



European Astronomical Society

Working Group Report

Exploring the road to Open Access Publishing

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Report to the EAS

Publishing research results and peers having access to these results is fundamental for science. Recent debates revealed worries among scientists about the new conditions for circulation and access to scientific publications. The European Astronomical Society (EAS) has asked for an evaluation of the evolution of the market and general conditions for astronomical scientific publishing in Europe in order to explore the ways to perhaps implement open access for astronomical scientific publications.

Since publishing in astronomy is an international activity, this report is not restricted to european publishing but addresses astronomy publishing world wide. It concentrates on the publishing practice of the main astronomy research journals.

In this report options for a transition to open access publishing are explored and the numerous difficulties are mentioned. In the case astronomy would attempt to make that transition, the report gives guiding principles which should be adhered to if changes in the publishing practice are proposed.

The EAS working group to study aspects of Open Access Publishing was established in 2011. It consisted of: R. Albrecht (AT), K.S. de Boer (DE), G. Di Cocco (IT), M. Cruise (UK), U. Grothkopf (ESO), M.C.E. Huber (CH), L. Cifarelli (IT), T. Lago (PT), J. Lub (NL), B. Nordström (DK), A. Quirrenbach (DE), J.-P. Zahn (FR), J. Zorec (FR). In 2012 Juan Zorec was succeeded by Klaas de Boer as chairman.

28 October 2013

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Important acronyms	Sect.	page
APC = Article Processing Charge	1.2	5
BM = Business Model	4.3	20
ForP = For-Profit	4.2	20
IF = Impact Factor	3.2	16
NonP = Non-Profit	4.2	20
OA = Open Access	1	5
OAI = Open Access Initiative	1	5
OAP = Open Access Publishing	1	5
Gold-, Green- OAP	2.1	6

Recommendations

The EAS panel on Open Access recognizes that academic publishing is at an important turning point and there are many future options with different possible business models. The publishing landscape is also made complex by different rates of progress in various parts of the world. In discussion between the panel members a set of guiding principles was developed with the intention that these, fundamental, concepts might be helpful to the EAS as the Open Access agenda evolves.

1. The highly regarded astronomy journals must maintain their quality based on peer-review by independent professional experts in the field.

2. Any publishing system must maintain a “version of record” in a sustainable way which is also capable of migrating to newer technical systems.

3. There should be no undue restriction on scientists to publish in the journals of their choice at the rate science developments demand.

4. If there is a mandate for astronomy to go to “gold” open access, the responsible agencies must provide the funds needed to maintain the quality and academic freedom as described in recommendations 1, 2 and 3.

5. The publishing practice in astronomy is de facto very close to full “green” open access; this will continue to be the case provided the current infrastructure for green OA with a central, widely accepted repository is maintained.

6. Because research in astronomy as well as astronomy publishing is a highly international activity, all responsible agencies are urged to come to one world-wide agreement about the mode of and transition to OAP. If the transition were to be made, the four high-quality big non-profit journals should do this simultaneously.

1 Origins of and arguments for “Open Access”

The costs of publishing are ever increasing. In some science disciplines commercial publishers are perceived as unduly making gains from their scientific journals. This, together with the possibilities of the internet, led to the concept of Open Access (**OA**; free access to publications in general) and Open Access Publishing (**OAP**), i.e., publishing with predetermined free access for all. Thus, in 2001, researchers initiated a movement for OA that transformed into what is called the “Budapest Open Access Initiative” (Budapest **OAI**, or **BOAI**). This asks the scientific community to enter a new way of communication favoured by the possibilities offered by the Internet.

1.1 Traditional publishing

Scientific research is publicly funded while its outputs are handed over to journals, who publish it, and in most cases the journals are subscribed to by publicly-funded libraries, or by publicly-funded researchers themselves. The access to the journals depends, however, on the possibility to pay the required subscriptions. Subscription prices have kept increasing steadily and substantially since at least three decades, in part due to the growth of the number of scientific articles published. Contrary to what could be expected, the electronic implementation of publications seems to have increased the cost of the subscriptions. At the same time public funding has dwindled. The widening gap between costs and funding led to a decrease of the acquisition power of libraries of such publications and consequently to a decrease in dissemination of scientific results.

Normally, astronomical/astrophysical publications are not remunerated. Scientists need, however, to be considered as owners of their work, and the influence or importance of their results has to be duly acknowledged. On one hand, this defines the genuine rights of scientists. On the other hand, it establishes an unavoidable dependence with the publishers, who own the required professional publishing practice and environment enabling high level presentation of the scientific results, their effective dissemination, the access to them and their citation, and carry the various procedures ensuring the evaluation and valorization of the scientific work at national and international level.

The hampered accessibility to publications and the embargo imposed by the publishers on the newly issued articles, have unleashed the OAI. Although attractive to researchers, this initiative has foremost echoed among the government authorities and public-funding institutions. Since the latter consider that “publicly-funded research results are a public good, and as such should remain in the public realm”, they immediately urged the researchers to publish in open access journals, and/or deposit their articles in open access repositories. OAP demands several implementations to finance the publications. Accordingly, authorities have made statements of principles, but in most cases nothing significant was concretely done to carry out the required changes.

1.2 Open Access Publishing (OAP)

OAP brings a new model for scholarly journal publishing that provides immediate, worldwide, barrier-free access to the full text of all published articles. OAP allows interested readers to view, download, print, and redistribute any article without limitation enabling far greater distribution of an author’s work than in the traditional subscription-based publishing model. Statistics show that in a variety of fields OAP increases quotations and thus the impact of the published work.

In the OAP model, the costs to publish an article are paid from an author’s research budget or by their supporting institution through an Article Processing Charge (**APC**). These APCs replace the traditional subscription charges and page charges (if existent) and allow publishers to make the full-text of every published article freely available to all interested readers. In addition, authors who publish in the open access journals retain the copyright of their work, which is released under a “Creative Commons Attribution License” that enables unrestricted use, distribution, and reproduction of publications provided they are properly cited.

1.3 Flavours of OAP

Apart from the principles defining the OAP stated above, there are several modes to accomplish this way of publishing. The various forms proposed up to now can be summarized as follows:

1) **“Green OA”** This basically means self-archiving by authors, e.g., by depositing manuscripts on institutional or subject-based repositories like arXiv/astro-ph (Sect. 2.6.3) and PubMedCentral, or even on authors’ home pages. This concept has known issues, in particular regarding the (lack of) peer-review, retrievability and preservation of the literature. The layout of manuscripts archived under the Green OA concept often differs from the final version that is available from the publisher. Depending on the publisher and subject area, authors may self-archive and provide access to their manuscripts already during or only after an embargo period imposed by the publisher.

2) **“Gold OA”** Gold OA is also referred to as “open access publishing”. The entire content is made available immediately at no costs to readers. Authors (or their funding agencies, institutions, etc.) pay a publishing fee (typically called article processing charge (APC)) to make the content available immediately at no cost to readers. Many journals that operate otherwise on a subscription-based business model offer their authors the option to pay an APC and thus make their specific manuscripts available through Gold OA; these publications are referred to as “hybrid” open access journals.

Additional flavours of open access include:

- Delayed open access: access is free for everyone after a given time;
- Time-limited access: selected articles are made available free of charge for a given time. This type of service is typically financed by the publisher as a “teaser” to attract new readers.

Open access concepts can be applied by electronic-only journals as well as by those that exist in print and electronic format.

1.4 Initiatives to reach OAP

According to: a) budgetary difficulties of libraries; b) opportunities provided by internet; c) the fact that public funds are significantly involved in the scientific publishing process, the declarations in favour of open access [i.e. Budapest Open Access Initiative, February 2002; Berlin Declaration on Open Access to Knowledge in the Sciences and Humanities, October 2003], were signed by thousands of individuals and organizations, as well as by the major research institutions and funding bodies in the world. These proposals have been favorably accepted by the civil society (e.g. the World Summit on the Information Society) and by political bodies at national and international levels (e.g. the OECD Declaration on Access to Research Data from Public Funding). In the UK, the House of Commons recommended in 2004 that public funding agencies require open access to publicly-funded research through deposit of the publications in the authors’ institutional repositories.

1.4.1 EU initiatives

Between 2007 and 2011 the European Research Council (ERC), European Research Advisory Board (EURAB), European Commission-1, European University Association (EUA), European Heads of Research Councils (EUROHORCs), European Commission-2, European-OCEAN Consortium on Ocean Ecosystem Analysis have issued funder mandates. In 2008, the European Commission launched the “Open Access Pilot in the Seventh Framework Programme (FP7)” (hereafter called EU-OAPi), intended to provide researchers and other interested members of the public with improved online access to EU-funded research results. And in August 2012, the EU commissioner Neelie Smit Kroes advocated in a public statement strongly to deposit the results from all publicly funded research immediately in digital open access repositories. Also the “Europe 2020 Flagship Initiative Innovation Union” contains an open access clause.

The EU-AOPi aims to permit easy and free access to scientific information, in particular peer-

reviewed scientific articles published in journals. It is intended to boost the visibility of European research and offer small and medium-sized enterprises access to the latest research for usage.

It appears that there are several hundreds of publishing houses in Europe. European researchers publish roughly 43 % of the research papers produced across the globe.

The EU-OAPi will ensure open access to a significant amount of scientific articles resulting from research funded under FP7. The EU-OAPi, which will run until the end of FP7 (in 2013), covers approximately 20% of the FP7 research budget. Grant agreements in these areas signed after the beginning of the EU-OAPi will contain a special clause requiring beneficiaries: - to deposit articles resulting from FP7 projects into an institutional or subject based repository; - to make best efforts to ensure open access to these articles within six months (Energy, Environment, Health, Information and Communication Technologies, Research Infrastructures) or twelve months (Science in Society, Socio-economic Sciences and Humanities).

These proposals were then slightly modified, so that the ERC and EURAB recommend to skip the embargo period by bringing only the metadata in open access immediately after publication, while the full article should be put in “enclosed open access”, i.e., only the metadata is in OA, but the articles become openly accessible upon researcher’s and publisher’s permission and depending on the juridical status of the document.

1.4.2 National developments

A survey of existing open access regulations among the (above mentioned) EUROHORCs member organizations in December 2007 revealed a large variety of open access policies in the member countries. This led the General Assembly of EUROHORCs to recommend a minimal standard regarding open access to the member organizations in April 2008¹.

An overview of current open access policies and mandates and their implementation in EU member states is provided by OpenAIRE (Open Access Infrastructure for Research in Europe; <http://www.openaire.eu>). In the following, the situation in some countries is briefly summarised. The information below is available on the OpenAIRE webpages.

France has played an important role in the European open access movement. Especially in the Humanities and Social Sciences has started an important initiative for open access journals with the [Review.org](http://www.review.org) platform. Universities and “grandes écoles” joined the open access movement with some delay, but at the beginning of 2010, 30 of them have an institutional repository. The Main French research funder ANR (National Research Agency) has issued an open access policy in 2007 and strongly encourages depositing of publications from research it has funded in the multi-disciplinary open access archive HAL (Hyper Articles en Ligne).

German research organizations, in particular the Deutsche Forschungsgemeinschaft (DFG), the Max Planck Gesellschaft (MPG), the Fraunhofer-Gesellschaft, the Helmholtz Association and the Leibniz Association, actively support open access projects and initiatives. A national OA mandate is not in place, but some university and research institutions signed the 2003 “Berlin Declaration on Open Access to Knowledge in the Sciences and Humanities” and run institutional or subject-based repositories.

In the Netherlands there is a widespread awareness of open access. Since 2005, all Dutch universities have signed the Berlin Declaration, and all of them have one or more repositories. Central access to these repositories is provided by a portal of the NARCIS (National Academic Research and Collaborations Information System). NARCIS also offers access to datasets as well as information about experts and organizations. The major research funders, the Netherlands Organization for Scientific Research (NWO) and the Royal Netherlands Academy of Arts and Sciences (KNAW) do not have OA mandates, but strongly support the open access movement.

In the UK, even more specific is the “Statement on Access to Research Outputs” by the UK Research Councils that holds the following four principles: ideas and knowledge derived from

¹<http://www.openaire.eu/en/open-access/mandates-a-policies>

publicly-funded research must be made available and accessible for public use, interrogation, and scrutiny, as widely, rapidly and effectively as practicable; effective mechanisms are in place to ensure that published research outputs must be subject to rigorous quality assurance, through peer-review; the models and mechanisms for publication and access to research results must be both efficient and cost-effective in the use of public funds; the outputs from current and future research must be preserved and remain accessible not only for the next few years but for future generations.

However, in all countries discussions on these policies continue at all levels.

1.4.3 Some special attempts to have OAP

In the rather limited field of high-energy particle physics a special solution to the basic problems of costly publishing has been created. The Sponsoring Consortium for Open Access Publishing in Particle Physics (SCOAP³) pays publishers for the usual services (refereeing, etc.) and the article will then be in OA immediately in the journal the author has chosen. The partners in SCOAP³ furnish the funds according to the share of the total of the publications under this scheme. SCOAP³ thus has the power to negotiate prices. For more about SCOAP³ see Appendix A.1. A list of publishers and journals that participate in SCOAP³ can be found at <http://scoap3.org/faq.html>, Sect. 4. Among them is also the New Journal of Physics (NJP; see Appendix A.2).

2 Current astronomy publishing

The goal of this report is to explore the state of publishing in view of possibly transit to OAP. Because the EAS initiated this report, it addresses initially the European publishing practice. However, astronomy is a very international endeavour and numerous research results from Europe are being published in journals based outside Europe, and *vice-versa*. Thus journals published outside Europe are an essential part of this report.

2.1 Astronomy journals

A scientific journal is a channel that enables diffusion and exchange of scientific results that helps to maintain ideas vivid and make them fruitful. It is a space that must be long-lived to make possible referencing, comparisons, and open debates at any time. It is a collection of texts normalized according to specific language codes which are currently used in the respective scientific communities, who consider the gathered publications their cultural or intellectual property. It also avoids that ideas are dispersed in more or less unknown publications or presented within frames that may hide the information they are carrying. To preserve the freedom and independence in creativity, the scientific journals are preferably owned by learned societies. These journals are thus open to scientists of all nations, and the journals are not burdened either by whatever belief or political and economic constraints. All publications are subject to peer review that gives the published work a label of being of certified quality.

The peer-reviewing is kept free from whatever external pressure to ensure that the judgment on the quality of publications is unbiased.

In Europe, astronomers publish their work in several journals of national and international character, which all have world-wide diffusion. The journals published in Western Europe with the highest circulation are MNRAS, A&A, A&AR, Ap&SS and New Astronomy (NA), while in Eastern Europe the best known is Astronomy Reports (Azh). Astronomers from the eastern part show an increasing tendency to publish in Western European journals, the opposite occurs rarely.

Important astronomy journals are published in the USA. These include the Astrophysical Journal, ApJ, with its supplement series, ApJS, and its letters section, ApJL. Three more important journals are the Astronomical Journal, AJ, the PASP, and the review journal Annual Review of Astronomy & Astrophysics (ARAA).

Astronomy journals of some relevance published outside both Europe and the USA are the PASJ from Japan and the Ap&A journal from India; these will not be considered here further.

There are also important specialized journals like Solar Physics, Icarus, Celestial Mechanics, etc., published in part in Europe. These are journals in the sense of this report, but given their specialization and generally small circulation they are also not further discussed.

It must be noted that the scientific work in astronomy is today carried out mostly through international collaborations. The journals largest in information content have more or less similar publishing vocations. They are, however, characterized by fairly different business models, so that they each face the possible change to genuine OPA with different difficulties.

2.2 Traditional astronomy journals in Europe

Monthly Notices of the Royal Astronomical Society (MNRAS) is a primary research journal in astronomy and astrophysics and one of the oldest (established in 1895). It publishes the results of original research in positional and dynamical astronomy, astrophysics, radio astronomy, cosmology, space research and the design of astronomical instruments. It is owned by the Royal astronomical Society (UK) and served initially the british Commonwealth. Currently, two thirds of its content originates from outside the UK. It is run entirely by astronomers, receives no financial support from anywhere, is produced by a commercial publisher, and some profit goes to the RAS.

All published papers are peer-reviewed. They are linked to the ADS database (see Sect.2.6). A paper edition is produced as well as a parallel electronic (on-line) edition. Access to the on-line version of the journal is free to subscribers of the journal. There are no page charges, so that the MNRAS is entirely financed by subscriptions.

MNRAS is currently published by Oxford University Press (OUP). OUP offers Gold OA via the Oxford Open website to authors paying an APC. In addition authors are allowed to self archive (in publicly available repositories) preprints. However, the OUP requests that after publication these preprint versions are not replaced by the pdf of the final peer reviewed article. This is a limitation on the green OA requirements.

Astronomy & Astrophysics (A&A) was established in 1969 through the amalgamation of various European national journals, originally published in several languages but foremost in English. The countries of these journals then became “member countries” of A&A. In 2004, A&A removed the “European” as non-european countries joined the A&A enterprise. A&A is governed by the Board of Directors whose members are designated by the Member Countries.

A&A publishes papers on all aspects of astronomy and astrophysics (theoretical, observational, and instrumental). All papers are peer-reviewed and linked to the ADS database (see Sect.2.6). Language editing is provided for most papers. The copyrights of A&A belong to the European Southern Observatory. A&A is published by EDP-Sciences, a french publishing company owned by three french learned societies. A paper edition is produced as well as a parallel electronic (on-line) edition. Access to the on-line version of the journal is free to subscribers of the journal.

In 2010, A&A was the first astronomy journal to change to an article-numbering system, more suitable to the electronic era than a page-numbering system.

A&A has in two aspects Gold OA and the option for paid OA. 1. The A&A Letters are since 2008 in Gold OA, as are the online sections (astronomical instrumentation, online data and catalogs, numerical methods and codes, and atomic and molecular data). 2. The newest papers published in A&A are in Gold OA for the week following their publication. For this option, readers have to register with the publisher. The A&A publisher monitors the downloads to make certain that there is no foul play by some readers. 3. A paid Open Access option exists for an article, currently for a fee of 200 euros (without VAT) per article, payable by the authors or their funding bodies.

Finally, A&A has “delayed open access”. Its embargo period is at most 2 years. The Publisher of A&A encourages arXiv archiving, or self-archiving of the final .pdf file corresponding to the article

as it is published in the Journal, so that A&A is at all times a Green OA journal.

Astrophysics and Space Science (Ap&SS) was established in 1968 and is published by Springer. It publishes original contributions and invited reviews covering the full range of astronomy, astrophysics, astrophysical cosmology, planetary and space science and the astrophysical aspects of astrobiology. This includes observational and theoretical research, the techniques of astronomical instrumentation and data analysis, and astronomical space instrumentation. It welcomes papers in the general fields of high-energy astrophysics, astrophysical and astrochemical studies of the interstellar medium including star formation, planetary astrophysics, the formation and evolution of galaxies and the evolution of large scale structure in the Universe. All papers published are subjected to peer-review.

New Astronomy (New Astron.) was created in 1999 and is published by Elsevier to publish articles in all fields of astronomy and astrophysics, with particular focus on computational astronomy: mathematical and astronomy techniques and methodology, simulations, modelling and numerical results and computational techniques in instrumentation. It includes full length research articles and letters. The journal covers solar, stellar, galactic and extragalactic astronomy, and astrophysics. It reports on original research in all wavelength ranges, from radio to gamma-ray. The articles are peer-reviewed. There are no page charges. Access to the electronic version is closely guarded.

Astronomy Reports (russian: *Astronomicheskii Zhurnal*, Azh), is a Russian, monthly, peer reviewed, scientific journal founded in 1924. It publishes original research regarding astronomical topics. Other types of reporting are also included such as chronicles, proceedings of international conferences, and book reviews. It was the most prominent astronomy journal during the age of the Soviet Union. It is also available online. Azh is translated into English by the International Academic Publishing Company Nauka/Interperiodica (MAIK Nauka/Interperiodica), which is also the official publisher. Since 2006, access and distribution outside of Russia is made through Springer. In addition, the English version of the journal is published simultaneously with its Russian version. Since 1999, it has produced 12 issues per year.

Astronomische Nachrichten - Astronomical Notes (AN), established in 1821 in Germany, is the oldest astronomy journal published. In its renewed appearance it is intended to serve as a supplement in all fields of astrophysical research including instrumentation, numerical methods, solar and stellar astrophysics, extragalactic and cosmological research. It can be used also for refereed workshop proceedings. It has no page charges. It publishes 10 issues per year with a total of about 1000 pages.

Astronomy and Astrophysics Review (A&AR), established in 1989, publishes reviews by experts from around the world. The topics covered include all areas of astronomy and astrophysics. They provide a starting point for scientists or students seeking access to a new or unfamiliar field as well as for researchers and lecturers in need of authoritative material in fields new for them. The number of reviews published is between 5 and 10 per year.

Generally on journals published in Europe, some leading scientists in astronomy in Europe have seen these journals as a tribune to foster a European identity and cultural independence. The fostering of this identity is certainly a big challenge that European astronomers should accept. It will allow to keep cultural differences alive which often lead to new research approaches and/or research policies. They both can give added value to the research contributions, to researches themselves, and certainly to journals that publish them. Promoting the european journals is worthwhile because of the trend of systematically under-quotation of European research, which has negative effects for the valorization and evaluation at national and international levels of researchers. The trend has been somewhat reversed with the advent of the “preprint server” astro-ph (see Sect. 2.6.3).

The fostering of the European identity can also be done by boosting the visibility of the European research in the frame of the OAP option for scientific results. This aim is in agreement with the statement of principles put forward by the EU institutions willing to implement OAP. However, such an implementation also requires that a number of public charges (such as VAT or licences for

publication techniques) in the EC be reduced considerably since they keep pushing the prices of publications up beyond reasonable limits.

Up to now, European astronomers have been keen to publish in the classical journals, some of them mentioned above. They have been preferred certainly due to their long and uniform good record of the astronomical and astrophysical research published. Moreover, the rate of citations and the higher impact factors of these classical journals attract good potential authors which in turn increases the interest from readers. This “virtuous circle” ensures the authors the required valorization of their work, which is today needed to satisfy the expectations of the research funding authorities.

2.3 Important astronomy journals published outside Europe

A large number of astronomy journals is published outside Europe. The ones most important for European astronomers are briefly described.

First we describe the journals owned by the learned society, the American Astronomical Society (AAS): the ApJ, ApJS, ApJL, and the AJ.

The Astrophysical Journal (ApJ) is one of the foremost research journals in the world devoted to recent developments, discoveries, and theories in astronomy and astrophysics. Many of the classic discoveries of the twentieth century have first been reported in this Journal. It is a peer-reviewed scientific journal founded in 1895 by the American astronomers George Ellery Hale and James Edward Keeler. It publishes three 500-page issues per month.

The Astrophysical Journal Supplement Series (ApJS) have been published, since 1953, in conjunction with the Astrophysical Journal. It aims at publishing significant papers containing extensive data or calculations, or of very specialized interest. It publishes six volumes per year, with two 280-page issues per volume.

The Astrophysical Journal Letters is the Letters part of the ApJ. It is peer-reviewed and allows astrophysicists to rapidly (electronically) publish short notices of significant original research. As of 2011, it is printed once per year for those who opt to have this service.

The Astronomical Journal (AJ) is the premier journals for astronomical observations. It is peer-reviewed and is published monthly. The AJ publishes with an emphasis on significant scientific results derived from observations, including descriptions of data capture, surveys, analysis techniques, and astronomical interpretation. It takes a broad view of astronomy, extending from the solar system to observational cosmology with a tradition of papers discussing dynamical processes.

The journal was established in 1849 by Benjamin Gould. Its publication was interrupted (1861-1885) due to the civil war. In 1941, the responsibility for the journal was transferred to the AAS.

The **AAS** calculates author charges for the ApJ, the ApJS, the ApJL, and the AJ using units of information in digital form supplied by the authors, i.e., digital quanta (digital form which includes words, figures, tables, digital-only components, and figures within a figure set). The AAS followed in 2011 the example of A&A and adopted also for its journals the article-numbering system, which is more suitable for on-line publishing.

The ApJ, the ApJS and the ApJL were published by the University of Chicago Press for the AAS. In January 2009 publication was transferred to the “Institute of Physics Publishing” (IOP), following the move made by the society’s Astronomical Journal in 2008. The reason for the change was given by the Society as due to the increasing financial demands of the Univ. Chicago Press.

The IOP enables authors and their funding agencies to make the final published versions of their research papers freely available online on payment of a publication fee. The fee covers all publication costs, from the management of peer review to the online hosting, dissemination and long-term archiving of the published paper. 34 journals published by IOP offer this option. This includes seven pure OA journals² and 27 “hybrid” subscription journals, among them some relevant

²These IOP pure OA-journals include: *Advances in Natural Sciences: Nanoscience and Nanotechnology Environ-*

for astronomy³. IOP also supports authors who are required by their funding agencies to make their research papers freely available via an institutional or subject repository. Authors may post their accepted manuscript in an institutional or subject repository after an embargo period of 1-2 years following publication, depending on the journal.

The Publications of the Astronomical Society of the Pacific (PASP) (country: USA) has been published regularly since 1889, as part of the ASP's mission to advance the science of astronomy and disseminate astronomical information. The PASP provides an outlet for astronomical results of scientific nature and serves to keep readers in touch with current astronomical research. It publishes refereed papers on astronomical research covering all wavelengths and distance scales as well as papers on the latest innovations in astronomical instrumentation and software. It also publishes invited reviews and dissertation summaries. It is produced by The University of Chicago Press on behalf of the Astronomical Society of the Pacific.

Authors pay page charges that depend on the type of published papers. Access to electronic issues of Publications of the Astronomical Society of the Pacific that are more than three years old is available without a subscription. Issues from the recent three years are restricted to institutional and individual subscribers.

Annual Reviews of Astronomy and Astrophysics (ARAA; country: USA) publishes since 1963 reviews by experts from around the world in the form of a book. An editorial Board selects each year topics of interest for that time frame and then invites authors to write a review. All areas of astronomy and astrophysics are covered. As with each journal of reviews, the articles in ARAA provide a starting point for scientists or students seeking access to an unfamiliar field as well as for researchers and lecturers that need authoritative material in fields new for them.

The number of reviews published per year in ARAA is 15 to 20. ARAA has a much higher standing than its younger counterpart A&AR.

2.4 Two special journals

Two international journals play a special role. These are the “all science” journals Nature (UK) and Science (USA).

Nature (Country: UK) is a weekly international journal created 1869 publishing peer-reviewed research in all fields of science and technology on the basis of its originality, importance and interdisciplinary interest. Nature also publishes Reviews, as well as a broad range of informal material in the form of Editorials, News and News Features, Correspondence, Opinion, News and Views, Books and Arts, Futures (the award-winning science-fiction series) and NatureJobs (articles on careers and recruitment). The journal also publishes regular supplements, including Insights, Outlooks and Technology Features. Nature publishes much online-only information, including the award-winning daily Nature News, blogs, regular web focuses (collections of topical material, often from the journal's archive) and other web-only special features. Research selected is said to be of the highest quality and impact in their specific disciplines. Nature's mission statements are: 1) to serve scientists through prompt publication of significant advances in any branch of science, and to provide a forum for the reporting and discussion of news and issues concerning science; 2) to ensure that the results of science are rapidly disseminated to the public throughout the world, in a fashion that conveys their significance for knowledge, culture and daily life.

The Nature Publishing Group (NPG, www.nature.com) does not ask for page charges and the

mental Research Letters, IOP Conference Series: Earth and Environmental Science, IOP Conference Series: Materials Science and Engineering, Journal of Physics: Conference Series, New Journal of Physics, Science and Technology of Advanced Materials.

³IOP hybrid OA-journals perhaps relevant for astronomy include: Classical and Quantum Gravity, EPL, Inverse Problems, Journal of Cosmology and Astroparticle Physics, Journal of Instrumentation, Journal of Physics A: Mathematical and Theoretical, Journal of Physics B: Atomic, Molecular and Optical Physics, Journal of Physics D: Applied Physics, Journal of Physics G: Nuclear and Particle Physics, Journal of Physics: Condensed Matter, Journal of Statistical Mechanics: Theory and Experiment, Physics Education.

publications are sustained by subscriptions. Nature research journals publish papers online weekly, with a hard copy compiled monthly. Material submitted to Nature journals must not be discussed with the media, except in the case of accepted contributions, which can be discussed with the media no more than a week before the publication date under NPG's embargo conditions. NPG encourages the self-archiving of the accepted version of manuscripts (authors version) in the respective funding agency's or institution's repository, six months after publication. The NPG is expanding open access choices for authors through both "green" self-archiving and "gold" (authors-pays) open access publication routes. The journals offering this option are not used by astronomers.

Nature is the world's most highly cited interdisciplinary science journal and an considerable number of astronomical contributions are published there.

Science (country: USA) is the academic journal of the American Association for the Advancement of Science (AAAS) and is one of the world's top scientific journals. Science was created in 1880, is peer-reviewed, is currently weekly published, and it has a print and online access subscriber base. The journal publishes important original scientific research and research reviews, but also science-related news, opinions on science policy and other matters of interest to scientists and others who are concerned with the wider implications of science and technology. Unlike most scientific journals that focus on specific fields, Science covers the full range of scientific disciplines. Although it is the journal of the AAAS, membership of the AAAS is not required to publish in Science. Papers are accepted from authors around the world. Competition to publish in Science is intense, as an article published in such a highly cited journal can lead to attention and career advancement for the authors. Fewer than 10% of articles submitted are accepted for publication.

Online versions of full-text archive articles are not generally made available to the public. Full text is available online to AAAS members from the main journal website. Individual and institutional subscriptions are also available for a fee (though it is significantly less expensive to simply join the AAAS and receive the magazine for free). The Science website also gives free access to some articles (principally original research articles and editorials) as well as the complete table of contents of the current and past issues, a year after their publication. Access to all articles on the Science website is free if the request comes from an IP address of a subscribing institution.

Both Science and Nature have very high impact factors. For that reason these journals are regarded as the best. In the practice, most of the astronomy research publications in these two journals serve to announce new findings whereas the details of the research are published in the "regular" astronomy journals.

2.5 OA astronomy journals

2.5.1 Two special OA journals

Two special OA journals deserve mentioning. They have a form in between the classical review-article journals and the newer OAP journals. They are:

Living Reviews in Solar Physics (Country: Germany) is an exclusively web-based, peer-reviewed journal, publishing reviews of research in all areas of solar and heliospheric physics. Living Reviews in Solar Physics is a service provided by the Max Planck Institute for Solar System Research.

Living Reviews in Relativity is the first (and original) "living journal"; it is now online for over five years. Living Reviews in Relativity is a service provided by the Max Planck Institute for Gravitational Physics research.

Articles are solicited from leading authorities and are intended for readers at or above the graduate-student level. The articles provide up-to-date critical reviews of the state of research in the fields they cover. Articles also offer annotated insights into the key literature (where possible with active links) and describe online resources available in these fields. Living Reviews is unique in maintaining a suite of high-quality reviews; its articles are subjected to strict peer-review. They are kept up-to-date by the authors, which is the meaning of the word "Living" in the journal titles.

The goal of these journals is to develop its articles into a carefully screened and edited, well-integrated, topical set of hypertext documents that, taken together, form a valuable research tool for the particular research communities. Their aim is to become one of the first places a scientist looks for information about work in the fields covered by the journals. Both journals are supported by the Max Planck Digital Library (MPDL).

2.5.2 OA and predatory publishers

A disturbing phenomenon has emerged along with the proliferation of new OA journals. This is the emergence of so-called “predatory publishers”.

Jeffrey Beall, a librarian at the University of Colorado, coined the term “predatory publishers” and defines them as “...those that unprofessionally exploit the author-pays model of OAP (Gold OA) for their own profit”⁴. Beall explains how predatory publishers are corrupting the entire scholarly publication system by misusing the author-pays model of open access. He argues that honest authors who publish in OA journals are also damaged by a likely unethical environment polluted by plagiarism, lack of quality control, and unsound publishing methodologies. Beall suggests that despite the pressure to publish, authors should resist the temptation to publish with predatory publishers, and librarians shouldn’t list such OAP-Journals in their catalogs.

While it has to be noted that Beall’s list is quite subjective and should be used with caution, it certainly provides an interesting (skeptical) view on some of the companies that are currently active in the OA publishing sector. Beall’s list with his Scholarly OA blog (<http://scholarlyoa.com>) has created a lot of discussion about undue behaviour among OA publishers.

Characteristics of predatory publishers include:

- spam sent to professional email lists to solicit articles and editors;
- “vanity presses” with basically no rejections and large numbers of journal titles in their portfolio;
- articles published without complete author approval;
- articles published before payment terms are agreed;
- errors introduced after proof-reading;
- papers published without peer-review.

Several of these listed characteristics are not easy to spot for an honest author. However, some points could be checked by every potential author.

- does the journal’s webpage list the names *and* affiliations of their editors and reviewers?
- are editors and referees geographically dispersed?
- are the offices of the publisher located where they claim to be, or is there only a mailbox address?
- does the publisher give clear information about the publishing costs?
- are the articles published in the journal up to the expected standard of quality?
- is the journal indexed by a citation database applying quality standards for the journals included in their listings, e.g., Web of Knowledge (<http://wokinfo.com>) or Scopus (<http://www.scopus.com>)?
- is the publisher member of OASPA (OA Scholarly Publishers Association, <http://www.oaspa.org>) and does it adhere to its Code of Conduct (<http://oaspa.org/membership/code-of-conduct>)?

2.5.3 Numerous OA journals

In the Directory of Open Access Journals (DOAJ), of which the aim is to increase the visibility and ease of use of open access scientific and scholarly journals, there are some two dozen OA journals in the world dealing with astronomy. These are pure OA journals, not hybrid journals that have the subscription and the article-OA model in place in parallel. These OA journals use a funding model that does not charge readers or their institutions for access, they execute peer review, they report primary results of research to a scholarly community, and they appear at regular intervals.

⁴Elliott, Carl, 2012: On predatory publishers: Q&A with Jeffrey Beall, *The Chronicle of Higher Education*, June 5, 2012; see <http://chronicle.com/blogs/brainstorm/on-predatory-publishers-a-qa-with-jeffrey-beall/47667>

New OA journals are created regularly. This field is very much in flux. For an up-to-date list we refer to <http://www.doaj.org>. One important aspect of such journals is that they need not have a home-base in a country. This is in line with the fact that they intend to be world-wide.

Publishing in these journals requires an APC at a level similar to that of the well recognized classical journals. For that APC, the article is peer-reviewed and produced in an internet-fit form. Articles are immediately accessible. No paper version is produced.

The DOAJ has taken on the problem of the creation of journals with another intent than to serve the science community (journals sometimes called “predatory”).

2.5.4 The DOAJ enhances criteria - Seal of Approval

The DOAJ is (at the time of writing of this report) in the process of constructing objective criteria that can facilitate more easily the compliance with the DOAJ criteria set, a requirement for being listed in the DOAJ. They provided the information following here.

These DOAJ-listed journals must meet the following criteria:

- *Journal will be asked to provide basic information (title, ISSN, etc.), contact information, and information about journal policies;*
- *Journal is registered with SHERPA/RoMEO;*
- *Journal has an editorial board with clearly identifiable members (including affiliation information);*
- *Journal publishes a minimum of five articles per year (does not apply for new journals);*
- *Allows use and reuse at least at the following levels (as specified in the Open Access Spectrum, <http://www.plos.org/about/open-access/howopenisit/>);*
- *Full text, metadata, and citations of articles can be crawled and accessed with permission (Machine Readability Level 4);*
- *Provides free readership rights to all articles immediately upon publication (Reader Rights Level 1);*
- *Reuse is subject to certain restrictions; no remixing (Reuse Rights Level 3);*
- *Allow authors to retain copyright in their article with no restrictions (Copyrights Level 1);*
- *Author can post the final, peer-reviewed manuscript version (postprint) to any repository or website (Author Posting Rights Level 2).*

The complete list of criteria can be seen at

<https://docs.google.com/spreadsheets/cc?key=0A1Fw8p9XB3C6dHE3ZC1Hd2FMMjAweE96czRQb3NDbnc&usp=sharing>

It is intended that future submissions for inclusion in to DOAJ must include the complete set of information provided by the publisher. This information will be publicly available in the Directory. The journals currently listed in the DOAJ will have to go through a re-evaluation process based on the new criteria. This work will take place over the next 12 months or so.

At the same time the DOAJ is launching the ***DOAJ Seal of Approval*** for Open Access Journals (in short: the DOAJ Seal) to encourage a high practice standard. These journals will be identified with the DOAJ Seal logo.

To receive the DOAJ Seal, also various detailed criteria have to be met. A subset is:

- Provides machine readable copyright information to help search engines identify open works;
- Provides DOIs at the article level;
- Provides metadata to DOAJ at the article level;
- Has a digital archiving/preservation arrangement in place;
- Allows use and reuse at least at the following levels (as specified in the Open Access Spectrum, <http://www.plos.org/about/open-access/howopenisit/>).

The DOAJ has the ambition to continue to be the white list of open access journals that are global in scope in terms of geography, scientific discipline and language.

2.6 The OA archives/repositories for astronomy research

Storing science data and the results derived, viz. publications, has become an essential aspect of science publishing. One has to distinguish between repositories for data and those for articles.

2.6.1 Repositories of astronomy data

The best known repository for astronomy data has been set up at the “Centre des Données Astronomiques de Strasbourg” (CDS). Long ago they took the initiative to collect and store all data on astronomical objects. The CDS takes care to verify the basic inputs, such as the correctness of names, of celestial positions, etc. Searches in the database are easy. Part of the output is a list of the publications in which the object is mentioned. In addition, the CDS stores for many objects observational data, such as photometry of stars, fluxes of galaxies, etc.

Other repositories exist at various observatories. Ease of access varies.

Noteworthy are the international Virtual Observatory initiatives, which do not only have the goal to archive astronomical data, but to use internationally agreed standards and to make “meta data” available. Such “meta data” allow to do searches for, e.g., multi-mission, multi-wavelength observations for a given target.

2.6.2 General aspects of article repositories

Article repositories are meant to store and preserve publications for eternity. Such repositories must be viable to store paper based publications or electronic publications.

Some repositories accept publications of different kind: research articles, review articles, state of the art/topicality in a discipline, PhD theses and other theses, various reports, publications for students, popularizing publications, etc. Does this variety of the publications archived lead to reluctance among scientists to refer to such publications and/or reluctance to use such repositories? Electronic repositories often accept different versions of the same paper that may or may not have been evaluated by peer-reviewers. Should one insist that repositories for research in astronomy be more specific/targeted regarding the type of publication they accept and should one require that the papers put in repositories be all peer-reviewed? One therefore can ask various questions.

- Do existing repositories enable easy access to the original publications? Are these repositories sufficiently known for current use? Are they transparent enough to know immediately that authors have deposited new articles somewhere?
- How long do repositories store the documents? Or rather, should they store and keep them accessible indefinitely?
- The electronic archives that traditional journals must develop to face the demands for OA must be perennial. Does present technology fulfill such expectations?
- If a journal decides to change publisher, how will it manage to conserve the electronic archives? What needs to be done so that archives are entirely owned by the journal?
- Are there legal frames that preserve the ownership of publications and who are then the owners? Is it (or should it be) the author, the research-funding institution, the journal?

None of these questions can be authoritatively be answered.....

In many disciplines outside astronomy more than 80% of researchers readily put their articles in various archives themselves, a little more that 10% do it with some help, the remaining ones are reluctant to use archives (according to a survey). The vast majority of researchers in astronomy put all their publications in repositories always (see Sect. 2.6.3).

Finally, indicators/indices of the scientific activity have become a main concern for scientists, since they have political dimensions. In fact, allocation of funding for new projects as well as the progression of careers directly depend on these indicators. Publishers of our traditional journals and those in OA have implemented the required tools to proceed to the statistics that enable such evaluations. Do the currently used repositories provide these tools to rate the scientific activity?

2.6.3 The astronomy database for newest publications: astro-ph at arXiv

arXiv was originally (early 1990s) hosted at the Los Alamos National Laboratories. arXiv is a database system with the goal to be a “pre-print server”, ensuring the earliest dissemination of new research results. Several mirror sites were set up, the first in Europe at SISSA in Trieste. Since 2010, arXiv is run by Cornell University, with financial support from several (large) institutions world wide. The annual budget for 2010 was \$ 400,000 (see the arXiv website). The astrophysics part is called astro-ph.

Researchers submit their article as text file with figures. This information (article title, authors etc., and the abstract) is then listed and the article is available as a (downloadable) preprint. Revised versions can be added. Readers can subscribe to an email service, through which they get informed about articles of their topic of interest. Lists of the essentials are sent out on a daily basis.

The large majority of astronomy researchers sends their papers to the astro-ph part of arXiv. Most of these submissions have completed the peer-review process of a regular journal. The astro-ph is very intensively used. At conferences numerous articles referred to are very new and only have an astro-ph identification.

Thus, astro-ph at arXiv is the major subject-based repository for astronomy (Green OA).

2.6.4 Comments on article repositories in general

Having many different “open” repositories, such as those of authors, of institutes, or other agents, is for a science field not helpful. Moreover, such repositories may have different lay-outs, likely have different update frequencies, and depend on the mood and whims of those who maintain them.

Essential for a good and well accessible repository is that it is stable and reliable, and that it covers a well defined area of science. Such good repositories become with time well known, and once they are there, they are the best one could hope for. Astronomy is lucky to have the “astro-ph” at arXiv. The policy of arXiv ensures that all astronomy publications are, in fact, in OA.

2.6.5 Access to article repositories

For science, finding relevant new and earlier publications is essential. Searches in the repositories of the main journals are easy. But one has to access several repositories.

Extremely useful is the portal “Astronomy Data Service” (ADS), a data-base financed by NASA, which gives links (and in part access to) actual publications. One can search by, e.g., author name to retrieve the bibliographical information of the author’s articles in whichever place or journal they have been published, plus a link to the pdf version⁵ (if available). In addition one can do a search for key words. This service is well established, it has several mirror sites in the world and is well supported by the various organizations.

2.7 What must astronomy consider with the push for OAP?

In the demands of institutions of the European Union (see Sect.1.4.1) it is stated that published papers, if they are not published in OA by the journals, must be deposited in open repositories.

⁵The ADS has scanned all publications of the main journals from the start of these journals up to the point where original journal pdf versions of articles are available.

This requirement eventually has to be fulfilled also by journals published outside Europe if European researchers choose to publish their articles there. For articles to be put in the repositories, it would be best that the archived version is only the one that journals have accepted after peer review and that they are accessible **even if an embargo is imposed on those articles by the publishers** (or at least, should be accessible a reasonable fraction of the imposed embargo time).

The embargo enforced by the publishers is, from a commercial point of view, needed to ensure their economic activity through subscriptions. The length of that period may have been chosen in relation with the time an article needs to acquire a given level of citations. This time depends on the discipline and/or on the theme. As a rule, the shorter the time to get the required quotations, the shorter the embargo phase can be. According to a statistical study carried out in 2006, the papers in astronomy and astrophysics attain on average 40% of citations after one year from publication and roughly 60% after two years.

It has been suggested that the citation rates of astronomical papers actually increase when articles are put in OA repositories. There are no hard data on that. If quotations actually increase, could one suggest the learned societies to shorten the embargo time accordingly?

Finally, most of the journals where astronomers publish regularly their results today, must change their business model (see Sect. 4.3) if they want to establish OAP. This means that the current “reader/library-pay model” with subscriptions must switch to the “author-pay model” or some equivalent “upstream-funding model”. Changing a business model is not easily accomplished, and the change will be in a different manner for each journal (see Sect. 6).

Whatever the business model of the journals, **scientific publishing must be considered as part of a research project. The funds needed for publishing represent in most cases a small fraction of the budget invested by the institutions funding research project proper.** Supporting/funding institutions should then consider this issue and adapt their funding policies according to the respective national or international funding modalities/usages.

3 The quality of journals

The quality of a journal is in part a perceived quality.

These “subjective” factors include: a) is validation/reviewing and quality control properly developed; b) is the processing done efficiently; c) how is the journal perceived in quality (e.g., “impact factor”; see below)?

3.1 Organizational quality

At the organizational level it is clear that the quality of a journal is defined by “technical” factors. These include: a) how well is the receiving and recording of research articles organised; b) is there adequate global editing; c) is language editing in place; d) is proof reading well organised; e) is attention paid to composition and processing of graphics; f) is the website for the published version well structured; g) is the archive well maintained.

3.2 Quality and impact factor

Is the quality of a journal reflected in the “impact factor”, **IF**?

The IF (a number) supposedly indicates how often a journal’s publications are cited in relation with the total amount of articles published in that journal. This immediately makes clear, that a journal’s high impact factor is no guarantee for a large number of citations to an individual publication in that journal. *Note* that the word “journal” is here used in a very broad sense, it also includes astronomy publications that only publish review articles, perhaps even in form of a book.

Because of this general nature of the IF, this number is often misunderstood.

- It is intrinsic to review article publishing “journals” to have (if they are perceived to have high quality) a very high impact factor. The ARAA as well as A&AR are in this high-IF category.
- “Normal” journals have a lower impact factor, perhaps at the “normal” level (for the science field). For astronomy it is clearly visible that this group includes the well established general astronomy journals A&A, AJ, ApJ, and MNRAS.
- The specialized journals as well as journals perceived to be in a different class of quality have the lower impact factor.

Some data for the main research journals.

The impact factors change continuously, numbers are for early 2013. Also embargo times are in flux. The number of pages published per year is taken from an unpublished study of 2010; numbers given are for 2009, normalised to equal page content.

Journal	Impact Factor	Embargo year	pages /year
A&A	5.1	1-2	25500
AJ	4.9	1	5000
ApJ	6.7	1	31000
MNRAS	5.5	2	18500

3.3 Is there a relation between subscription price and quality?

As said, quality aspects of a journal are manifold. Price aspects are complicated (see Sect. 4.1).

In general, one might expect that a higher IF goes along with a larger circulation. This, in turn, should imply lower subscription prices. But the relation of price with circulation is in astronomy rather confused.

However, if quality is also meant to include the size of a journal (number of articles published per year), one might see differences between the journals. The smaller ones tend, in comparison, to be (quite) more expensive (price per page or price per bit of information).

4 Commercial aspects of astronomy publishing

Numerous aspects of the large variety of journals and publishers dealing with astronomy have to be considered in view of the goal of this report. For almost all journals and publishers, modalities and financial aspects are different. All these differences will make developing a general strategy for all journals toward OAP a daunting task. One aspect is common to all journals: making a journal is not for free and labour and services have to be paid for. And for astronomy it is relevant to know, that there are only about 700 astronomy institutional libraries, clearly defining the total possible circulation of astronomy journals.

In this report, we will assume that the costs of making a journal are those to make the material ready for publication in electronic form. This excludes the costs of the printing. Almost all journals offer a choice for their subscription of electronic-only, or electronic + printed, the OAP journals have by-and-large only the electronic version.

It is the choice of a subscriber to get (and pay for) a standardized printed version of the journal. However, it is not impossible that in the not too distant future printed editions will be rare.

4.1 The costs of making a journal

Publishing research in journals needs money for the publishing process. The balance of costs and income is set by

- **Costs** of the entire process which include: the peer review, possibly text polishing, perhaps technical work on tables and diagrams, technical work on the text in preparation for the digital form, the costs for administration of subscriptions and perhaps for advertising.

- **Income** from various sources, such as: subscriptions, page charges (or APCs), OA fees, subsidies, and perhaps from advertisements.

Details of costs vary from place to place according to, e.g., salary level (of where the work is done), hardware price levels, or other aspects.

It has to be repeated that, even if a journal is not made to earn money, considerable costs are involved in making a journal, be it a low quality or a high quality journal. This is equally true for the making of an OAP journal!

4.2 Non-Profit (NonP) compared with For-Profit (ForP) journals

The market of science publishing knows generally two kinds of publications, acknowledging there are also in between cases. For the present discussion we consider these two categories.

I. Publications by non-profit (**NonP**) organizations. They publish research results for the benefit of science, defraying the costs from various sources, but not diverting a balance surplus.

II. Publications by for-profit (**ForP**) organizations. The prime goal of these publishers is to make money by making good-looking journals of preferably high-class research. Costs are defrayed from subscriptions and other levies while the balance surplus is diverted.

The NonP and ForP situations may refer not only to the journals, but also to the publishers. A ForP Publisher may run a NonP journal; the reverse is, however, very unlikely.

Comparing the two kinds in practice shows interesting differences.

The NonP publications in astronomy appear to be dedicated to broader fields for a larger readership. The size of the circulation is rather large (for the science field). The journal mostly has a high IF. On average, NonP journals in astronomy are being made under the aegis of “learned societies”. The well known NonP astronomy journals are long-standing and successful journals.

The ForP publications are mostly dedicated to more or less specific interests/readers. The ForP publications are on average more expensive than the NonP (three times, roughly). The size of the circulation is rather small. Such journals have a lower impact factor. The higher prices are possibly due to a lower circulation for most of the ForP journals. Also, the ForP publishers are prolific in creating new titles/journals.

Sometimes, new ForP journals are created with the purpose of “milking the market”. The new journal seems to be important, scientists (like all humans) do not like to miss new developments, so one has to come up with the subscription price, thereby straining ones budget.

4.3 Business models

The business model, **BM**, is the way a journal is financed, how income and costs (as described in Sect., 4.1) are balanced.

ForP journals. Gains are made and these are diverted away from the journal. Obviously, commercial publishers give seldom insight into the details of their respective BMs. In the simplest case, the journal is financed solely through subscriptions. This applies mostly to the lower circulation journals, but also some higher profile journals have this BM.

NonP journals. For some of these journals the BM is known (approximately).

- Income essentially only from subscriptions, but some gains are diverted to the RAS, from where the flow into astronomical activities. This is the case of MNRAS.
- Income from subscriptions as well as from APCs (for essentially all authors), and perhaps from other sources. This is the BM of the ApJ and AJ.
- Income from subscriptions, from APCs of authors in non-member countries, and subsidies from the member countries that cover essentially only the costs of the refereeing process. This is the BM of A&A.
- Income only from APCs. This is the BM of Non-P OA-journals.

After comparing various journals one can see that (considering only the electronic edition) the production costs per page of a journal with a quality and a yearly size like that of A&A, ApJ and MNRAS is about the same.

4.4 Ownership of journals

The ownership of a journal may be an important factor in how the standing of a journal is seen.

Mostly, the NonP journals are owned by “learned societies”. Examples of that in astronomy are A&A (“owned” by astronomers through its Board of Directors), AJ and ApJ (owned by the Amer. Astron. Soc.), and MNRAS (owned by the RaS). It has to be noted that some learned societies have some profit goal with their journals, so these journals are, strictly speaking, cases of “in between” Non-Profit and For-Profit; the profit made is used for the science goals of these learned societies.

The ForP journals are owned by ForP publishers. Or rather, it is fair to classify a journal as ForP if it is owned by a ForP publisher. This classification does not preclude that a ForP publisher makes a NonP journal. The ForP journals are in the internet clearly visible as publisher owned.

Journals published by learned societies are by-and-large of high quality, as described above. Other journals are on average of lower quality.

Note on Web-domain and branding of NonP journals The four NonP high impact journals, A&A, AJ, ApJ, and MNRAS can, of course, be accessed through their webpages. Only A&A has its own web-domain. The other three journals *appear* in the internet as if they are owned by their publishers (and not by the respective learned societies). This leads to a recommendation in the interest of these journals. The research journals of the learned societies can maintain or even improve their standing by making clear they are “Non-Profit” indeed. This could be emphasized for the journals owned by the AAS and RAS by, e.g., making the electronic version available through a web-domain that clearly is part of the organization of the respective learned society. This may enhance the notion of quality and its sustainability. In general, the strengthening of the identity of a journal is often labelled with the word “**branding**”.

4.5 Prices of journals

4.5.1 Development of journal prices

Over that past decades the price of journals has increased considerably, creating real problems in the budgets of University and Institute libraries and leading to restrictions in the numbers of journals held. Some of the increase can be put down to financial inflation which affects the cost of all the processing. Another part is due to increasing technical facilities. Also the costs of licences has increased. Finally, a decrease in the number of subscriptions, mainly among individual researchers, has reduced the possible income.

The main factor for the increase in journal prices has been the increase in the number of articles published. This is so, because the number of scientists has increased and because the output per scientist also increased due to the vast amounts of new data becoming available from new observing and modelling facilities.

Some commercial publishers have raised their subscription prices markedly more than others. There are, however, astronomical journals whose price per page (or price per bit of information) has fallen consistently over the last decade as higher production efficiency has exceeded both journal growth and financial inflation.

4.5.2 Pricing policies

The actual pricing of journals has become non-transparent. Journals mostly offer a paper-only, an electronic-only, and a combined subscription. Many subscriptions are handled by brokering com-

panies instead of being a direct relation between subscriber and publisher. Subscription prices of journals are different for individuals and for institutions. And there are “bundles” (see below).

ForP journals define their subscription price such that the costs of the production are covered and the set level of gains is achieved. This does not preclude that they offer lower priced subscriptions to individuals or that they would not grant other kinds of deals. But the goal of the first sentence of this paragraph must be met including those other niceties.

NonP journals have, by definition, a subscription price that is tailored to just cover the actual costs of making the journal. Of course, some reserve is generated to have a financial buffer for financial mishaps. Often, NonP journals offer subscriptions to individuals at a nominal price level. E.g., A&A allowed individuals working in subscribing institutes to have a subscription at a price close to the level of postal costs plus the costs of the paper.

To complicate matters, there are prices for “bundles” of journals. This means that a publisher groups a large number of its journals in a “bundle” that can be subscribed to for a price lower than the sum of all the subscriptions. How the price for such a bundle can then be mapped on the individual journals is utterly obscure.

On the other side, libraries can organise themselves into consortia, and a consortium then has bargaining power against the publishers to obtain a reduced subscription price.

Because of this large variety on price possibilities, it is almost impossible to disentangle what is the actual cost of journals.

Finally, in whatever way the journals are priced, both the NonP and the ForP journals must pay the contractor that does the production. It is up to the owner of the journal to reach a financially good contract (within the set goals) with that contractor.

4.6 Which role play the authors?

In astronomy authors rather choose the journal to publish their science results based on a) the quality of journals (such as the impact factors); b) the tradition in their research field; c) direct costs involved (like the APCs, by whatever name they come); and d) the association with a learned society. Which of the four factors is the more relevant depends on the specific case.

The direct costs of publishing an article are relevant for researchers with limited budgets. These authors may opt to publish in journals without APCs. The journal’s subscription price plays a smaller role, since the money for that normally does not come directly from the author’s budget.

The tendency to consider impact factors is strengthened by the funding agencies, who erroneously think that only papers published in high-impact journals are good papers that will be cited often. If authors are guided by the impact factors they do this to the detriment of the economics surrounding the publishing activities and the rising costs.

4.7 Can publishing be done cheaper than currently?

It is legitimate to ask if publishing could be done at a lower cost. As said before, the costs considered here are only those for the electronic version. A few aspects come to mind.

First, all steps in the production of a journal should be as efficient as possible. This should be the interest of all journals. Journals not owned by a publishing house are here at an advantage in that they can explore the market for the best production deals. ForP journals are mostly owned by publishing houses; they also want to work in an efficient way but their financial goals are different.

Second, one could fancy to abandon ForP publishing. However, the question is how much one would save, in other words, is the gain publishers make collectively on ForP journals large? In astronomy, journals have in general a low circulation: the larger well established ones have only up to 1000 subscriptions from institutes, and these provide the basic income to make the journal.

Third, one might try to create more favourable tax and levy conditions for science publishing.

E.g., one could bring such journals in a low VAT bracket⁶). Governments might be sensitive for such a change but it would reduce crudely only roughly 1/10th of the subscription costs.

Merging journals could be considered. This would probably help only marginally because the number of research articles is not really correlated with the diversity of journals. E.g., merging two equally well established journals would just shift the work, it perhaps only would reduce a bit the amount of work (and thus costs) with the electronic presentation.

One could decide to compromise quality in certain areas of the production, by reducing the review process, lowering lay-out standards, reducing fanciful internet access, and the like. This particular road is tricky and, clearly, not serving the advancement of science.

But ultimately, the costs of making a journal depend on the efficiency of all steps in the production process, on the actual costs of all those steps, and on the profit margin of those unavoidable subcontractors that carry out those steps not done by the scientists themselves.

Finally, journals might become cheaper indeed if the gains made are not diverted to other goals. For the ForP journals the gains should then NOT go to the stakeholders, for the NonP journals the learned societies should refrain from diverting the gains to the goals of the societies. With the ForP journals the price reduction might be considerable, with the NonP journals that is less so.

5 What can OAP in astronomy deliver?

The drive for OAP came for a good part from those sciences, where the publishing was dominated by ForP publishers. The ForP publishers guard(ed) their property (the articles with copyright transferred) by limiting access to the journals to only the subscribers (at substantial costs). Also, in the internet era, digital access was and is strictly limited in that sense.

Astronomy has been lucky to have been open in all respects since time immemorial. Exchanges of ideas were open and publications or national journals have in times past often been financed by the local organizations (institute series financed by the institute, journals sometimes distributed for free on the basis of a fair exchange).

Astronomy now is also lucky in that almost all authors have, since the early 1990s, brought their articles into the pre-print “astro-ph” repository in arXiv (see Sect. 2.6.3). Thus, whatever NonP or ForP journals have decided in terms of embargo periods, all information has been readily available for everybody. This has not hampered the existence of the classical journals. Their “stamp of approval” based on the peer-review process is still highly valued.

So why push for OAP? One reason is the strong drive in other sciences and one should perhaps follow that. Another reason is that it is perceived unfair that research paid for by public funds is put under embargo by publishers. Whatever further arguments there may be, the push is there.

5.1 Can one reach OAP in astronomy? What would be the problems?

In spite of the merit and international political support to come to OAP, there are a number of unknowns and issues that may prevent this way of publishing be implemented immediately. OAP can be envisioned under specific models, but probably not generalized. The reasons for this difficulty and questions related with the issue deal with financial aspects, others are at the idealistic level.

• Costs

- Will OAP reduce the global cost of publishing astronomical articles?

Only marginally, and only if one could abandon all ForP publishing. However, in astronomy the well established journals are NonP (or close to that), so the cost-saving aspect would not be large and come foremost from the lower-circulation ForP journals.

⁶In France and Germany VAT for printed journals is 2.1% and 7% respectively, while they are 19.6% and 16% for electronic versions !

- Does OAP guarantee that prices of publications will not keep increasing steadily?
Clearly, that guarantee cannot be given. Work has to be paid for and salaries and hardware costs always increase due to general financial inflation. Moreover, when more articles are written and accepted, the size of a journal grows, which has to be paid for, too. It is illusory to expect substantial reductions in the total costs of all astronomy publishing (except when one degrades the quality of journals).
- Who will pay for the printed version of a journal?
Under OAP no subscription is to be paid. It is recalled that, with OAP, the work toward making an article ready for access through the internet is covered by the APC. Receiving a printed version is up to those who wish to receive one, and they will have to pay for that.

● **Article Processing Charges and author budget difficulties**

- Will all journals in OAP then come to APCs?
It is most likely they will, unless some benevolent entity would pay all costs up front. The required APCs would include all costs per article. But it is not at all inconceivable, that some journals might continue with the subscription BM.
- Who will pay the charges required for an article in OAP?
In the simplest form, the author is responsible for payment of the APCs. However, a high(er) level part of an organization (e.g., the institute, a funding agency, a ministry, or the government) might also take care of such APCs.
- When the author or his institute pays the APCs, where will the necessary funds come from?
This is the critical issue. Budgets are structured now the way they are, while in a situation with OAP the money likely has to come from a different budget. This aspect is discussed in more detail in Sect. 5.2.

● **Impact factor effects and APCs**

- Would the impact factors of the various journals be influenced by OAP?
This is difficult to predict. If the existing high-IF journals keep their standing and new journals do not take hold (e.g., because of poorer quality at various levels), not much will change. If, however, the APCs of high-impact journals would be much above those of low-IF journals, a shift might occur for financial reasons.
- Would authors (or agencies) accept an APC very high compared to the APCs of NonP journals?
It is to be expected, that at some point financial considerations will become important. However, these should not interfere with the scientific freedom of choosing the journal one feels is best for ones research.

● **Voluntary OAP and a mixed landscape vs. imposed OAP**

- If OAP were to be encouraged but not imposed, what would happen?
High-IP journals might continue in the subscription based fashion. But would authors still accept the embargo periods, intrinsic to the subscription BM? Or would the embargo periods become shorter, continuing the trend of recent years?
- Is the value added to research papers by journals in various ways worth the embargo period?
The value added consists of classifying the article as having a “stamp of approval” (based on the peer review as well as the editing), sending the papers to (protected) online links, providing citation statistics, etc. Researchers do need the “stamp of approval”. But they do not need those extras for immediate use. As long as the information gets disseminated to those interested, authors are not concerned by the other (embargo) limitations.
- How would a high-ranked journal react to a decision that OAP is imposed?
It is not predictable what a high-ranked journal (like Nature, which is ForP) would do. For the classical astronomy-research journals it would cause temporary problems because of the restructuring of the respective BMs as well as for the authors who need to restructure the funding to pay for the OAPs.

- **The effect of and on arXiv (astro-ph) and ADS**

- What is the gain produced by gold-OAP compared to the current arXiv (green-OAP) practice?
Here the answer is simple, there is little (except for the small fraction of papers that are not brought to astro-ph). But this is only this way, because for astronomy arXiv with its astro-ph functions very well. Without this green-OA repository the situation would be quite different.
- Would astro-ph of arXiv disappear?
It may be that the transition to gold OAP may lead to dwindling interest in arXiv astro-ph. But the services currently offered by astro-ph, now the most up-to-date (and in fact most central) repository of publications and “pre-prints”, are difficult to be matched if such services would have to come from all the journals that changed to OAP individually. Scientists then would have to search several databases, all in OAP, but no longer have a central one. Astronomy would be at a loss if astro-ph were to disappear.
- What would be the future of the ADS?
With each journal having its own OAP database, the function of the ADS becomes essential. The ADS would be the entry point to obtain the link to the desired article in whichever database it would reside. Astronomy would be at a loss if the ADS were to disappear.

- **Hybrid OA models**

- Is there a future for hybrid OA models?
The hybrid publishing model means that papers for which authors pay the required sum are brought immediately in OA, while other articles will be accessible after a given embargo time. This mode preserves the subscription base of journals, while it can respond to the demands for OAP formulated by funding institutions if the OA fee is paid, and allows those research organizations that cannot afford the per-article OA fee to publish in the classical manner.
- Which changes would occur if the hybrid OA model would spread?
With a spreading of the hybrid model, one could expect that the embargo periods journals have would be shortened for those articles published for which no OA fee is paid. Shortened embargoes can thus approach the period of time defined by the funding institutions for putting in OA the publications of research results made possible by their funding.
- The hybrid model leads to “double dipping”.
In the hybrid OA model, a journal has income from the OA fee as well as from subscriptions. This makes for a muddled BM, which is not transparent, and is disliked by most experts in the field. Subscription prices should in this case become lower in relation with the increase in the journals income from OA fees.

- **Article Processing Costs and the For-Profit journals**

- Will the current ForP journals come to reasonable APCs?
Time will tell. If the NonP journals in astronomy go to OAP, and if their APCs are perceived as reasonable, then the ForP journals have to follow suit. If, however, the ForP journals fill important niches in the world of the science fields, they may continue to exist, even with elevated APCs.

- **Complications for the business model of research-article journals**

- Journals now cover their costs through subscriptions, which in OAP would no longer be the case. Is this a problem?
Here it is of relevance how many subscriptions a journal currently has and if they are from the entire community publishing in that journal. Because, if a journal has a substantial amount of subscriptions from institutes whose scientists do not publish in that journal (but whose institutes subscribe nevertheless), then such subscriptions constitute something like a subsidy. The amount of money contributed by such subscriptions would, after a change to OAP, be gone and that amount would effectively have to be recovered from the APCs.

- Would APCs for research-article journals become prohibitively high?

Not necessarily. APCs of all NonP journals would be based on the actual costs of making the journal (costs which should, by-and-large, be the same for all high-quality journals). ForP journals might be recognisable by their elevated APCs or by normal APCs and lower quality.

5.2 What are the problems when the author/institute has to pay?

Changing from a subscription model to an author-pays model can have tremendous consequences for authors and institutions. Here we discuss three simple cases. Assume there is a high class journal in which authors can publish at minimal costs, and the institute pays for a subscription to that journal.

1. A *small institute* currently pays the full subscription price and its scientists publish just a few articles per year; the cost is the subscription price. After a transition to OAP the scientists or the institute would pay a few times the full APC which may well be less than the subscription price of the journal. For this institute, the total costs might become lower.

2. A *medium size institute* currently pays for the full subscription price while its scientists publish a few dozen articles per year. After a transition to OAP the sum of all the APCs would be quite higher than the current journal subscription price. This institute may get into financial problems, unless they would have, or create, sources to defray the APCs. Or they might come to limit the number of publications they allow themselves, which might compromise scientific freedom.

3. A *large organization* currently has its one subscription and its scientists publish numerous articles per year. With OAP, such organizations will pay a considerable sum for the APCs. However, some organizations have already opted to pay up front for OA so they may have solved the possible financial problem beforehand.

Since in astronomy most institutes are of “medium size”, many will face financial trouble *if OAP would be enforced*.

5.3 Objections to OAP and warnings

Various warnings circulate in relation with plans to come to OAP.

Publishers seem to be more sceptical about OA, mostly regarding the new publishing BMs that are to be developed and that may threaten their existence and/or legitimacy (see, e.g., [2008_04_01_Overview_of_STM_Publishing_Value_to_Research-1.pdf](#)). Because of their claimed position of trust in the chain of registering, certifying, formalizing, improving, disseminating, preserving, and accessing scientific information, publishers admonish that the new BMs must ensure: sustainability, scientific quality and integrity, the quality level of peer review; and that one has to recognize that publishers add value to scientific discourse, that they have to recover the economic cost of that value, and that they enable authors to have a choice on where to publish.

These concerns are understandable, in relation with publishers of journals of smaller circulation and having a lower impact factor.

However, in the case of long-standing large-circulation NonP journals in astronomy there is no doubt they can and will continue to deliver the quality they have delivered up to now.

Another concern is whether the OAP journals will be able to maintain an open repository of the publications for many years. Maintaining such an article repository is a large and important task.

5.4 What can we learn from SCOAP³?

One of the initiatives for moving from classical subscription journals to genuine OAP was taken by SCOAP³ (see Appendix A.1) in a specific domain of High-Energy Physics (HEP) publications. The SCOAP³ move implies that articles currently published in a set of (named) journals are sent

to SCOAP³ as well and are through that organization immediately available to the public (OA!). This transfer does (in principle) neither limit these journals, nor their economic and publishing model. Whether changes in the publishing behaviour in this special research field will come about, also changes with those journals, remains to be seen.

Is there an astrophysical discipline that has enough researchers to follow a similar initiative? And if there was, would such a initiative cause problems that may threaten the existence of astronomy journals with more general thematics? Given the state of astronomy and its publishing today such an initiative is unlikely.

6 If OAP, can advice be given to astronomy?

Let us assume that several journals are interested in going to OAP. Any advice one could come up with must be related to the business model, the way income and expenses for the making of astronomy journals are structured and organised. It is, however, not easy to know what the actual BM of journals is. But for the NonP journals the BM seems to be pretty clear.

6.1 Advice to journals

One could perhaps distinguish between: 1) journals publishing research articles; 2) journals publishing reviews; and 3) journals publishing articles of diverse nature (research like, reviews, conference proceedings, etc.). Based on these crude categories one can generally say the following.

6.1.1 Journals publishing research articles

a. Current BM: income essentially only from subscriptions.

OAP would mean all costs are to be covered through APCs. *For such journals, this is “in principle” simple to implement:* one decides to make the transition at a certain date and all articles submitted after that date have, once accepted for print, to pay the APC. The entire digital form of the journal should then be in OA as of a few months after the transition date. → However, since numerous authors who thus far published in such APC-free journals would not have the funds to pay for the APCs, there could be a problem for the low-budget researchers as well as those in prolific institutes (see Sect. 5.2).

b. Current BM: income from subscriptions and APCs (page charges).

OAP would mean all costs are to be covered only through APCs. *For such journals, this is “in principle” very simple to implement:* one decides to make the transition at a certain date and all articles submitted after that date, once accepted for print, have to pay the (new) APC. The entire digital form of the journal should then be in OA as of a few months after the transition date.

→ Since most authors publishing in such journals are used to APCs they only need to acknowledge these are now likely a bit higher than before.

6.1.2 Journals publishing reviews

Current BM: income solely from subscriptions.

Because of the nature of these journals, OAP seems difficult to implement. With some of these journals, the authors are *invited* to write a review which they may do for the benefit of the readers and because of the honour bestowed and the pleasure in the writing. However, examples are known of articles for which an large OA fee has been payed. Still,

→ these journals will, by nature, likely stay subscription journals (unless something like SCOAP³ would come into existence for astronomy).

Examples of these journals are: ARAA and A&AR.

6.1.3 Journals publishing articles of diverse nature

Current BM: income essentially from subscriptions.

OAP would mean most costs are to be covered through APCs. This might be implemented. Depending on the nature of the article, an APC could be levied, e.g., for conference proceedings a lump sum to be paid by the conference, but perhaps not for a review. As in the cases of Sect. 6.1.1, one just has to define how to make the shift.

→ These journals will, due to the mixed content nature, perhaps stay subscription journals but might come to OA.

Examples of these journals are: Nature and Science, and those journals (here not individually named) which often include material other than research reports (such as conference proceedings) in a volume or as a separate volume.

6.1.4 Conclusion on journals contemplating OAP

If a transition to OAP were to be made by astronomy journals, it preferably is made simultaneously by the high-level journals (which are by-and-large NonP). They would be leading the way to all other journals in astronomy. A forewarning by the journals to the authors of at least two years before the implementation of OAP is a must.

It is advisable, that journals start paying much attention to establishing their good name and making themselves well known with their good name. This requires investing in branding, e.g., by making the internet access of NonP journals well identifiable as the one of the journal itself.

6.1.5 If journals do not plan to go to OAP, what advice should be given?

It is not known (and basically cannot be known) if journals have plans to go to OAP. Many journals do not plan to go in that direction, many may be afraid of OAP.

These journals would be well advised to study the consequences of OAP for their BM. They better prepare for a change because the pressure from countries and agencies to come to OAP will not decrease.

6.2 With rising pressure toward OAP, what can one advise authors?

First, researchers/authors should be made aware of what OAP really is. This will require considerable effort of all who understand the matter. Second, it should be made clear that a transition to that system is in the making. A forewarning by the journals to the authors of two years before the implementation of OAP is a minimum.

With a very early announcement of the transition to OAP, the research institutes, the universities, the funding agencies, and perhaps even the ministries could help in a timely way (over two years) to make that transition smooth. All these levels should help the transition at the budgetary level of the researcher and its institute.

In a transition period, all journals of a nature as given in Sect. 6.1.1 could implement and encourage the use of OA fees, fees which soon should be brought to a level close to the APC.

6.3 What about green OAP (arXiv) and not gold OAP?

Astronomy could just continue with the “green OAP” solution as provided by astro-ph at arXiv, thus not go to gold OAP. Then arXiv should continue to provide the services it does today.

If all authors bring their research articles (after peer review) to astro-ph, and if all journals would allow this practice, then this green OAP should satisfy those levels in government, that require all publications to be in AO. Currently, many journals allow (voluntarily?) this green OAP.

For review articles, this will stay different, given the intrinsic difference in the BM of review journals (see Sect. 6.1.2).

6.4 More open peer review in OA?

In relation with OA, it has been advocated to come to a more open peer-review process. Generally, a publication would be “accepted” after a period of review by experts and interested others, be it researchers or people outside the field of research. Also, publishing the article with the possibility to add comment has been proposed.

Such possibilities are interesting but they will make the peer-review process more complicated. They will in all instances delay a formal acceptance by the journal. Moreover, giving more people a say may deform into a popularity poll while the peer-review itself might be done less thorough than now.

It still might be worthwhile to consider a medium in which one can publish or post comments on a research article. This possibility has been considered by some journals but has not been implemented because also such comments would have to be reviewed to prevent spreading of unfair criticism or unjust attacks.

6.5 Scientific freedom and OAP

Whatever may happen in the drive to OAP, scientists must have the freedom to choose the journal in which they like to publish their research results.

Examples in recent times have shown that higher level agencies have attempted to enforce publishing in specific journals. Such directives are often based on wrong conceptions of the practices in the particular science field as well as on misconceptions about the meaning of the impact factor.

Scientists and institutes know best where to make public the results of their creative work.

7 Conclusions and recommendations

7.1 Conclusions

Although numerous aspects of the problem discussed in this report are uncertain or hard to quantify, some conclusions can be formulated. Very important is to educate our fellow scientists about the pro’s and con’s of OAP. Equally important are the recommendations related with OAP (see below). A transition in astronomy to OAP seems to be possible for science article journals. It may, however, cause financial upheaval in the field of science publishing: monetary problems with the authors.

For NonP science article journals in astronomy a transition to OAP seems to be not very difficult organizationally. However, specific measures have to be taken for a smooth transition. One is, that the new BM model has to be explained in detail to the community and well before a transition.

For ForP science article journals a transition to OAP is equally simple. Here it remains to be seen if the smaller ForP journals will survive.

Medium sized institutes and their scientists will face considerable financial difficulties if OAP would be forced on them.

Problems for the budgets of authors during the transition to OAP could, in principle, be solved with the help of the various national research-funding organizations, provided they are really committed to OAP (and not just with words). Publishing scientific research results is not for free, also

not in OAP. Even the costs are mostly small compared to what has been invested already in the research, the authors may face considerable budgetary problems.

Some journals, among them those that publish review articles, likely will not come to OAP because of their different nature.

Scientists know best themselves where (in which journals) their publications would get the best visibility.

If the transition to OAP would be made, there are several recommendations to those in charge of the science journals.

7.2 Recommendations

The EAS panel on Open Access recognizes that academic publishing is at an important turning point and there are many future options with different possible business models. The publishing landscape is also made complex by different rates of progress in various parts of the world. In discussion between the panel members a set of guiding principles was developed with the intention that these, fundamental, concepts might be helpful to the EAS as the Open Access agenda evolves.

1. The highly regarded astronomy journals must maintain their quality based on peer-review by independent professional experts in the field.

2. Any publishing system must maintain a “version of record” in a sustainable way which is also capable of migrating to newer technical systems.

3. There should be no undue restriction on scientists to publish in the journals of their choice at the rate science developments demand.

4. If there is a mandate for astronomy to go to “gold” open access, the responsible agencies must provide the funds needed to maintain the quality and academic freedom as described in recommendations 1, 2 and 3.

5. The publishing practice in astronomy is de facto very close to full “green” open access; this will continue to be the case provided the current infrastructure for green OA with a central, widely accepted repository is maintained.

6. Because research in astronomy as well as astronomy publishing is a highly international activity, all responsible agencies are urged to come to one world-wide agreement about the mode of and transition to OAP. If the transition were to be made, the four high-quality big non-profit journals should do this simultaneously.

A Appendices

A.1 SCOAP³

SCOAP³ (Sponsoring Consortium for Open Access Publishing in Particle Physics; see details at <http://scoap3.org/about.html>) is a consortium of: High-Energy Physics funding agencies, High-Energy Physics laboratories, and Leading national and international libraries and library consortia. As of June 2013, the SCOAP³ consortium includes members from: Australia, Austria, Belgium, Canada, CERN, China, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Israel, Italy, Japan, Korea, Morocco, Netherlands, Norway, Portugal, Romania, Russia, Slovak Republic, Spain, Sweden, Switzerland, United Kingdom and United States of America. Some negotiations still need to be completed (see <http://scoap3.org/whoisscoap3.html>).

The SCOAP³ initiative aims to facilitate open access publishing of HEP (High-Energy Physics) literature in high-quality, peer-reviewed scientific journals. In the SCOAP³ model, publishers are paid by a single partner, SCOAP³, on a per-article basis for peer-review and other editorial services, and to make the final version of articles immediately available in open access. SCOAP³ is a global network of funding agencies, research institutions, libraries and library consortia, who are re-directing funds currently used to subscribe to HEP journals to a common fund used to pay for the open access. Individual authors will continue to be free to choose the journal in which they wish to publish and, where that publication participates in SCOAP³, its services will be remunerated by SCOAP³. SCOAP³ is inspired by the collaborative models that the HEP community has used for decades to design, build, operate and exploit global research infrastructures.

Each SCOAP³ partner will finance its contribution by *canceling* journal subscriptions. Each country will contribute according to its share of HEP publishing. The transition to OA will be facilitated by the fact that the large majority of HEP articles are published in just six peer-reviewed journals: Physical Review (A, B, and E)⁷; Journal of High Energy Physics (JHEP); Physics Letters (A and B); Nuclear Physics (A and B); Physical Review Letters and the European Physical Journal (A and C). They are published by three publishers: Elsevier, SISSA/IOP, and Springer.

SCOAP³ will link quality and price, stimulating competition and enabling considerable medium- and long-term savings. Today, most publishers quote a price in the range of 1000-2000 Euros per published article. On this basis, it is estimated that the annual budget for the transition of HEP publishing to OA would amount to a maximum of 10 Million Euros/year, sensibly lower than the estimated global expenditure in subscription to HEP journals.

The example of SCOAP³ could be followed by other fields, directly related to HEP, such as nuclear physics or astro-particle physics, also similarly compact and organized with a reasonable number of journals.

A.2 New Journal of Physics (NJP)

The OA journal in Physics that can be seen as a successful example of OAP is the New Journal of Physics (NJP). The financing for NJP was provided by the Deutsche Physikalische Gesellschaft and the Institute of Physics. Also, the German Research Foundation (Deutsche Forschungsgemeinschaft) changed its original policy and now allows researchers to apply for publication costs. The MPG finances publications in the NJP from its central funds. The Joint Information Systems Committee (JISC) in the UK financed publications by British authors over a period of three years.

A.3 List of journals dealing with publishing in astronomy

For this report, a list of journals related to publishing in astronomy was assembled. It contains approximately 130 entries. It is available upon request.

⁷The American Physical Society has recently withdrawn with Physical Review C and D