γ, to the point of equipartition, i.e. ($\rho\gamma v^2 \sim B_\phi^2/8\pi$). Therefore the value of σ must decrease linearly with the distance to $\sigma \sim 1$. Since the increase in γ is limited by the pulsar power input to the wind, some of the conditions leading to this linear increase must give-in. The authors propose that what gives-in is in fact the wind geometry which must deviate from the monopolar, conical, one appropriate for a magnetically dominated wind when $\sigma \sim 1$ to one in which the magnetic field lines collimate along the pulsar's rotation axis. Indeed, recent X-ray observations of the Crab indicate the presence of such a collimation of the associated emission at a distance consistent with that predicted by the theory. With this potential resolution to the pulsar nebula σ-problem, it appears that we are approaching to a rather precise, well constrained picture of pulsars, their MHD winds, the winds' geometry and their influence on the dynamics of the expanding nebulae and the emission of high energy radiation.

This picture covers nearly 11 orders of magnitude in radius, from the neutron star radius to the pulsar wind shock and collimation and twenty decades in frequency from radio to TeV gamma-rays.

THE NATIONAL COMMITTEE FOR ASTRONOMY (GNCA)

The Greek National Committee for Astronomy (GNCA) is the official advisory panel for advising the government on all matters relevant to Astronomy and Astrophysics and representing Greece to international astronomical organisations. Furthermore, the Committee is responsible for co-ordinating and promoting various astronomical activities in Greece, including research and education.

The Committee is nominated by the General Secretariat for Research and Technology (GSRT) for a period of two years.

In August 2001 the, then, Minister of Development, N. Christodoulakis, appointed the members of the Committee to serve for the period 2001 – 2003. Since then, two members resigned and one new member was appointed. The current members of GNCA are: J. H. Seiradakis (University of Thessaloniki – Chairman), S. Katsanevas (University Claude Bernard Lyon-1), E. Kontizas (National Observatory of Athens), E. Harlaftis (National Observatory of Athens), E. Plionis (National Observatory of Athens) and D. Hatzidimitriou (University of Crete).

Among the current tasks of the Committee is to ensure a smooth fulfilment of Greece's commitments to international astronomical organizations. In particular, the payments of our dues to the *International Astronomical Union* and the organization of *Astronomy & Astrophysics* have been approved. This means that Greek astronomers will continue enjoying free of page-charges, publications in the European journal *Astronomy & Astrophysics*. It is worth mentioning that the page charges to the journal amount to 100 US$ per page.

One of the most difficult tasks that GNCA is facing at the moment concerns the role that Greek astronomers should play in the forthcoming agreement between Greece and the European Space Agency (ESA). As you may know, a preliminary agreement has already been signed and, currently, specific ESA projects are under investigation in order to determine those that Greece and ESA will initiate their collaboration with. Of course, strong industrial interests are at stake. However, astronomy, which we believe is the driving force behind ESA's activities, should play a decisive role in any future agreement between Greece and ESA.

Several other issues have been discussed during Council meetings, the Minutes of which will, in the near future, be posted in the web page of GNCA: *http://www.astro.noa.gr/gnca*

J.H. Seiradakis
President of the GNCA

MAGNETIC COUPLING OF THE SOLAR ATMOSPHERE
EUROCONFERENCE and IAU COLLOQUIUM 188

It is well known that the Sun is an extremely diverse system. From the solar core to the outermost atmosphere (the heliopause) the particle density drops by 26 orders of magnitude! The temperature also varies by over four orders of magnitude. Thus different physical processes act in the different layers of the Sun and its atmosphere. Not only the underlying physics is different, but also the instruments and observational techniques are quite distinct. This has led to the development of separate communities that study the solar interior, its photosphere and chromosphere (lower atmosphere), the corona (upper atmosphere), and the heliosphere and solar wind. Insufficient interaction between these communities has been a hindrance to developing a global view of the Sun's atmosphere.

In recent years results from space missions have enormously advanced our understanding of the dynamical state of the solar atmosphere providing a more complete picture of the highly structured topography of the different solar layers. Indeed, current high spatial resolution observations of the Sun, from an unprecedented array of observatories located at various places around the earth (THEMIS, VTT, SVST, DOT) and in space (Yohkoh, SOHO, TRACE), are providing the solar community with startling new insights into the structure and dynamics of its surface and atmosphere. An important milestone reached from these observations is that the great variety of features and dynamic processes observed in the solar atmosphere and ultimately the existence of what, traditionally, is called the chromosphere, transition region, and corona is due to the important role of the magnetic field and its complex interplay with the highly conductive plasma, convection and differential rotation.

It is also becoming a common consensus that the transition from the photosphere to the corona is much more complex than a continuous interface between layers, but rather that these layers constitute a coupled system of mostly unresolved fine structures that extend to various heights above the photosphere and that this coupling is again due to the pervasive role of the magnetic field. A major challenge to the solar scientific community is now to combine the observational content provided by several space missions and high-resolution ground-based measurements of magnetic fields together with theoretical modelling and numerical simulations in order to improve our understanding of their emergence and evolution upward from the solar surface to the outer corona, as well as their role in the coupling, structuring and heating of the solar atmosphere, and their effects in the interplanetary medium and the Earth's environment.

The time is ripe for a conference to have a maximum impact by reviewing major scientific milestones already reached and identifying those problems remaining open for future missions. This international conference on the "Magnetic Coupling of the Solar Atmosphere" will be held on the Greek island, Santorini, on 11-15 June, 2002. The meeting is co-organised by the National Observatory of Athens (Greece) and the Max-Planck-Institut für Aeronomie (Germany) and is co-sponsored by the European Union and the IAU, as it has been granted the status of an IAU Colloquium (N^{o} 188). The aim of the conference will be to concentrate on the current knowledge about the central theme of solar physics, i.e., solar magnetism and to try to synthesize, by an integrated approach, the great collection of observations and theories in order to get a holistic picture of the solar atmosphere. Senior solar scientists in theory, observation, modelling and instrumentation, will address all the relevant scientific issues with a global oriented approach and clarify the main open questions in order to fully exploit the opportunities to be provided by the new generation spacecraft to be launched in the next few years (STEREO, SOLAR-B, SDO, Solar Orbiter), as well as the ground-based instruments (ATST, SOLIS VSM) to be installed in observatories around the world.

The topics have been chosen with the aim of maintaining a balance in the coverage of activities ranging from instrumentation and observing techniques, observations both from the ground and from space, methods for data analysis and interpretation, theoretical investigations, modelling and numerical simulations. The sessions are:

1. Magnetic fields: Instrumentation, observational techniques and models.
2. Dynamics and evolution of the magnetic fields
3. Magnetic fields and coupling through atmospheric structuring
4. Magnetic fields and coupling of the physical processes
5. Prospects and opportunities – Conclusions and closing remarks

Participants interested in attending the meeting and also in contributing a paper (oral or poster) are invited to fill in the pre-registration form and the preliminary abstract submission form not later than the end of December 2001.

Detailed information on the meeting including purpose and focus, scientific programme and invited speakers, pre-registration, T&A grant request and abstract submission forms may be found at the conference web page: **http//www.space.noa.gr/solmag**

Georgia Tsiropoula
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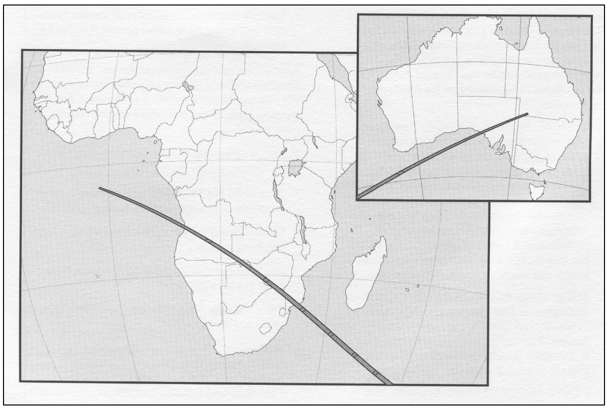
spiral galaxies" and Dr. Basilakos gave a talk on "*Cold dark matter with negative pressure*".

Members of Hel.A.S. and other colleagues (Ph.D. supervisors in particular) are encouraged to bring to the attention of the Council potential candidates for the "Best Ph.D. in Astronomy" prize for the year 2001. The prize will be awarded to an active junior member of the Society, who has successfully defended his/her Ph.D. thesis during the present calendar year. The recipient will be selected by the Council of Hel.A.S. Please note that this is an award, not a scholarship, and therefore no formal application procedure is involved.

For more information contact the Secretary of Hel.A. S., Dr. Harry Varvoglis (varvogli@astro.auth.gr).

7. The Next Total Solar Eclipse

The next total Solar eclipse will take place on Wednesday, December 4th of 2002, and will be visible in a narrow corridor of the Southern Hemisphere. Moon's unmbral shadow will start from the South Atlantic at 05:50 UTC, cross southern Africa and the Indian Ocean, and end in southern Australia at 09:12 UTC, as can be seen in the figure below. The umbra will create a 50 km wide path in Angola, which will increase to 60 km were the totality will last around 1 minute. The maximum totality duration (~2 minutes) will take place in the Indian Ocean, about 2000 km away from Madagascar.



From "Total Solar Eclipse of 2002 December 04" by Espenak & Anderson, 2001

8. Annual Hel.A.S membership fees: payment using credit card

It is now possible to make payments of your Hel.A.S. membership using a VISA credit card. This should clearly facilitate our members who live and work outside Greece, as well as all members who wish to avoid the extra charges associated with money orders or wire money transfers. The new payment invoice for the year 2001 is available in PDF format and can be retrieved from the end of the web page:
http://www.astro.auth.gr/elaset/membership.html
or directly from:
http://www.astro.auth.gr/elaset/forms/dues2001.pdf.

Please note that there is a deadline by which members should pay their membership fees. For this year it has been set to October 1st. Payments are accepted in Greek drachmas or Euros.

You may contact the treasurer of Hel.A.S., Prof. Panagiotis Niarchos (Tel.+30-1-7276896, E-mail: pniarcho@cc.uoa.gr), for information on the status of your past payments or any other questions you may have on this issue.

News & Views were prepared by
Harry Varvoglis, Secretary of HelAS
Manolis Plionis, Editor of Hipparchos

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(IZMIRAN) for the study of lithospheric-ionospheric coupling effects, performing correlation studies of ionospheric and seismic real-time data.

Observations from Athens Digisonde are systematically used for the investigation of the occurrence and the nature of space weather effects in the middle latitude ionosphere. Also through the participation of the Ionospheric Physics Group of ISARS/NOA in the CHAMP satellite mission, as Co-Investigator, a systematic comparison is performed between the electron density profiles from CHAMP GPS Receiver TRSR-2 and Athens Digisonde, aiming to validate the CHAMP ionospheric products and to further develop realistic ionospheric models, to provide more accurate information to operational radio systems as satellite communication and navigation systems and to provide input parameters for space weather now and forecasting.

Anna Belehaki (belehaki@space.noa.gr)
ISARS, National Observatory of Athens

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Greece at the Gates of the 21st Century". Both delegations concluded that the step of Greece joining ESO could be very beneficial, both for ESO and for Greece. It would demonstrate the commitment of Greece to European scientific and technological development and would provide the Greek scientific community and industry with access to technologies that are recognized worldwide. It would also enable Greece to participate actively in future developments in optical and radio astronomy, such as the building of new instruments, whereas Greek astronomers and engineers would join ESO staff. As to the financial implications, the hypothetical present share of Greece in the regular contributions to the ESO budget would be about 2.3%. For a total contribution of 76M EURO (the level of the 2001 budget) this would mean about 1.7M EURO per year. In addition, a joining fee would have to be negotiated. Following traditional calculation methods, a total amount of about 10M EURO has to be paid over a certain number of years (10 or more). I would like to stress that Greece is currently paying 5.2M EURO as annual contribution to CERN, which is 3 times the expected annual contribution to ESO.

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