eas NEWSLETTER

Issue 21. June 2001

Contents

Message from the President

This Newsletter - the first of the new millennium - bears our new logo, which is more legible and better adapted for posters and letterheads. It was designed by Leigh Edwards, from ESTEC, whom I thank again for her collaboration, as well as all those of you who sent us their proposal.

This is my last message as president of our society, and I shall use this opportunity to look back on the past four years. There have been many achievements we can be proud of. Our JENAMs draw an increasing attendance, and most of their parallel sessions have now reached the level of genuine international colloquia. We owe this in great part to the dedication of the local organising committees, but also to the increasing involvement of EAS in the scientific organisation. Thanks to Mary Kontizas, the Newsletter has grown better and more eclectic, as attested by the present issue. Michel Dennefeld has shaped our Website in a precious tool, with its on-line directory, its many links and the possibility it offers for hosting forums. It is complemented by the periodic e-mailing, which is highly appreciated by most of you.

What has been less satisfactory is our membership, which stagnates at the level of about 1,500, in spite of a recruiting campaign we launched a year ago. At least these members are paying their fees, thanks to the vigorous action of our treasurer Birgitta Nordstrom, and this was not always the case in the past. The optimists may call that consolidation, but we can do better. And we should, if we want our society of increase its impact and influence.

Which brings me to the role that our society should play in the astronomical community of Europe. The goal that our constitution assigns to EAS is to promote European astronomy by all possible means. We are clearly doing that by the activities mentioned above. But our Council felt that we should be more ambitious, and that EAS should take part in the strategic planning of European astronomy, much as is done the United States.

At our meeting in 1997 in Thessaloniki, we decided to explore that possibility. Assisted by Frangoise Praderie (founding member of EAS and general secretary of Euroscience), I had many contacts, notably with ESO, with ESA, with the European Science Foundation. ESA was the most reluctant, and understandably so, since strategic planning plays an essential role in this organisation, and is accomplished in-house by its own committees. ESF found the idea quite interesting, but insisted that it should be done under its auspices. ESO was the most open to such an initiative, and was willing to support it, mainly because it could express broad support from the community for some major project(s) which needed the approval from the governments of member countries.

I could only conclude that the situation was not ripe. But let us examine how this is dealt with in the United States. The National Research Council appoints every 10 years a survey committee, to which it gives mandate for such planning, with NSF, NASA, etc. providing the necessary support. The American Astronomical Society contributes by organising forums on selected subjects, to associate more widely the community in the planning. This is a role that EAS is not only able, but most willing to play, should such a planning be launched in Europe, by one of its ruling bodies. But I hardly see how we, EAS, could take the initiative, without any mandate.

Does it mean that nothing will be done until long? I am not that pessimistic. In the meanwhile, the European Community implemented a number of Infrastructure Cooperation Networks, of which two concern us, namely OPTICON and its counterpart in radioastronomy. I consider this as a promising start of European cooperation in the domains which are not covered by our two major organisations, ESA and ESO. Our society has a representative in these ICN, who among other has the mission to make sure that astronomers of all European countries have access to these infrastructures, not only those from the member countries. This is admittedly a small step, but all of us who are sitting in the various committees which plan the future of European astronomy should act likewise as militant members of EAS: being aware that these bodies represent only part of Europe, they should foster the interests of all European astronomers.

I look forward to meet you in Munich, where our JENAM, co-organised with the Astronomische Gesellschaft from September 10 to 15, will be dedicated to the "Five days of creation".

Jean-Paul Zahn

Editorial

For the new millennium EAS is starting with new logo. The winner of the logo competition is Leigh Edwards from ESTEC, whom we congratulate and thank sincerely. The Newsletter's first page appearance has therefore changed and I hope you like it. As it is progressively evident this is no longer a Newsletter litteraly. The electronic ones are faster and more efficient to this extent. However this edition can serve as a discussion forum on certain issues each time and articles from local Societies with general interest to all (European heritage, exchange of ideas, strategy).

Under these new circumstances of highely competitive environment and fast exchange of information, I asked Cristian Boily to write an article on the existing free-of-charge Newsletters in astronomy. I believe this special report has come out very interesting and informative not only for reviewing the situation and giving relevant addresses but also for adding useful statistics and thoughts. I would very much like other colleagues' opinion on this subject.

The other general discussion we opened is the interaction of astronomy with other sciences. Chemistry and Geology and their impact with astronomy are very well presented by Monica Grady, whereas Nicholas Spyrou has written very interesting views on the environmental role of Astronomy.

The South-East branch of EAS has recently started an initiative in order to keep up astronomy alive at this part of Europe after the difficulties they face for the last 15 years or so. They already had a first meeting. Good luck! I hope more astronomers are interested in helping such initiatives with ideas and/or volunteering work.

A new feature of this issue is the presentation of new books. So three book reviews are presented here.

I remind you all, the most important activity of EAS the JENAMs. In our last page you find dates and addresses useful for all members who like to attend and seek information. I wish to EAS and our German colleagues a very successful meeting in Munich next September.

Finally I would like to let you know about the **new EAS officers.** The nomination committee headed by

P. Murdin has proposed the following new officers which are accepted to serve from next September:
For President
Prof. Harvey Butcher, Netherlands (radio astronomy)
For Council members
Prof. Cesare Chiosi, Italy, (stellar evolution)
Dr. Michel Dennefeld, France, (exragalactic astronomy)
Dr. Oddbjorn Engvold, Norway, (solar physics)

Mary Kontizas

Special Report

Newsletters in Astronomy

Bulletins or newsletters certainly date back to the foundation of astronomical societies, or indeed scientific societies. The idea of a communiqué distributed periodically to society members comes naturally as a means to disseminate results and information, to keep members informed and up-to-date. Examples in astronomy includes this (EAS) one of course, but also just about every single society that comes to mind: the Astronomische Gesellschaft (or AG, Germany), the Astronomical Society of the Pacific (USA), and so on. In certain cases, societies also publish comptes-rendus or research summaries, such as the Mitteilungen: Jahresberichte Astronomischer Institute, in the case of the AG.

However since the advent of the World Wide Web (WWW) traditional routes for publishing are short-circuited, to a certain extent, by on-line compilations such as preprint servers (e.g. Los Alamos, Sissa) and newsletters normally devoted to specific fields of research. The information high-way has allowed, not merely to rehash what was being distributed already on paper, but to extend the scope of newsletters with added flexibility. In what follows I present a brief survey of electronic newsletters that exist at the present time in astronomy. I concentrate on those operated by individuals (with one exception), and not societies: the list would be unmanageable otherwise. [1] I will discuss the impact of those based on their development over the past decade. I volunteer some personal views in the closing section, leaning heavily on my (relatively recent) experience with the newsletter SCYON.

The list I present below is partial and follows from my own scan of the WWW. It is meant to be indicative only.

Solar News (S.Walton) 1988–, bi-weekly
http://helios.tuc.noao.edu/SolarNews/
The Star Formation Newsletter
(B.Reipurth) 1992–, monthly (Y)
http://casa.colorado.edu/reipurth/newsletter.htm
Chemically Peculiar Red Giant Stars
(S.Yorka) 1992, twice-yearly
www-astronomy.mps.ohio-state.edu/∼wing/prgnews.html/
The Hot Star Newsletter
(P.Eenens) 1994–, monthly, (Y)
http://www.astro.ugyo.mx/∼eenens/hot/index.html
The Be Star Newsletter
(G.Peters,D.Gies& D.McDavid),1994–,twice yearly(Y)
http://www.limber.org/benews/
A Peculiar Newsletter
(P. North), 1995–, twice-yearly (Y)
http://obswww.unige.ch/ north/APN/Welcome.html)
The Cool News (cool stars and sun)
(S. Skinner) 1995–, monthly (Y)
http://casa.colorado.edu/∼skinners/coolnews.html
The Standard Star Newsletter
(R. Gray) 1995–, twice-yearly (Y)
http://stellar.phys.appstate.edu/ssn
The Magellanic Clouds Newsletter
(E.K.Grebel & Y.-H.Chu) 1995–, monthly (Y)
http://www.astro.uiuc.edu/projects/mcnews/MCNews.html
Barred And Ringed Spirals
(J.Knapen) 1996-1997, bi-monthly
http://www.iac.es/proyect/bars/News.html
The Radio Pulsar Newsletter
(S. Johnston) 1996–1998, monthly (Y)
http://physics.usyd.edu.au/rcfta/psrnews/psrnews.html
The Galactic Center Newsletter
(A.Cotera, H.Falcke & S.Markoff) 1996–, quarterly (Y)
http://www.mpifr-bonn.mpg.de/gcnews
Active Galaxies Newsletter
(M.Redman) 1996–, monthly (Y)
http://www.ast.man.ac.uk/ mpr/agn/
White Dwarfs Newsletter
(S.Jordan) 1998-1999, quarterly (Y)
http://saturn.astrophysik.uni-kiel.de/wdnews/
Distant EKOs The Kuiper Belt Electronic Newsletter
(J.Parker) 1998–, bi-monthly (Y)
http://www.boulder.swri.edu/ekonews/
Dwarf Tales (dwarf galaxies)
(E.Brinks & E.K.Grebel) 1998–, bi-monthly (Y)
http://www.astro.ugto.mx/∼dwarfs/
Star Cluster Newsletter SCYON
(C.Boily,P.Kroupa&J.-C.Mermilliod), 2000–,bi-monthly (Y)
http://www.rzuser.uni-heidelberg.de/∼s17/scyon/
The GRAPE Newsletter
(P.Hut & J.Makino) 2000–, quarterly
http://www.astrograpе.org
In the list I give the newsletter's name, the editor(s), the date it first appeared, how frequently it appears, and its url.

[1] Several links will be found at url http://cdsweb.u-strasbg.fr/astroweb/.

Those accepting abstracts of research papers are marked with (Y). All figures cited were obtained on-line. Practically all 18 newsletters listed here were born with the WWW, most accept research abstracts submissions and cover varied topics such as job opportunities, databases, conferences, and the likes. [2] Their great advantage over older newsletters is their immediate availability through the web. Hence it is somewhat of a paradox that most of them, as I understand, maintain a distribution list, so that new issues are sent out by email as well as being posted on the web. Since email predates the WWW, one can imagine that the number of such mailing lists may at some point have been rather large, though their contents presumably never as accessible as they are today. I could fancy email postings are inherited from work-habits developed earlier in the electronic age, hard to shake off. However it is more likely a key asset of newsletter publishing, an integral part of it, one on which astronomers tend to rely, namely that the information is delivered to their pigeonhole - free of charge.

There is of course no 'membership' (and fees) attached to any newsletters or mailing list, and hence it is remarkable that they should mushroom spontaneously. In the case of astronomical societies, this activity is well orchestrated, and may or may not reflect the flavour of topical research in specific fields. In contrast WWW Newsletters come alive and die without fanfare, according to popular demand or changing circumstances. This brings up the important issue of management of newsletters, to which I return in the last section.

Readership sizes up the impact of a newsletter. This is actually difficult to quantify, given the nature of the WWW and the diversity of newsletter formats. What is more, the frequency of publication varies from one letter to the other, from bi-weekly to twice-yearly. However one may presume that astronomers who receive a letter by email will read it. Five newsletters: the Star Formation, Hot Stars, Galactic Centre, Magellanic Clouds and Star Cluster newsletters, communicated to me the number of subscribers to their mailing lists. The combined figures make a total of 868 + 400 + 301 + 444 + 609 = 2622 email recipients. This figure betters the membership of the EAS (as of 1999), but it is an upper-limit only since I could not verify multiple subscriptions. If the remaining fourteen had comparable, mutually exclusive mailing lists, we would easily reach a readership on the order of a few thousands. In other words, newsletters already reach an appreciable number of astronomers. There is however much room for improvement. In its last edition, covering the first half of the year 2000, the Astronomy & Astrophysics Abstracts (Vol. 73A) lists 17,024 author names for some 12,000 abstracts. If we equate, loosely, the number of authors to the number of readers in circulation, and extend the statistics of the five newsletters mentioned above, to all eighteen, we obtain 2622 x 18/5 = 9439 authors or readers, well short of the numbers compiled by A&AA.

As the number of newsletters is still on the increase, this indicates that we have not reached saturation levels yet (see Fig.1). What fraction of the astronomy community will ultimately make use of them is another matter. Putting the question directly to the interested party is the simplest way to find out: in the case of the Star Cluster newsletter SCYON, we (myself, P.Kroupa, and J.-C.Mermilliod) found that of the original mailing list of 1924 astronomers and 15 institutions, 609 replied positively to the first announcement of the letter and wished to receive more information, or 31.6% of those contacted. The original list included participants to two international meetings on star clusters, as well as members of the AAS (563 entries), the IAU's Commission 37 members, members of ESO (441 entries), and more. We sent out the notification to all addresses, irrespective of the recipients' field of interest in an effort to broaden the readership as much as possible. In the end, only 17 out of 391 (4.3%) addresses not common to conferences and Commission 37 listings wished to be added to the SCYON list. This shows rather clearly that astronomers are timid to venture out of their field of interests, at least with regards to newsletters. The real impact of this 'cross-fertilisation' is hard to assess however : a PhD adviser or librarian may well subscribe to one or several newsletters and distribute them within the group or institute, by email or in paper, so that the one-to-one relation subscriber/reader is lost. By ricochet, the existence of a newsletter devoted to a field is an indication of activity in this field of work only, and ultimately it is the volume of research notes circulating that must prove the better yardstick.

To quantify this would require statistics of each newsletter. I have not found systematic compilations of the contents of newsletters, so my analysis suffers. Of all the newsletters, the Star Formation (100 issues) and the Magellanic Clouds (51 issues) newsletters offer baselines long enough to seek out trends. Both are monthly instalments. I am interested in the number of research abstracts per issue. To do this I divided all issues of the SFN into two groups of 50 in chronological order, then inspected 1 in 10 issue in each group, for a total of 20 issues. For the first ten of those (covering the period 1992-1996), I compiled the number of abstracts submitted: numbers varied between 14 and 25, with a mean of 20.6 (variance 3.0). For the second group (1997-), I found the number of abstracts ranging from 20 to 39, with mean value 29.2 (variance 7.2). The Magellanic Clouds Newsletter for the same period averaged 624/53 = 11.8 (variance 3.3) abstracts per issue. To these figures I would add the statistics of the Galactic Centre Newsletter (1996-): 242 abstracts for 12 issues, and the SCYON: 52 abstracts for 2 issues. It is clear that comparisons between newsletters are dubious as they are not issued equally frequently. Certainly the interest in a newsletter is more than passing as testifies for instance the data for the SFN, which has been running for 9 years and if anything has increased its volume over the years.

[2] Note that two, the Peculiar Newsletter and the Be Star newsletters were actually founded in the seventies (Peculiar) and in 1980 (Be Star), when they were mailed out to subscriber; I have given the dates of their transmutation to the web.

All being said a typical newsletter issue will contain some 20 abstracts. The point I am driving at is this: if all newsletters were published monthly, which is not the case, I would count 12 x 20 abstracts x 18 newsletters = 4320 research abstracts per year (both from refereed and non-refereed work). There is a factor six difference between this and the numbers cited in A&AA (Vol. 73A) extended to a full year. There is, therefore, a wide gap between the number of abstracts distributed, and published work. This gap is filled, at least partially, by preprint servers such as the Los Alamos or Sissa servers, the ADS and, until now, completely by the A&AA series. In fact, the Sissa archives receive nearly 30 contributions daily, accounting for half of the A&AA census, though not so much in its scope, since the Sissa bibliographic data is incomplete. One could challenge these figures by point out that the coverage of a particular *field* by a given newsletter is much more complete than transpires, i.e. that the sum of all 18 newsletters I listed do not add up to the same range of topics covered by AA&A, and so I am being unfair. Instead suppose I count one newsletter per field. I then require 106 newsletters to cover the 106 entry codes of AA&A, or a factor $106/18 = 5.889 \approx 6$ times more newsletters, precisely the inverse fraction I deduced above. This is a coincidence, surely, but it is telling of the level of coverage individual letters achieve in their respective field. Bo Reipurth (SFN) and Heino Falcke (GCN) both report from their own scan of preprint databases a completeness of around 75% of research abstracts. Newsletters offer a near-complete coverage of a field, yet there is room for many more of them if all bits of research are to be disseminated, in all fields of work. Put in this perspective, we would be right to ask whether preprint servers threaten the long-term survival of newsletters: is there a danger that they become redundant for being too small, too few? Or for lack of support from institutions?

What aims, which future?

At first I was tempted to see in a bad light the long-term future of newsletters. After all, preprint servers channel a good fraction of research abstracts *and* papers already, and WWW newsletters may seem to cover only specific areas of astronomy.

But newsletters are more than a list of preprint abstracts. They cover a selection of news items tailored to a specific group. Newsletters are a decant of paper Abstracts, with extras not found at archiving nodes: research features that appear in newsletters may now be found listed on the ADS; it is also a tool for conference announcements, meetings, jobs, and the such, always adapting (in scope, format) to the need of the readers. This aspect of WWW newsletter publishing should appeal to newcomers, students in particular, who will develop new habits of work, by subscribing to newsletters and contributing to them, just like email mechanics was instantly adopted when it appeared. Indeed this appears to be happening already with the Star Formation Newsletter: Bo Reipurth mentions that not only is SFN readership on the up, but the new subscribers seem to be mainly students. This is certainly encouraging for all newsletters.

Where I can see a (possible) problem is that in both instances, archiving/servers and newsletters, the authors have to do the work of submitting their contributions. They should fill out forms and format their data/articles, in different ways if they want to reach a large audience through several databases or newsletters. Not surprisingly this will discourage many from forwarding their contributions to more than one place, and the archive will, I can imagine, come as the first choice. The basic appeal of newsletters should be their reliability, both in coverage and in door-step delivery. The active role taken by the newsletter sendouts means that the reader can spare his attention for other activities, rather than keeping watch for new announcements. Furthermore, email sendings to the readers also saves download time, which can be slow according to the demands on a particular server, again emphasising the effectiveness of email distributions.

So how can newsletters strengthen their position? A possible future development might be for data archive sites to forward research abstracts to relevant newsletters registered with them. This would save the authors from duplicating his/her work, and assure greater coverage of the field. The newsletter, rather than being simply the messenger of forthcoming articles and other news, would then become a permanent, specialised link between the reader and the subject of his/her interest. Links from say an object in databases such as the CDS (Strasbourg) or Webda (Lausanne), to an abstract or a conference announcement, could be tailored to the main theme behind the newsletter. Coordination between servers and newsletters would be of great help here. Commission 5 of the IAU has setup a task group (2000, led by Michelle Storey) to look into electronic publications, among other things: goal number 3 of the C5-group is to 'find techniques to maximise the usefulness of electronic access to research results'. I believe hyperlinks between topics and integration to a database are part of the answer. This is the direction we have taken with SCYON, and hopefully more development will take place as we go along.

The large gap between pre-publication abstracts listings and data archives suggests that newsletter services should continue to develop for the foreseeable future. It must be pointed out though that 4 of the newsletters I listed have died out after only a few seasons. Without seeking a precise reason for this, I note that continued success with newsletter listings demands efforts and much commitment: this is not a 'one off' thing. Newsletters, rather like newspapers, require continued development and attention, a task made more difficult when the promoters are on short-term positions, for example. Support comes from authors and editors generally, but also from hosts institutions, in the form of shared hardware. It would be worth remembering that no newsletter, as far as I can assess, has a devoted host computer or even hard disc, when second rate machines would suffice amply, a point that highlights their precarious status until now.

Access to complete bibliographies and information is essential for continued progress. As the burden of publication rest rather heavily on the shoulders of the authors, dissemination of results should be eased as much as possible. This is one of the main objectives of WWW newsletters. This year sees a change of guard, as the A&AA series comes to an end. In future ADS, ARIBIB and possibly other servers will assume the compilation of published material. It remains to be seen what impact this will have on patterns of publications and citations. Hopefully newsletters will continue to be active agents for the dissemination of scientific data, linking research summaries to other scientific activities.

Acknowledgements - It is a pleasure to thank all newsletter editors for email exchanges and help. Bo Reipurth and Heino Falcke offered detailed comments which forced me to rethink the first version of this essay. E.Brinks, E.Grebel, P.North and R.Wielen pointed out errors in that version. All are thanked warmly.

Christian Boily

Interdisciplinary Views

The Impact of Chemistry and Geology on Astronomy

Introduction:

Take a traditional view of three scientists:

A chemist is often portrayed as a white-coated boffin in front of a bench of glassware. Depending on how much influence Hollywood has had over the image, the glassware might be full of different coloured liquids, some of which are bubbling and steaming.

A geologist, complete with woolly socks and sandals, hammer in hand, strides across a rocky outcrop, compass and hand lens at the ready to survey the strata.

An astronomer, alone in a draught observatory, one eye fixed to a telescope, waits for a comet or a supernova to brighten the darkness.

Do these figures have any bearing in reality? At some basic level, they do: a chemist is based in a laboratory; fieldwork is vital for geologists, and astronomers observe the sky. Superficially, then, it seems that the disciplines of astronomy, chemistry and geology have little in common. But they are more related than these bald outlines at first might suggest. Astronomy is the study of stars, galaxies and the universe. Observations are made, and interpreted on the basis of theoretical models. Astronomy is a science of vast distances and enormous time periods: light years separate the stars, and billions of years are needed for the evolution of stars and galaxies. In contrast to astronomy, geology is literally a down-to-earth study, although, like astronomy, geology deals with evolution over billions of years. Chemists are laboratory-based analysts, needing physical materials on which to make their investigations. The area where these three fields meet is in meteoritics, the study of meteorites. Some of the most fruitful and valuable collaborations over the past few years have been between astronomers and astrophysicists, chemists, geologists and geochemists, where each discipline contributes to, and enhances the others.

Meteoriticists have used geological principles to infer physical conditions (e.g., pressure, temperature, oxygen fugacity) and compositional variations (e.g., mineralogy, major, minor, trace element and isotopic chemistry) in the dust from which the Solar System formed. They have drawn on the skills, experience and instrumental expertise of chemists to perform precise and accurate measurements, at high spatial resolution, of the elemental and isotopic composition of sub-micron-sized grains. Results from the study of meteorites provides a solid basis ("ground truth") for verifying observational predictions made by astronomers and testing the theoretical models of star formation and evolution constructed by astrophysicists.

Meteorites:

So why are meteorites so invaluable for study by astronomers, chemists and geologists? The last decade has seen a greater understanding of the processes that led to the formation of the Sun and Solar System. Advances have resulted from astronomical observations of star formation regions in molecular clouds, the recognition and observation of protoplanetary disks and planetary systems around other stars, and also from refinement of chronologies based on short-lived radionuclides. Meteorites are the only physical objects that can be analysed directly in the laboratory, hence they are an unparalleled resource for Solar System, and Galactic, exploration. Asteroids are the building blocks remaining from the era of planet formation; meteorites are fragments broken from asteroids during collisions, ejected from the asteroid belt, and picked up by the Earth as they fall inwards to the Sun. Meteorites are pieces of rock and metal with a compositional variation that spans a whole range of planetary materials, from completely unmelted and unfractionated stony chondrites to highly fractionated and differentiated iron meteorites. These materials, and the components within them carry records of all stages of Solar System history.

Study of meteorites allows a more complete understanding of the processes undergone by the material that resulted in the Earth of today. The most significant meteorites, for early Solar System chronology, are the chondrites, the most primitive of all meteorites, having experienced only mild thermal or hydrothermal metamorphism since accretion into parent-bodies. Chondrites mark the change that took place between simple aggregates of interstellar dust and their accumulation into parent bodies as a protoplanetary disk formed and then evolved into the Solar System. The presence of the decay products of short-lived radionuclides within components in chondritic meteorites provides a chronology for the formation of the earliest solid materials within the nebula. Primary mineral assemblages in chondrites trace the heterogeneity of the solar nebula, whilst secondary minerals reveal the extent of hydrous and thermal alteration on the parents. Chondrites contain a minor component of 'ex-

otic' grains, including sub-micron-sized diamonds, graphite and silicon carbide. Isotopic analysis shows that these grains originate from stars other than our own, having been formed in supernovae and red giants. Study of these grains helps us to understand the galactic neighbourhood in which the Sun evolved. Melted meteorites record the extent, timing and duration of heating and subsequent magmatic activity on their parents, indicating the short timescale on which parent bodies aggregated, then melted and differentiated. Iron and stony-iron meteorites act as markers for iron-silicate segregation and core formation.

Past, and future space missions to comets, asteroids and Mars rely on measurements from meteorites to aid in interpretation of returned data. Although there are many examples that I could have selected, I will focus on two particular subject areas within the field of meteoritics that have benefited from collaboration between scientists of different disciplines. The first is the study of interstellar dust grains, whilst the second is the newly-recognised science of astrobiology.

Interstellar Dust Grains

Dust is a major component of interplanetary and interstellar space. Based on data from ground-based telescopes (e.g., UKIRT in Hawai'i) and space-based observatories (e.g., ISO), astronomers have learned much about the composition, size, shape and distribution of dust - but until interstellar grains were identified in meteorites, had no direct chemical or mineralogical analyses of the dust. The grains comprise several populations of nanometre-sized diamond and micron-sized silicon carbide, graphite and aluminium oxide, and are a volumetrically insignificant, but scientifically critical component within chondrites. The presence of the grains was first inferred on the basis of the unusual isotopic composition of noble gases released from the meteorites. Together with noble gas data, carbon, nitrogen and silicon isotopic measurements suggest to a variety of extra-solar sources for the grains including supernovae and red giant stars. Over the past 20 or so years, increasingly sophisticated instrumentation, such as the ion microprobe and the analytical transmission electron microscope, have revealed different generations of interstellar grains, including grains within grains.

Astrophysicists have been able to construct, then fine-tune, models of stellar evolution on the basis of the combined isotopic data resulting from analysis of the grains. Currently, grains from at least 15 different extra-solar sources have been isolated from chondritic meteorites. These grains were presumably introduced into the pre-solar nebula prior to its collapse and the onset of proto-planet formation. The presence of such a variety of grains indicates that the Sun did not form in isolation, but was part of a busy neighbourhood in which AGB stars, supernovae, novae and planetary nebula co-existed. When coupled with astronomical observations of interstellar and circumstellar dust clouds, meteorite data are enabling astronomers to model star and protoplanetary disk formation processes. Astronomers studying interstellar and circumstellar dust by both ground- and space-based techniques are turning more frequently to results from meteorites, and the grains separated from them, to help with interpretation of remotely-acquired data. Direct measurement of the isotopic composition of the several populations of interstellar grains isolated from meteorites, and the gases trapped within them, are enabling astrophysicists to model more accurately stellar evolutionary sequences, and to confirm (or refute) predictions made from these models. It is hoped that continued study of pre-solar grains with a new generation of instrumentation will allow both relative and absolute chronologies to be constructed for the different grain populations, leading to models for the history and evolution of our galactic neighbourhood.

Astrobiology

Astrobiology (or exobiology, or cosmobiology) is the study of the origin, evolution and distribution of life in the Solar System and beyond. It is an old subject (humanity has always wondered about its origins) that has received fresh impetus from results from recent space missions, coupled with a better understanding of the origin of life on Earth. Astrobiology is a discipline that has embraced a broad range of subjects, from Astronomy to Zoology, via, amongst others, Biology, Chemistry, Geology and Philosophy. Meteoritics offers several rich strands of material for research towards understanding the origin of life on Earth and the search for life in the Solar System. Specific examples of the meteoritics input to astrobiology are in (i) the study of organic molecules in primitive chondrites and (ii) the study of meteorites from Mars.

(i) Organic compounds in meteorites:

Life is assumed to have arisen on the Earth from a potpourri of simple molecules (including CO, NH3, CH4, etc.) that, in the presence of an energy source, combined to form more complex molecules. Although the Earth formed with its own complement of volatiles, much of these would have been lost by degassing during the earliest era of planetary formation, when the surface of the Earth was molten as a result of heavy bombardment by asteroids and comets. As the bombardment decreased in intensity, the Earth cooled and volatile species carried by the impactors are assumed to have accreted to the Earth. Meteoritic input appears to have been significant in providing at least a component, if not most, of the starting materials necessary for life to have arisen.

The Earth is constantly bombarded by extraterrestrial material, ranging from micron- to metre-sized bodies. The total annual flux of such material is estimated at approximately 1010g, of which over 90% comes from particles less than 1 mm in size, and known as cosmic dust, micrometeorites or interplanetary dust particles (IDPs). Cosmic dust is thought predominantly to arise from collisional debris in the asteroid belt, or from dust ejected by comets during perihelion passage. The most volatile-rich impactors of the early Earth were comets. The icy and volatile-rich nature of comets implies that they have not been heated or melted since their formation during the final stages of Solar System aggregation. Comets accreted from unaltered dust and ices, rich in organic compounds, sweeping up matter at the fringe of the protoplanetary disk. Comets are samples of the most

primordial material available for study, and are reservoirs of interstellar and interplanetary dust and ice. If comets played a vital role in the development of life on Earth, they could also have have been instrumental in the development of life on other bodies in the Solar System. Organic compounds from interstellar space came to the Earth either directly by asteroidal and cometary bombardment, or indirectly as cosmic dust, either way bringing the building blocks of life to the Earth; the same mechanism presumably imparted similar materials to Mars, and other potential Solar System harbours for life.

(ii) Meteorites from Mars:

Mars has long been recognised as a planet with, at past times in its history, a range of surface conditions compatible with the origin and evolution of life. There have been several successful space missions to Mars, results from which have aided in a better understanding of the magmatic and fluvial history of the planet. In addition to remote missions, much has also been learned from the 20 or so meteorites that have come from Mars. These rocks were delivered to Earth following ejection from the martian surface by impacts; their martian origin is confirmed by the presence of martian atmosphere trapped within the rocks. Study of minerals within martian meteorites has revealed how much Mars' atmosphere has changed since the planet formed, and how much water has flowed across the planet's surface. Recognition that Mars was once warmer and wetter than it is today has stimulated studies into the potential existence (extinct or extant) of life on Mars, and whether there is any evidence for extraterrestrial life within martian meteorites.

In 1996, a team of scientists based in the U.S. described tiny features within carbonate patches in the ALH 84001 martian meteorite, and claimed to have found evidence for primitive fossilised martian bacteria. Identification of the features remains controversial; since much of the evidence is circumstantial and relies on the coincidence between a number of otherwise unrelated characteristics of the meteorite (the occurrence of carbonates, organic compounds and magnetite associated with the carbonates). The most compelling observation, though not the most compelling scientific evidence, was an electron microscopic image of a 'microfossil'. Even so, it is possible that the object was produced by fossilisation of a terrestrial bacterium during the meteorites' time in Antarctica. Given that the potential for terrestrial contamination of martian meteorites will always remain, the only way in which there can be an answer to the question of whether or not there is (or has been) life on Mars is to analyse rocks and soil in situ on Mars.

Summary

Two case studies have been discussed: interstellar grains and astrobiology. In each instance, different communities of scientists have worked together to achieve a better understanding of particular problems. Research projects seem to be becoming more multi- or inter-disciplinary in nature, with scientists both more aware of advances in fields outside their own, and recognising that techniques and instrumentation developed in other disciplines might be applied to problems within their own. Thus, e.g., astronomers need organic chemists to understand fully reactions between interstellar molecules; geochemists rely on astrophysicists to model, and astronomers to observe, stellar evolution, to enable understanding of unusual and exotic grains isolated from meteorites. Over the past two decades, the synergy between scientists involved in inter-disciplinary studies has led to more rapid breakthroughs in the understanding of some of the problems concerning the origin and evolution of the Sun and Solar System. It is anticipated that advances in instrumentation, both ground-based (e.g., the Nanosims ion microprobe, the Gemini telescopes) and space-based (e.g., NGST, SIRTF, Mars Express) will allow such fruitful collaborations to continue.

Monica M. Grady

Astronomy as an Environmental science

I present arguments in favour of the environmental nature of Astronomy. I examine briefly the mutual interaction of man and the near-Earth space environment. Finally, I express my personal agony, as an astronomer, concerning the really serious, dangerous and perplexing problem of the preservation of the nearby space environment for Astronomy and for future generations.

Practically, the notion Environment is identified with simply the subatmospheric environment of our Earth. However, it is hardly denied anymore that mankind's activities in space during the last 45 years force us to extend the notion of environment, so as to include in it also the overatmospheric environment, generally the Earth's astronomical environment and more specifically the near-Earth space. I shall try to emphasize that the astronomical environment, nearby and distant, is closely related to everyday life not only of astronomers but of all citizens. I consider such an effort necessary, because the astronomical-astrophysical character of the term Environment is not properly emphasized, at least in the way and to the extent this has been done, very successfully, indeed, with our atmospheric and subatmospheric environment from many different aspects. Additionally, I am convinced that the environmental sciences should not and can not be considered independently of the broader scientific area of Astronomy and Astrophysics, and this overlapping of environmental and astronomical sciences, of interest to both of them, should be adequately taken into account in specifying our future scientific priorities in general.

Astronomy depends almost entirely on data coming from the Earth's astronomical environmental. There is nothing to "touch", so to say, and so Astronomy is a typical environmental science as regards its relation to everyday life, its roots, its research methods, and its areas of research. I recall the first cosmological ideas and the geocentric system of the cosmos with the epicycles, as a powerful tool of describing the heavens, according to which the centre of the cosmos was the Earth. And we should always remember that it was Aristarchus of Samos, not Copernicus, who originally proposed the correct system of the cosmos, namely,

the heliocentric system.
Also, I recall the various types and uses of artificial satellites, in geostationary orbits or not, with or without nuclear generators on board, and their applications. Everyone knows of Communication Satellites and satellite TV; Meteorogical Satellites and weather forecasting as an necessary ingredient of our everyday life; Remote-sensing Satellites with their many applications (e.g. localization of new sources of oil, water and ore; the prediction about crops by continuous surveying of an area; the open-sea fishing; the curing of diseases of forest trees by ascertaining the colour differences in different parts of a forest, and even the ability to perform archaeological excavations from space); Scientific Satellites (e.g. the Hubble Space Telescope-HST, the Cosmic Background Explorer-COBE, the Compton Satellite); and Military Satellites whose real number is unknown. And we must not forget that progress in the use of artificial satellites and spaceships has not been without accidents and loss of life, e.g. as with the Challenger spaceship.
The environmental nature of Astronomy is revealed, additionally, through many Position-Astronomy phenomena, of interest to everyday life, such as the apparent motions of planets and other bodies due to the diurnal rotation of the earth, and especially the rising and setting of the Sun, more or less regulating life on Earth, as well as the phenomena of astronomical diffraction, diurnal and stellar parallax, astronomical aberration, horizon depth, twilight, eclipses and so forth. Also, the precession and especially the mutation of the axis of the cosmos with respect to the axis of the ecliptic can be responsible for severe climate changes on Earth, e.g. for the phenomenon of glaciers. Moreover, of particular importance is the motion of small-mass objects, e.g. asteroids, comets, and meteors, which are the almost-unchanged fossils of the primordial solar nebula. These objects, devoid of atmospheres, are clues to the history of the Solar System, in contrast to the fact that atmospheric erosion wipes out all the initial details on the Earth's surface. So the study of e.g. an asteroid, might yield information concerning the initial stages in the formation of the Solar System. Who, anyway, does not remember NEAR-Shoemaker spacecraft? However, we should not forget the potential dangers from a Skylab- or Mir-type type destruction, or from a Chernobyl-type event coming from the heavens, or from the collision of an asteroid with Earth.
Nearby-space phenomena of interest to Astronomy and everyday life include the production and flow of solar energy, the solar and planetary magnetospheres and magnetic fields, the planetary atmospheres (composition, formation, albedo), the greenhouse effect, the planets' environments (ionospheres, magnetic fields, "Van Allen" belts), the tree trunks as records of variable solar activity and as indicators of the solar-terrestrial relationship, the Earth's energy balance (climate, greenhouse effect), the phenomena of tides, the solar wind, the solar flares and their relation to communications, the effects and importance of solar and planetary particle and electromagnetic radiations, the interaction of solar wind with Earth and planetary atmospheres, the space weather, the Van-Allen belts and the space travels etc.

I now come to the important question of the influence of man on the nearby space environment as well as its consequences generally, and (primarily) from the viewpoint of an astronomer. In nearly 45 years of space activities, since the flight of Sputnik 1 on 4 October 1957, more than 3,400 missions have reached Earth orbit or beyond. The consequences of this activity have left more than 8000 satellites in near-Earth space which are traceable by terrestrial sensors, and the number is growing at a rate of 200 additional pieces per year. From this population only approximately 5% (400 objects) represent spacecraft which continue to provide useful services. A small fraction (¡1%) of catalogued satellites possess radioactive materials, which raise special long-term issues. The actual number of man-made objects orbiting the Earth, including objects as small as 1cm in diameter, is estimated to be several times the official count. Particles injected into near-Earth space are trapped by the Earth's gravitational and magnetic fields, and they become hazards to spacecraft until they are removed by interaction with Earth's upper atmosphere. Eventually these particles will collide with enough air molecules to slow them down, go into decaying orbits, and reenter the atmosphere.
The most important environmental threats associated with human activities in space are on the one hand space debris and the consequences of using offensive weapons in space, and on the other hand the light pollution caused by orbital activities including radio interference and charged particles from space reactors affecting -ray science. It is rather frightening that, at any moment, at a height of 2,000 km from the Earth's surface, the mass of the man-made debris is 15,000 times larger than the natural meteoroidal mass. As a result, a large satellite, such as HST or ISS, has a chance of at least 1% per year of failure due to a collision, and, most important, the amount of small debris is doubling roughly every decade. Moreover, offensive weapons in space could pose perhaps the nastiest threat to satellites in low-Earth orbits. On the other hand, light pollution in/from orbit is equally dangerous both in the optical and radio frequencies, and so it increasingly threatens both ground-based and space-born Astronomy. In the optical frequencies, the main problem is bright satellites, whose number has increased by a factor of at least 3 since 1970, while, at the same time, the sensitivity of astronomical detectors has increased by more than a factor of 10. As a consequence, wide-field telescope exposures are contaminated by satellite tracks. The main space-environment problem for Radio Astronomy is unfiltered sideband radio emissions from networks of satellites, and it appears to be inevitable that most of the radio window will increasingly fog over, with consequencies on even the SETI program. But also -ray Astronomy, done from satellites or high-allitude balloons, is seriously affected by unshielded nuclear reactors in satellites interfering with observations from them. It is not widely known, that the geomagnetically trapped electrons and positrons, in some cases, are produced in such reactors at a rate of 1013/sec and, as a result, they have caused serious interference with -ray Astronomy.
Finally, the artificial objects in the near-Earth environment

may, through random collisions, produce a cascading number of debris fragments, and fragmentation of this debris by further collisions could eventually produce enough dust, to cause, as illuminated by the Sun's light, a new and particularly unpleasant sort of light pollution.

It becomes therefore transparent, that near-Earth space, at great risk from human activities, is in great need for protection by scientists and humanity. After all, space is the most fragile environment that exists, because it has the least ability to repair itself. Scientists should be especially concerned, both because they place so many scientific instruments in near-Earth space, and also because they are in a unique position to foresee the problems human activities are causing, of which others are unaware, and to propose measures to mitigate or avoid them. Their dual role is to increase the understanding of relevant basic science, and to define and advocate needed policies. A code of acceptable behaviour should state that e.g. nothing should be launched into space unless it fulfills certain basic requirements to protect the space environment. We must remember that near-Earth space is a desirable location for astronomical instruments, some of which are really of great importance. So unnecessary launches of objects that will produce or themselves become long-lived space debris are far worse than ocean dumping, and should be prohibited by international agreement.

Up to now, the range of adverse environmental impacts on and threats to Astronomy appear to be very large: electromagnetic pollution, increasing ground vibration, increasing dumping of heat and particles in the atmosphere, accumulation of heavy molecules in the stratosphere, increasing high-altitude cloudiness, growing amounts of space debris, uses of space including increased provision for mass communication, solar-power transmission and advertising from space, and pollution of the nearby solar system with terrestrial matter. The activities of mankind are contributing to a relentless growth of all such adverse impacts. Our technological civilization is producing extremely sensitive detectors, while, at the same time, causing growing degradation of observation conditions. Hence Astronomy is exposed to all the above adverse impacts, being a science devoted to the detection of the weakest of signals in an environment naturally hostile to such endeavours. It is unfortunate that Astronomy appears to enjoy no protection in law or by convention against the consequences of such degradation of observation conditions. The situation is so severe that, according to some scenarios, certain types of astronomical observations may well be compromised irretrievably. That such scenarios are not fiction is deeply discouraging. A very characteristic example of such a scenario is the Russian experiment Znamya 2.5, which failed and for which there has been a proper reaction by the IAU.

In view of all the above, international conventions on the protection of astronomical science and actions are urgently needed against threats to Astronomy on the time-scale of years rather than the decades more usual to reach such agreements. Otherwise in our combative, de-regulated, commercial world, the interests of Astronomy could be easily swept aside, and rampant profit could overwhelm astronomical science. We need to arrive at a satisfactory compromise with a technological civilization in which its benefits continue to be enjoyed, but where it is also recognized that the astronomical science must have its protection. Since national political leaders usually take a short-range view, hardly ever stretching past the next change of government, and astronomers measure time in millions or ever billions of years, we must help to educate the general public to think with at least an intermediate perspective of centuries and millenia about the environment degradation that our increasingly powerful technology is causing on and near our beautiful but fragile planet - the only one like it that we know in the entire universe. Such a necessity is enhanced by the widespread ignorance within the community of astronomical matters.

Astronomy, therefore, must pay generous attention to public education in astronomical matters and to creating public support for the survival of astronomical science as a vigorous contributor to mankind's knowledge of the Universe and the cosmic environment and history of our planet. This becomes even more necessary, since the most important virtue that people in this world desperately need today is education, and since it is clear that actions without knowledge are often misguided and sometimes disastrous. After all, education in science and technology offers the only safe pathway for society to a happy, peaceful and comfortable existence, and it must be supported, as it is experiencing a rapid decline around the world in almost all areas of study.

In the long (astronomical) perspective every society on Earth will, most probably, be endangered by some kind of impact from space. So every surviving civilization is obliged to become space faring-not because of exploratory or romantic zeal, but for the most practical reason imaginable: staying alive. We must keep our planet and its space environment habitable not on a leisurely timescale of centuries or millennia, but urgently, on a timescale of decades or even years. Naturally it will require changes in government, industry, ethics, legislation and economics. We have never done such a thing before, certainly not on a global scale. It may prove be too difficult for us, because dangerous technologies may be too widespread, corruption may be too pervasive, and too many leaders may be focused on the short term rather than the long. There are too many quarrelling ethnic groups, nation-states, and ideologies for the right kind of global change to be instituted. We may be too foolish even to perceive what the real dangers are, or that much of what we hear about them is determined by those with a vested interest in minimizing fundamental changes. We must realize that the newly-recognized dangers threaten all of us equally, and no one can say how it will turn out down here on Earth or up there in our space.

In conclusion, Astronomy is a typical environmental science, and the issue of adverse environmental impacts on Astronomy and our planet Earth affects us all directly both as astronomers and as citizens. If we do not strive to understand the Universe, we may well not understand the nature and evolution of the Earth. To lose the cosmic perspective, however, would be a cultural, and perhaps an environmental disaster. We, as astronomers, may feel that this is obvi-

ous. However, we need to convince the public of this thesis. We need too to be creative in reaching a balance in society, where technological benefit and Astronomy have both their acknowledged places. This will not be easy to achieve. It will cost our science to quantify adverse impact and to seek ways to minimize adverse impacts. It is all too easy to hope the problem will go away. However, failure to grasp the nettle now may lead to the extinction of Astronomy as a worthwhile and vigorous science, a science with a long history in the annals and culture of mankind.
Being an optimist by nature, I prefer to hope that, given the creative inspiration that has driven the best astronomical endeavours over the millennia, such a challenge can be met!!!

Nicholas K. Spyrou

The EAS Affiliated Societies

South-East Branch of EAS

Between 25 and 29 September 2000, astronomers from Bulgaria, Greece, FYR of Macedonia, Romania, Ukraine and Yugoslavia, gathered in Belogradchik (Bulgaria) for a Balkan Meeting of Young Astronomers (http://www.astro.bas.bg/∼aobel/news.html).

We have discussed many topics of common interest for the astronomy of this part of Europe. At the same time, we discussed specific problems, raised due to our special financial situation. This has the same consequences for all of us: lack of scientific journals and books, difficulties to travel, continuously decreasing number of young astronomers, etc. We suppose that it would be easier for us to organize from time to time some meetings in this part of Europe (it is not so expensive to cross only one border of a neighbor country). Together it would be easier to find international funds to develop astronomy in our countries. We have the same celestial area to observe, so we could follow some common astronomical programs. We even have a common history of our science. As the European Astronomical Society was founded in 1990 to join together astronomers from western and eastern countries, astronomers of the developed countries and astronomers of the former communist countries we suppose that one way to push faster and better the European astronomy is the organization of a group of the south-east countries of Europe, which could act as a part of the EAS.

The group would organize some joint meetings (general or on special topics), a web page with specific information on the astronomy in this part of Europe. This organization might assure some exchanges between astronomers of neighbor countries. It could contribute to increase the educational level of the young astronomers in this part of Europe. This group (which could be named South-East Branch of the EAS) will periodically report to EAS its progress and will ask advice and possibly support (not only financial, but scientific, too). It would act like an IAU Commission or an IAU Working Group. An Information Letter of the Balkan Astronomy (ILBA) managed by Vladan Celebonovic (vcelebonovic@sezampro.yu) will be published in the web.

We believe that the S-E European astronomy will be a real active component of the European one and together we shall be able to contribute to the progress of the international astronomy at the dawn of the new millennium. Of course, everyone is free to join us.

Magda Stavinschi and Milcho Tsvetkov

Solar researches in South-Eastern European Countries: Present and Perspectives

The first international seminar of the South-Eastern Branch of the European Astronomical Society was held in Bucharest, from 24 to 28 April 2001.

The first seminar of this kind was dedicated to solar researches. It benefited by a larger participation than the one envisaged, not only of researchers from the member countries, but also of some colleagues from Azerbaijan, France, Italy, and Russia. It is worth mentioning the presence of Brigitte Schmieder, President of JOSO, an international body of solar researches, and of Mauro Messerotti, President of the JOSO Working Group "The Coordination of the Database and of the Processing Methods".

The Seminar was dedicated to the memory of Prof. Vladimir Nikolov Dermendjiev (1943 - 2001), the initiator and coordinator of the solar researches in Bulgaria, who passed away on 5 January 2001.

Both the contributions and the debates which followed were very lively, not only due to their high scientific level, but especially due to the topics approached, as we are just in the maximum activity phase of the current solar cycle and, between two total solar eclipses (the last eclipse of the second millennium, the one of 11 August, 1999 and the first one of the third millennium, that of 21 June, 2001).

The invited lectures presented the solar researches in Bulgaria, Greece, Romania, Ukraine, and Yugoslavia, emphasizing the competitive results and the plans of future researches.

The contributed papers were also centered on current topics of solar research from each participant country. Thus, papers on the cyclic variation of the solar activity, solar magnetic fields, solar prominences, coronal mass ejections, sympathetic flares, and the importance of spectroscopic researches for solar physics were presented. Researches on the solar wind and some geophysical effects of the solar phenomena were also discussed.

The most interesting research projects, concerning the intense study of the solar energetic phenomena, will be submitted in the immediate period to the specialized European and world scientific bodies to be analyzed, so that they may finally enter the international circuit of solar researches and probably benefit by financing.

Magda Stavinschi and Georgeta Maris

A Letter

Dear EAS members,

The Research Society in Valjevo (Yugoslavia) has been working for 31 years now. Within the Society the Department of Astronomy operates and I am the Head of it. Members are young people at the first place. Our program concerns both educational and practical work. The educational part consists of lectures for members and citizens. Additionaly we observe meteors, variable stars, Sun, planets, Deep sky objects, do astrophotography and ethnoastronomy - that is the practical part. Our work is respected in Yugoslavia but also abroad. The best testimony of this is that our results have been published in scientific magazines. Our work is the result of our good will and interest for science. We are all volunteers. During the attack against our country, Valjevo has been very damaged and our Society as well. Lot of books, photos, CDs, negatives and posters were destroyed. We are looking forward to receiving your HELP. Help for young enthousiastic people who want to do research and learn.We would be grateful if you could provide us with some equipment like: books, magazines, posters, photos, negatives, etc. Your minimal help will mean a lot to us. We are thankful to you in advance.

Yours faithfully,
Mr Nikola Bozic
Head Department of Astronomy
Oslobodioci Valjeva 29/4, 14000 Valjevo,
Yugoslavia

Book Reviews

Flat and Curved Space-Times, by G. Ellis and R. Williams, 2001 (Oxford Press, 2nd Edit.)

Relativity about one hundred years after its conception seems to keep unweary its spell over experts as well as the general public. Einstein's persona mixed with his genious produced an unparallel event in the whole science ever. Let me rush to odd, and justifiably so ! He changed our view of the world and opend the way for understanding the internal world of the Universe as a whole. So, any end eavour to explain the theory of Relativity is as an admirable noble cause, as a very difficult task because of the lots of misconceptions out there of what is all about. G. Ellis and R. Williams two seasoned and wellknown Relativists, have done a super job in succeeding to present "just the facts" and at the same time make their book a pleasure to read, even for motivated, non- expects. They have succeeded in hitting their target(s), as explained in the preface(s) and the Introduction, i.e. to reach a wider, than usually expected, audience, by writing in a simple, clear, understandable, straightforward manner, avoiding unnecessary jargon and complicated mathematics. Anyone with the backround of a good high school's math and physics should be able to grasp all the best facts of relativity, special and general and understand what is all about in an non-artificial way. The selection of topics, is a "round up of the usual suspects" but present in such a emphatically glomarate way, assisted by the abundant and very clear illustrations, that one gets a fresh view of the whole subject. The exercises and the appendices, not only help the "daring souls" to check their in-depth understanding, but it makes the book an excellent case for a basic undergraduate physics course on the subject. While as I stressed above, this is an excellent, basic treatise of relativity, I have spotted a few things that, in my opinion, deserve some more discussion and better standing, than they have in the present volume. In section 5.12, "Alternative Theories and approaches", varying k, Quantum gravity, Broken symmetries, Regge Calculus, get almost event treatment. Let me pick up Quantum gravity, why is it under the above heading? Quantum gravity completes. General Relativity, I think thus is not an alternative. I understand that for many relativity Quantum gravity is a nuisance but for the rest of us, is where the real crack of the whole matter is to be found. Maybe Quantum gravity including string or M-theory deserves of bit better.

In Section 7.4 under the heading. "New Observational data" while containing a lot of useful information in this, indeed, fast pacing field of Astronomy, it somehow belittles to my opinion, the importance of the High-Z Astronomy with its remarkable discovery that we are living in an accelerating universe, fuelled by some, unknown till now "Dark Energy". A rather dramatic discovery even if we obviously need more date. Furthermore, it is rather unfortunate the fact, probably became of bad timing, that the spectacular results of BOOMERANGS and MAXIMA on Cosmic Background radiation anisotropy have not been included,

while now make Fig. 7.19 makes completely obsolete. Actually, a combination of the results of high-Z Astronomy with that of BOOMERANG/MAXIMA not only are compliment with each other but clearly support the idea of inflationary universe, that, admittedly gets the cold shoulder by the authors. In any, case, my last remarks are there in order to indicate that small changes, in the next edition (?), may make this book a perfect companion, to anyone who is interested in the basic question "what is all about?" The authors should be very happy with their end product and they should know that their hope, as expressed in the end of their 2000 preface, has been more than fulfilled. Their book is indeed enlightening.

D.V. Nanopoulos

Encyclopedia of Astronomy and Astrophysics
P. Murdin (editor-in-chief), 2001,
Nature Publishing Group & the Institute of Physics Publishing

A Totally new approach for a complete guide to astronomical knowledge through ages.

Astronomy is a fascinating subject for many people with a very wide range of interests and professions. The attraction is our curiosity to understand the creation of the Universe and of human beings, the beauty of celestial objects, our future and maybe all these together. Regardless of what exactly is the motive, a steadily increasing interest in astronomy must be recognised. It is also true that changes in astronomy during the last decades due to a series of discoveries have left most reference books completely out of date. Other disciplines closely or marginally related to astronomy are fast developing and scientists need to open their minds to fresh information from broader areas of science. The era of very narrow specialization is coming to an end.

Therefore an encyclopedia of astronomy must posess the above features, i.e. be **accurate, complete and longlasting, have a broad scientific coverage and be appealing to a broad range of readers**. I believe that the internationally eminent advisory board under the editor-in-chief P. Murdin guarantees its **quality** and the required **accuracy** all the way through. To be aimed at scientist and layman alike is achieved through a variety of articles and styles, with clear explanatory diagrams,illustrated with appropriate photographs, most of them with relevant equations, meticulously edited to ensure that they will appeal to a **wide range of readers**.

Particularly at this point, I think it has been a wise choice to present the same or similar topics under various approaches and from different writers, so that a subject is covered in such a way as to be informative and of a high standard at the same time. The encyclopedia is a must for all astronomy libraries because it is an excellent reference book for students of all levels. It is definitively **complete**, embracing the totality of our knowledge gained and synthesized over the ages, with an excellent complementary selection of articles from all relevant sciences such as art, philosophy, general information and strategy. Although most of what is contained in the printed version will have enduring value, the requirement of being **longlasting** is ingeniously faced through the combination of the modern on-line facilities of our times. I find it is a great advantage to know that all the text will be under continuous revision in accord with the old philosophical message of Socrates "I grow up continuously educating myself". We are not talking of a revised edition but of a book following new and fresh knowledge the moment it appears. This a **novelty** indeed!!

Coming to more specific comments, I have to say that the articles retain their individual styles and conventions. This variety is not a fault but imparts an informal flavour to the encyclopedia, which makes it a more interesting collection of personal perspectives on the most challenging topics.

However, this is a disadvantage when we compare the **reference lists** where some authors (fortunately very few) give no references at all and others have a list with comments adding a really valuable guide to information on the subject. I hope all articles, when revised, will include this useful style of bibliography.

The **alphabetical order** of many of the entries in the index is sometimes surprising and at first sight one finds subjects not well covered. However, the index is really excellent and lots of supplementary information can be found under other, sometimes unexpected titles.

Small entries like "inclination", "differential rotation" lack a complete definition. They refer to our solar system only and do not give the relevant definition on galactic astronomy for example, although these are mentioned in the specific articles. So, in the short entry a few words should be added, otherwise the definition of the term is misleading.

I found a very good coverage with fine articles on topics with historical philosophical and more general interest

such as Astrology, Art & Literature and Information in Astronomy. The article on the Anthropic Principle, being of broad interest as well, is approached in a fine way by its author. It is obvious that an excellent job is done on solar physics and our planetary system - an exhaustive coverage with excellent articles, which I believe is necessary. For professional astrophysicists it would be too much, but from my experience as a teacher, students are equally interested in our nearby environment as in cosmology.

I think the on-line version will be the keynote part of this encyclopedia. Considering that cosmology is the fastest developing branch of astronomy, not just in its details as for other subjects but in its principles as well, the editors should really prove the valuable contribution of the on-line edition with fast updating on cosmological issues.

The encyclopedia forms a complete source of information on the subjects of Exoplanets and Life in the Universe which are very interesting no doubt to a very wide range of readers. Stellar & solar system magnetism is treated at all levels and detail with very clear illustrations and enough physics and mathematics to allow the encyclopedia to serve as a text book to University students.

The general entry on software in astronomy is an excellent idea, finely treated, but I would like it to be completed with the advancement of theoretical codes and simulations.

The general topic of distances is adequately represented in a few articles. I only found that the index in the entry on distance determinations should point to page 3885 (on Universal Distance Scale) instead of a small paragraph in page 3485.

Spectrographs and Spectroscopy and all articles on photometry are complete and very well written. Stellar parameters and mechanisms are very good and when matched with the solar ones make a complete reference guide on the subject. Excellent choice of selection of these articles.

The small series of articles on space instrumentation seems to me to be weak; a better coverage is needed, considering the enormous interest in space astrophysics these days. I should like to see a better and more detailed article on sundials.

In conclusion, I must say how important and difficult the production of this encyclopedia has been. Paul Murdin and the editorial board have created a valuable set of educational material that should not be missing from any University and Research Institute, not only those with a direct astronomical interest but any with a broader scientific orientation. The on-line version would make students delighted when navigated through its pages.

To summarise, I have to say that the editorial board has succeeded in creating a reference work of the highest scientific standard and of lasting value which is both a challenge and a pleasure to read. I also like to praise the 24 hour free access to the on-line edition, that is offered by the publishers to all those, who want to explore and have a quick look at it.

The publishers Nature Publishing Group and the Institute of Physics Publishing are also to be congratulated for being bold enough to create such an ambitious encyclopedia that is state of the art in the publishing world. Finally the 24 free trial for individuals is extremely useful and a novel feature to be praised.

Mary Kontizas

Stellar Magnetism, by Leon Mestel

International Series of Monographs on Physics 99, OUP Oxford 1999.

This is a surprising book. It is a Tome – six hundred and thirty-six pages, bound in Oxford's dark blue, written by one of the masters of its subject: and yet laced with sparkling lightness of touch (things we don't know about star formation, for example). It is by a theorist, and yet the introduction concentrates on observational issues. The early chapters roll out a standard development of MHD, yet reading between the mathematical lines one discovers a wonderful physical intuition which leavens the exposition into something new. The subject, *Stellar Magnetism,* is monolithic, and yet at first sight the book appears to be a set of separate subject reviews.

It took this reviewer a little time to see the deep perspective built seamlessly into this excellent treatise. Each part is built on and explores issues previously clearly introduced, so that at the end – although there's no need to read this book as a novel – the big picture of magnetism at work in the Universe (and not just in stars) emerges.

In detail: in chapter 2 the physics of MHD is developed, and then applied to waves, instabilities, convection and

flux tubes in the following two chapters. Next magnetized star dynamics, dynamos and magnetic braking are expounded, before more empirical chapters treat magnetic behaviour in late- and early-type stars. In these chapters the initially disconcerting blend of observation and theory illuminates the subject, removing completely the artificial division between observer and theorist, and leaves a much clearer view of the science of this subject. Next, star formation is given two chapters, in which the classical results are expounded beautifully (and in several cases by their author), and the current uncertainties (*e.g.* is the magnetic field responsible for the form of the initial mass function?) are clearly analysed.

Finally the pulsar magnetosphere, the subject of so much of Mestel's work, is dealt with. Again, this hugely complex subject is expertly subjugated. Only Solar magnetism is given scant attention, being left explicitly to other authors.

A particular feature of this book – aside from the essential thread of physical intuition by which we are guided through the labyrinth – is that throughout, at significant junctures, there are introductions and summaries to guide us, appendices to deal with detailed results (*it can be shown*'s are conspicuously rare), and reference lists, which while not overwhelming, are guides to the heart of the research in each section.

There is still an enormous amount to be learned about magnetic fields in the Universe. This book is going to be a classic, and will be used as an inspiring guide in the search.

Peter W.J.L. Brand

Announcements

Astronomical Instrumentation
New degree in University of Madeira, Portugal

A new five-year course (Licenciatura) will start during the academic year of 2001/2 at the University of Madeira, Portugal. Entitled "Lic. in Instrumental and Electronic Engineering (Astronomy branch)", it will be the first degree of its kind created in Portugal on this topic and the second one within the general area of Astronomy. The Tuition fees in Portugal are fixed at about 300 Euro/year. The expected number of students to enrol in the first year is 15. We are hoping to get some external funding for studentships. In the final year, students are expected to get some training at one of several institutions: European Space Agency; Experimental Observatory of the University of Madeira; Madeira Civil Engineering Laboratory; several instrumentation companies in Portugal that already showed their interest. Furthermore, we are negotiating Socrates exchanges with European Universities. Further details of the new Licenciatura (still only in Portuguese), such as syllabus/topics, can be found at http://www.uma.pt/Investigacao/Astro/Curso/index.htm

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