

# **The SCOAP3 initiative and the Open Access Article-Processing-Charge market: global partnership and competition improve value in the dissemination of science**

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The most recent update reports the 2014-2015 average APCs

## **Abstract**

The SCOAP3 (Sponsoring Consortium for Open Access Publishing in Particle Physics) initiative is an international partnership to convert to Open Access the published literature in the field of High-Energy Physics (HEP). It has been in operation since January 2014, and since then has covered over 4,000 articles per year. Originally initiated by CERN, the European Organization for Nuclear Research, and now counting partners representing 44 countries and 3 intergovernmental organisations, SCOAP3 has successfully converted to Open Access all, or part of, 6 HEP journals previously restricted to subscribers. It is also supporting publication of articles in 4 existing Open Access journals. As a “Gold” Open Access initiative, SCOAP3 pays Article Processing Charges (APCs), as publishers’ source of revenue for the publication service. Differentiating itself from other Open Access initiatives, SCOAP3 set APCs through a tendering process, correlating quality and price, at consistent conditions across participating publishers.

The APCs determined by the SCOAP3 tendering process are compared with those charged in both Gold Open Access and hybrid markets, the latter referring to the piecemeal conversion to Open Access of individual articles in subscription journals. If the journals’ “Impact Factor” is used as a proxy for quality, the results indicate that the SCOAP3 APCs align with, or slightly improve upon, those of the service-based Gold Open Access journals. The SCOAP3 APCs vastly improves upon the price levels of what appears to be a less-functional hybrid publication market, in general and for the field of Physics in particular.

The SCOAP3 tendering process included mechanisms to cap yearly expenditures in any single publishing outlet. Based on articles published in the 2014-2015 period (8,757 articles), the average APC effectively paid by SCOAP3 through its first two years was €1,100. This is among the best value-for-money in the Open Access marketplace.

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## I. Introduction

The (scientific) publishing market is characterised by a vastly dominant model where the reader (as an individual or an organisation) is the source of revenues for the publisher through purchase of selected content or, most often, subscription fees for a wider offering. The main role of the (scientific) publisher is to filter content through the peer-review system and guaranteeing the version of records. Content is assembled in journals, and thematic “packages” thereof, and subscriptions sold to (academic) libraries. All services offered by the publishers in the process (the infrastructure for peer-review, the preparation of content for online publication, the content delivery systems, the value added in linking and managing references, the digital archival systems and the infrastructure to deliver legacy printed copies) are paid for by the sale, or the licensing, of this content.

Over the last decade, this historical model has clashed with demands for unrestricted access to publicly-funded results of research, as part of the overall driver of a more open society. In the case of peer-reviewed publications, this objective is met by an alternative publishing model, “Gold” Open Access<sup>3</sup>, which switches the source of revenues from the reader side to the author side, typically through the payment of an Article Processing Charge (APC) for the publishing services, rather than for the access to content. For the purpose of this study, this model of “Gold” Open Access encompasses two variants. The first are journals for which APCs are the only income source. The second are “hybrid” journals which offer the possibility to pay an APC for individual articles to be Open Access, alongside the rest of content which is still sold with the traditional subscription model. Out of 1.8 million science, technology and medicine articles in English published in 2011, is estimated that about 12% were made available through “Gold” Open Access journals or, individually, in hybrid journals<sup>4</sup>.

It is worth noting that the appeal of Open Access goes beyond the opportunity of accessing articles. While the traditional publishing model generally relies on authors to transfer the copyright of their work to publishers, making the sale of content possible, the Open Access model allows for content to be disseminated through licenses which allow wide re-use<sup>5</sup>.

Originally proposed by CERN, the European Organization for Nuclear Research (a *de-facto* global focal point of the High-Energy Physics - or HEP - community), and now counting almost three thousand partners in 44 countries<sup>6</sup> and three intergovernmental organisations, SCOAP3

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<sup>3</sup> A distinction is often made between two types of Open Access, the “Gold” Open Access, discussed in this article, where scientific journals are the vehicle, and “Green” Open Access, where authors posts a version of their articles on an online repository, for either immediate or delayed dissemination.

<sup>4</sup> Mabe, M., Ware, M. (2012). The STM report. An overview of scientific and scholarly journal publishing. Retrieved from <http://www.stm-assoc.org/industry-statistics/the-stm-report/> (accessed 25-06-2014).

<sup>5</sup> Examples are Creative Common licenses (see: <http://creativecommons.org/licenses/>). Earlier studies of the 14 largest Open Access publishers found that 71% of their output was published under the CC-BY licence (see: Dallmeier-Tiessen, S., et al. (July 8, 2010). Open access publishing - models and attributes: Study of Open Access Publishing. Max Planck Society Digital Library. Retrieved from <http://edoc.mpg.de/478647>).

<sup>6</sup> Armenia, Australia, Austria, Azerbaijan, Belarus, Belgium, Canada, China, Cuba, Czech Republic, Denmark, DPRK, Finland, France, Georgia, Germany, Greece, Hong Kong, Hungary, Iceland, Israel, Italy, Japan, Kazakhstan, Korea, Mexico, Moldova, Mongolia, Netherlands, Norway, Poland, Portugal, Slovak Republic, South Africa, Spain, Sweden, Switzerland, Taiwan, Turkey, Ukraine, United Kingdom, USA, Uzbekistan, Vietnam. In addition to three International Organisations (CERN, IAEA and JINR). SCOAP3 (n.d.). Current partners. Retrieved from <http://scoap3.org/participating-countries> (accessed 05-01-2016).

proposes an evolution of the “Gold” Open Access model. It converts, at no direct cost to authors, existing high-quality peer-reviewed journals in HEP to Open Access. It also supports publication in existing Open Access journals. SCOAP3 pays publishers centrally for their services, on a per-article basis, with APCs determined through a bidding process. Publishers of subscription journals in turn reduce subscription fees to all their customers (academic libraries and library consortia, irrespectively of their country participation to SCOAP3), as this material has been already paid for. Libraries, through national intermediaries, redirect to SCOAP3 the savings in subscriptions. Authors in SCOAP3 journals never pay for articles they publish, nor are institutions billed on a per-article basis. SCOAP3 is supported by nation-wide yearly contributions according to a “fair share” scenario, calculated on a pro-rata basis, as fractions of the global authorship of HEP articles<sup>7</sup>. Any author can publish in journals supported by SCOAP3, even those from countries or institutions which do not support the initiative yet. CERN, as the legal entity representing SCOAP3, guarantees all payments to publishers.

Effectively SCOAP3 migrates scientific publishing in HEP from a content economy to a service approach. SCOAP3 distinguishes itself by targeting an entire scientific field beyond individual journals or publishers. This concept is facilitated by the fact that 97% of articles appearing in peer-reviewed journals in this field are freely available in a “preprint” form on the online repository arXiv.org<sup>8</sup> well before publication. A unique element of SCOAP3 is that APCs are the result of a tendering process, which correlates quality and price and introduces competition across providers.

Funding agencies are paying increasing attention to Open Access. As a result, there is a growing interest in APCs pricing mechanisms. This article compares two aspects of the SCOAP3 model to the existing APC market. The first is an analysis of the result of the 2012 SCOAP3 tendering process, through which the APCs were established, to assessing how it effectively correlated quality and price, and to compare its outcome with the existing Open Access market. The second focus is to analyse the first two years of the SCOAP3 operation, to compute the APCs effectively paid over 2014-2015, and the value-for-money that the operation is delivering.

The structure of this article is as follows: after this introduction, Section II presents background information on the mechanism used by SCOAP3 to determine its APC. Section III outlines the methodology used in this study of the APC market. Section IV compares the results of the SCOAP3 tendering process, and the APC it will effectively pay, to the overall APC market. A summary and conclusions are offered in Section V.

## **II. Background: the SCOAP3 tendering process**

The SCOAP3 tendering process to determine the level of the APCs was organised by CERN, as the legal entity acting for the benefit of SCOAP3. Pursuant to CERN status as an intergovernmental organisation, its public procurement process is strictly determined in the

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<sup>7</sup> The SCOAP3 Working Party. (2007). Towards open access publishing in high energy physics: Report of the SCOAP Working Party. Geneva: CERN. Available at <http://scoap3.org/files/Scoap3WPReport.pdf>.

<sup>8</sup> Gentil-Beccot, A., Mele, S., Brooks, T. (2009). Citing and Reading Behaviours in High-Energy Physics. How a Community Stopped Worrying about Journals and Learned to Love Repositories. arXiv:0906.5418.

CERN Financial Rules, in the spirit of openness and fair competition<sup>9</sup>. This context offers the opportunity to introduce competition among publishers for Open Access services, and introduce best-value-for-money concepts, previously absent from the APC market. Through the tendering process, CERN intended to grant publishers three-year contracts (2014-2016) for publishing services covering all HEP articles in retained journals. The budget envelope allocated to SCOAP3 was fixed by the international SCOAP3 partnership to €10 million, targeting conversion of around 7,500 articles in the field: only journals offering best-money-for-value could be therefore retained in the process. Value was defined through several quality criteria such as the journal Impact Factor<sup>10</sup> (IF) and the services provided.

The tendering process started in June 2012 when CERN provided Technical Specifications<sup>11</sup> of the requested services by sending an Invitation to Tender to qualified publishers identified by a previous market survey<sup>12</sup>. In addition to the requested APCs, publishers had to specify which Creative Commons license they would adopt<sup>13</sup> and, in addition to unrestricted dissemination of articles on their web sites, which formats they would supply to SCOAP3 for further dissemination (including formats such as XML and PDF/A which are usually not available to subscribers of scientific journals). Most importantly, publishers' bids included the contractual obligations to perpetual Open Access for the articles and to effect reductions of subscription fees to their entire customer base (irrespective of their participation in SCOAP3) commensurate to the value of the journals migrating from a subscription model to Open Access.

The SCOAP3 model accommodates two kinds of journals, covering the entire spectrum of HEP publications. Journals which in 2011 (the last year with complete data at the time of the tendering process) had published at least 60% HEP articles, according to their classification on arXiv repository, would be fully covered by SCOAP3. If this condition is not met, then only individual HEP articles would be covered by SCOAP3, the rest of the journal continuing with its other sources of revenue (either Gold Open Access from other sources or as hybrid, as the case might be).

The adjudication of the contracts was equally based on price and quality of service, by attributing each bid up to a theoretical maximum of 100 points. A price score was determined out of 50 points, with 50 points attributed to the journal with the lowest APC. The journal with the highest APC would receive 0 points. The quality score was also determined out of 50 points as an undisclosed combination of the IF<sup>14</sup>, the license under which the articles would be published provided (the CC-BY license representing the highest quality) and the delivery format (with a simultaneous delivery of XML and PDF/A being the most desirable). The journal with

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<sup>9</sup> CERN. (n.d.) How to do Business with CERN. Retrieved from <http://procurement.web.cern.ch/how-to-do-business-with-cern> (accessed on 13-06-2014).

<sup>10</sup> The Impact Factor is a measure of the frequency with which the "average article" in a journal has been cited in a particular year. The Impact Factor of a given journal is calculated by dividing the number of citations in a given year to articles published in that journal during the previous two years. It is calculated by Thomson Reuters. Retrieved from <http://wokinfo.com/essays/impact-factor/> (accessed on 25-06-2014).

<sup>11</sup> CERN. (n.d.) Invitation to Tender. Retrieved from [http://scoap3.org/files/Technical\\_Specification.pdf](http://scoap3.org/files/Technical_Specification.pdf) (accessed on 13-06-2014).

<sup>12</sup> CERN. (n.d.) E-tendering. Retrieved from <http://cds.cern.ch/record/1384149> (accessed on 13-06-2014).

<sup>13</sup> No other licenses than Creative Commons licenses were allowed by the tendering process.

<sup>14</sup> The calculation of the Impact Factor was slightly altered by removing the impact of the bi-yearly "Review of Particle Physics", a periodical review article in the field, appearing in a given journal, which receives thousands of yearly citations.

the highest total score was considered as the economically most advantageous journal. Closed-envelope bids were received at CERN in June 2012 and ranked on a journal-by-journal basis, starting from the economically most advantageous one, down to the economically least advantageous one. For each bid, a theoretical maximum value of the yearly contract was evaluated from the baseline volume of articles published in 2011 multiplied by the APC value. All journals within the fixed €10 million budget envelope entered negotiation for the award of contracts.

Publisher	Journal	2011 reference articles	APC	Model
American Physical Society	Physical Review D	2,989	\$1,900	1
American Physical Society	Physical Review C	107	\$1,900	2
Elsevier	Nuclear Physics B	284	\$2,000	1
Elsevier	Physics Letters B	1,010	\$1,800	1
Hindawi	Advances in High Energy Physics	28	\$1,000	1
Institute of Physics Publishing/ Chinese Academy of Science	Chinese Physics C	16	£1,000	2
Institute of Physics/Deutsche Physikalische Gesellschaft	New Journal of Physics	20	£1,200	2
Institute of Physics/SISSA	Journal of Cosmology and Astroparticle Physics	138	£1,400	2
Jagellonian University	Acta Physica Polonica B	32	€500	2
Oxford University Press/Physical Society of Japan	Progress of Theoretical and Experimental Physics	46	£1,000	2
Springer/Societ� Italiana di Fisica	European Physical Journal C	326	€1,500	1
Springer/SISSA	Journal of High Energy Physics	1,652 <sup>15</sup>	€1,200	1

Table 1. Results of the SCOAP3 tendering process. Publishers are presented in alphabetical order as the ordering of the tendering process was not released by CERN<sup>16</sup>. Model 1 refers to journals fully covered by SCOAP3 while model 2 refers to journals where only HEP articles are covered.

The 2011 volume of articles is used as the baseline for the calculation of the 2014 contracts.

At the end of the tendering process 12 journals from as many publishers were retained for participation in SCOAP3<sup>17</sup>, these are summarised in Table 1, and represent the vast majority of the HEP scientific literature. The SCOAP3 tendering process succeeded in achieving a level of APCs such to convert the field to Open Access within the fixed budget envelope.

<sup>15</sup> The July 4<sup>th</sup> 2014 version of this article reported an erroneous value.

<sup>16</sup> CERN retains the right to disclose this information, as well as information on the journals which fell outside of the €10 million budget envelope.

<sup>17</sup> SCOAP3 (July 2012). SCOAP3 tendering process is complete. Retrieved from <http://scoap3.org/news/news94.html> (accessed on 13-06-2014).

Between the completion of the tendering process and the start of operations one publisher, the American Physical Society, decided not to sign a contract<sup>18</sup>. Consequently, SCOAP3 entered operations for its first three year period in January 2014 with 10 journals from 11 publishers and with a revised budget envelope of €5 million a year<sup>19</sup>.

### **III. Methodology**

This study investigates the relation between a journal APC and its quality, as measured with its Impact Factor. While much criticism is articulated regarding the IF accuracy and relevance<sup>20 21 22</sup>, this article has retained the IF as a proxy for quality given its current prevalence in making value assessments of the offering of the publishing industry, and for consistency with the original SCOAP3 tendering process.

For this analysis, a sample of 2,617 Open Access journals from 17 different publishers has been compiled. Publishers were selected among large and renowned establishments, either fully relying on an Open Access business model (Gold Open Access journals), or having co-existing subscription and Open-Access offerings (hybrid journals). Five data elements were retrieved for each of these journals: the ISSN, the full title, the 2012 IF, the APC charged in 2014 and the corresponding currency.

The 2012 IF was retrieved semi-automatically from the Journal Citation Reports database<sup>23</sup> in May 2014. Journals which did not have a 2012 IF were removed from the sample.

APCs were retrieved either from properly formatted price list offered by the publishers (e.g. Hindawi and Springer) or through web-scraping (e.g. Elsevier) or manually for publishers with a limited number of journals (e.g. PLoS or APS). Only journals which either charged APCs in 2014, or for which this information was clearly identified on their web pages, were further retained. In order to have consistent APCs values, VAT was excluded, and discounts for either developing countries or for learned society members were ignored.

The final sample comprises 1,410 journals and their break-down by publisher is presented in Table 2. These include the 10 journals participating in SCOAP3. The data sample is presented as supplementary material to this article<sup>24</sup>, with the exception of the IF data, which are proprietary and were accessed through a subscription license. Anyone wishing to reproduce or augment

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<sup>18</sup> APS. (June 2013). Summary of Executive Board discussion and actions on Open Access and SCOAP3 at June 18/19, 2013 meeting. Retrieved from <http://www.aps.org/about/governance/executive/openaccess.cfm> (accessed on 13-06-2014).

<sup>19</sup> As the APS contract represented about €5 million a year, the SCOAP3 yearly budget envelope was consequently reduced from €10 to €5 million a year.

<sup>20</sup> Arnold, D.N., Fowler, K.K. (March 2011). Nefarious Numbers. *Notices of the AMS*. 58(3), 434-437

<sup>21</sup> Saha, S., Saint, S., Christakis, D.A. (2003). Impact Factor: a valid measure of journal quality? *Journal of the Medical Library Association*, 91(1), 42-46.

<sup>22</sup> Van Noorden, R. (June 2012). Record number of journals banned for boosting impact factor with self-citations. *Nature News Blog*. Retrieved from <http://blogs.nature.com/news/2012/06/record-number-of-journals-banned-for-boosting-impact-factor-with-self-citations.html> (accessed on 13-06-2014).

<sup>23</sup> Thomson Reuters. (n.d.) Journal Citation Reports. Retrieved from [http://wokinfo.com/products\\_tools/analytical/jcr/](http://wokinfo.com/products_tools/analytical/jcr/) (accessed on 05-2014).

<sup>24</sup> Romeu, C., et al (2014). Supplementary data for a study of Open Access Article Processing Charges – 2014. ZENODO. 10.5281/zenodo.10752.

this study, and having such a subscription, can easily retrieve this data element from the ISSN of each journal. Journals were further separated in two mutually-exclusive categories: Gold Open Access or hybrid journals (89 and 1,321 journals, respectively). Physics journals were tagged (131 journals), as well as SCOAP3 journals (10 journals). All these tags are also included in the data sample which supplements this article.

<b>Publisher</b>	<b>Journals in the Sample</b>
American Institute of Physics	4
American Physical Society	7
BioMed Central	10
British Medical Journal	1
Elsevier	1,185
Frontiers	7
Hindawi	31
Institute of Physics	15
Jagellonian University	1
Nature Publishing Group	1
Oxford University Press	108
Public Library of Science (PLOS)	7
Royal Society	9
Sage Publications	1
Springer	15
Taylor and Francis	3
Wiley	5
<b>Total</b>	<b>1,410</b>
Hybrid Journals	1,321
Gold Open Access Journals	89

Table2. Journals used in this study, broken down by publishers. SCOAP3 journals are included. The number of gold Open Access journals and Hybrid journals is indicated.

## IV. Results

Two sets of results are presented. The first is a comparison of the APCs determined by the SCOAP3 tendering process with those of Gold Open Access and hybrid journals, with particular attention to physics journals. The second is a projection of the APCs that SCOAP3 will pay in 2014, its first year of operation, taking into account price-volume control mechanisms, and its comparison with the overall APC market.

### 1. The SCOAP3 tendering process and the APC market

Figure 1 presents the APCs of Gold Open Access journals as a function of their IF. There is a correlation between the two of 0.71<sup>25</sup> (n=89), which confirms the idea that interpreting publishing as a service (which is the case in the Gold Open Access scenario) correlates its quality and price. The APCs of SCOAP3 journals are aligned with the expectations from this APC market, showing that SCOAP3 is consistent with trends that are already manifest on the Gold Open Access market. This also confirms the effect of the SCOAP3 tendering process in linking quality and price, when turning existing subscription journals, or parts thereof, to an Open Access model.

Figure 2 presents the APCs of 131 physics journals as a function of their IF. In addition to the SCOAP3 journals, only nine other journals are Gold Open Access, all others are hybrid journals. While some journals (notably those of the American Physical Society<sup>26</sup>) are mostly aligned with the overall correlation of APC and IF of the Gold Open Access market, the rest exhibit no such relation. Within the field of physics, the SCOAP3 journals generally deliver better value for money than other Open Access options. It is interesting to remark the change in APCs<sup>27</sup> of five journals participating in SCOAP3 in 2014 which were either hybrid journals or Gold Open Access journals in 2013: they now align to the overall correlation between APCs and IF.

The disconnect between quality and price for hybrid journals discussed for the physics journals is a widespread phenomenon, as presented in Figure 3. This figure presents APCs of the 1,321 hybrid journals in the sample as a function of the IF. For the sake of legibility the 1,182 Elsevier hybrid journals are represented by a contour which contains 75% of the titles. This contour is

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<sup>25</sup> The correlation coefficient is calculated as follow:  $\rho_{X,Y} = \frac{COV(X,Y)}{\sigma_X \sigma_Y} = \frac{E[(X-\mu_X)(Y-\mu_Y)]}{\sigma_X \sigma_Y}$  with  $X$  representing the Impact Factor and  $Y$  the APC.  $\mu_X$  and  $\mu_Y$  represent the expected values for the two distributions, with standard deviations  $\sigma_X$  and  $\sigma_Y$ . It is computed from a sample of 89 gold Open Access journals.

<sup>26</sup> The public hybrid APCs of the APS are different (lower) than their SCOAP3 bid as prices reported in Table 1.

<sup>27</sup> APC retrieved through the waybackmachine on 13-06-2014

Elsevier. (2012) Physics Letters B:

<http://web.archive.org/web/20121029113036/http://www.elsevier.com/journals/physics-letters-b/0370-2693/guide-for-authors>;

Elsevier. (2012) Nuclear Physics B:

[http://web.archive.org/web/20120629055434/http://www.elsevier.com/wps/find/journaldescription.cws\\_home/505716/authorinstructions](http://web.archive.org/web/20120629055434/http://www.elsevier.com/wps/find/journaldescription.cws_home/505716/authorinstructions);

Springer. (2012) The European Physical Journal C:

[http://web.archive.org/web/20120224230417/http://www.epj.org/guidelines\\_epjc.html](http://web.archive.org/web/20120224230417/http://www.epj.org/guidelines_epjc.html);

Hindawi. (2012) Advances in High Energy Physics:

<http://web.archive.org/web/20130113091754/http://www.hindawi.com/journals/ahep/apc/>;

Oxford University Press. (2013) Progress in Theoretical and Experimental Physics: *Mitsuaki Nozaki, private communication.*



built by using steps of 0.25 in IF and €250 in APC, starting from the population maximum, and connecting contiguous cells in decreasing order of population, till 75% of the sample is included.

Figure 4 compares the APCs of the entire journal sample. There is a striking difference on the one hand between the clustering of APCs for hybrid journals at high price points, almost irrespective of the IF, and on the other hand of the distribution of the Gold Open Access journals. The distribution of hybrid APCs has also been studied by Björk and Solomon who found that hybrid journals charge “relatively uniform price in most cases without regard to factors such as discipline or impact”<sup>28</sup>. They previously concluded that the hybrid market is “highly dysfunctional” and that hybrid journals charge higher APCs than Gold Open Access publications<sup>29</sup>.

SCOAP3 journals offer generally better value-for-money than the hybrid APC market, which demonstrates the effectiveness of the SCOAP3 process allowing hybrid journals to migrate into a Gold Open Access model.

## 2. Average SCOAP3 APC and the overall market

The SCOAP3 tendering process included the notion of a maximum contract amount for each journal (referred from here on as the “capping” mechanism). The capping mechanism has an impact on the actual average APC SCOAP3 is paying. As presented in Section II, the adjudication process of the SCOAP3 tendering process needed to identify a theoretical maximum value of each contract, in order to retain journals. The last available numbers at the time of the tendering process were the numbers of articles published in 2011. This is the number of articles that SCOAP3 was effectively paying for in 2014. Articles published above this cap enjoy the same Open Access conditions and services, but the costs are borne by the publishers. For the second and third year of the initial 3-year period of SCOAP3 (2015–2016) volume increases were part of the SCOAP3 contracts and overall budget envelope, reflecting the measured organic growth in the entire field of High-Energy-Physics, while allowing smaller journals to grow somewhat faster. This mechanism was clearly explained to bidders, which factored it into their bids.

As a result of the capping mechanism, the effective APCs that SCOAP3 is paying are lower than those resulting from the tendering process listed in Table 1. The numbers of articles published by each SCOAP3 journal in 2014<sup>30</sup> and 2015<sup>31</sup> are listed in Table 3. These numbers are compared to the respective caps, which defined the amounts payable for each journal by multiplying the lower number (the number of articles or the cap) with the APCs (Table 4). With almost 8,757 total articles published in 2014-2015, and a total expenditure of €9.6 million, the average APC paid by SCOAP3 was around € 1,100. This value is compared, in Figure 4, with the entire sample of this study: on average, SCOAP3 titles outperform the entire APC market in terms of value for money.

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<sup>28</sup> Björk, B., Solomon, D. (March 2014). Developing an Effective Market for Open Access Article Processing Charges. Wellcome Trust.

<sup>29</sup> Björk, B., Solomon, D. (July 2012). A Study of Open Access Journals Using Article Processing Charges. *Journal of the American Society for Information Science and Technology*. 63(8), 1485-1495.

<sup>30</sup> SCOAP3. (n.d.) SCOAP3 Repository. Retrieved from <http://repo.scoap3.org/> (accessed on 31-12-2014).

<sup>31</sup> SCOAP3. (n.d.) SCOAP3 Repository, Retrieved from <http://repo.scoap3.org/> (accessed on 31-12-2015).

Publisher	Journal	2014			2015		
		Cap (2011 reference articles)	Articles published <sup>(2)</sup>	Articles payable <sup>(3)</sup>	Cap (2011 reference articles + growth)	Articles published	Articles payable
Jagiellonian University	Acta Phys. Pol. B	32	11	11	48	27	27
Hindawi	AHEP	28	198	28	42	160	42
IOP/CAS	CPC	16	18	16	24	30	24
Springer/ SIF	EPJC	326	525	326	352	602	352
IOP/ SISSA	JCAP	138	236	138	160	198	160
Springer/ SISSA	JHEP	1,652	2,009	1,652	1,784	2,160	1,784
IOP/DPG	NJP	20	9	9	30	8	8
Elsevier	NPB	284	321	284	307	320	307
Elsevier	PLB	1,010	890	890	1,091	875	875
OUP/ PSP	PTEP	46	63	46	69	97	69
		3,552	4,280	3,400	3,907	4,477	3,648

<b>Total number of articles</b>	<b>8,757</b>
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(1) Snapshot at [repo.scoap3.org](http://repo.scoap3.org) as of 31-12-2014

(2) SCOAP3 paid only the lower number between articles published or the cap

(3) Snapshot at [repo.scoap3.org](http://repo.scoap3.org) as of 31-12-2015

Table3. SCOAP3 journals, reference volumes, articles published in 2014 and 2015.

Publisher	Journal	APC	2014		2015		Amount payable
			APC in EUR <sup>(1)</sup>	Articles payable <sup>(2)</sup>	APC in EUR <sup>(3)</sup>	Articles payable <sup>(2)</sup>	
Jagiellonian University	Acta Phys. Pol. B	€ 500	€ 500	11	€ 500	27	K€ 19
Hindawi	AHEP	\$ 1,000	€ 753	28	€ 919	42	K€ 60
IOP/CAS	CPC	£ 1,000	€ 1'241	16	€ 1,363	24	K€ 53
Springer/ SIF	EPJC	€ 1,500	€ 1,500	326	€ 1,500	352	K€ 1,017
IOP/ SISSA	JCAP	£ 1,400	€ 1,737	138	€ 1,908	160	K€ 545
Springer/ SISSA	JHEP	€ 1,200	€ 1,200	1,652	€ 1,200	1,784	K€ 4,123
IOP/DPG	NJP	£ 1,200	€ 1,489	9	€ 1,635	8	K€ 26
Elsevier	NPB	\$ 2,000	€ 1,505	284	€ 1,837	307	K€ 991
Elsevier	PLB	\$ 1,800	€ 1,355	890	€ 1,653	875	K€ 2,652
OUP/ PSP	PTEP	£ 1,000	€ 1,241	46	€ 1,363	69	K€ 151
<b>Total</b>				3,400		3,648	K€ 9,637

<b>Average APC<sup>(4)</sup></b>	<b>€ 1,100</b>
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- (1) The 2014 average of the daily exchange rate of the European Central Bank is used for the conversion into Euro.  
(2) SCOAP3 paid only the lower number between the articles published or the cap  
(3) The 2015 average of the daily exchange rate of the European Central Bank is used for the conversion into Euro.  
(4) Calculated as the total amount payable/total articles

Table4. SCOAP3 journals, APC determined by the tendering process, their equivalent in Euros for 2014 and 2015, payable articles in 2014 and 2015 and average APC.

## **V. Conclusions**

This study confirmed that Article Processing Charges for Gold Open Access journals and hybrid journals show a very different relation to journal Impact Factors. Gold Open Access journals exhibit a strong correlation between Article Processing Charges and Impact Factor, suggesting that in “publishing as a service” there is a normal relation between the perceived quality of the service and the price it can command. On the other side, hybrid journals which arrange Open Access publishing as a “side” offering appear as worse “value for money” than their Gold Open Access counterpart, as they do not exhibit such a strong correlation with quality as measured by the Impact Factor.

The SCOAP3 experiment is interesting in this context, by effectively moving (hybrid) subscription journals to a Gold Open Access model. Through its open and competitive procurement process, SCOAP3 introduces an overall correlation between “quality” and “price” for publications in the field of High-Energy Physics. The SCOAP3 Article Processing Charges determined by its tendering process align to the overall trend in Gold Open Access journals, and consistently offer good value for money in the wider field of physics. SCOAP3 Article Processing Charges were as low as €1'104 in 2014-2015, generally outperforming the Open Access Article Processing Charge market in terms of value for (public) money.

This value is even more remarkable once one takes into account that funds which support SCOAP3 are mostly a re-direction of budgets previously used for subscriptions, which are no longer due. These findings highlight the value of global partnership between the publishing industry, the library community, and national funding agencies, to address Open Access debates delivering more value in the process of dissemination of peer-reviewed results of publicly funded research.

## **Acknowledgements**

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## **Contribution to this study**

AGB, AM and SM ideated the study; CR and MV built the data sample; CR performed the analysis; CR, AGB, AK, AM and SM interpreted the results; CR and SM wrote this article, with support from AK and AM; CR prepared the figures. Disclaimer: all authors are or have been involved in the design, implementation or operation of the SCOAP3 initiative as CERN employees or on a CERN bursary (CR, MV).

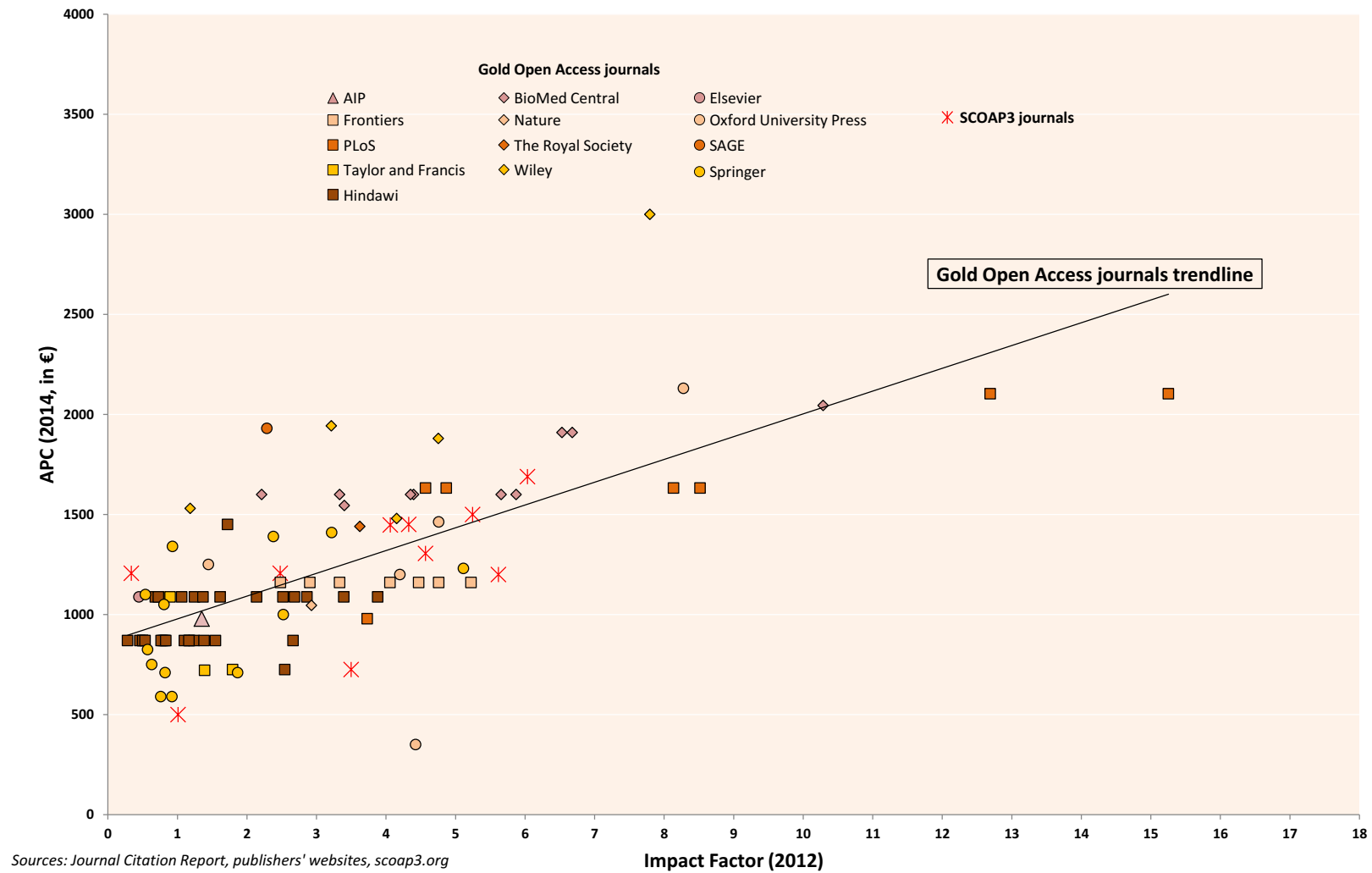


Figure 1. Article Processing Charges (2014) as a function of Impact Factors (2012) for Gold Open Access journals, and comparison with the SCOAP3 titles. The correlation coefficient is 0.71 (n=89) and corresponds to the line.

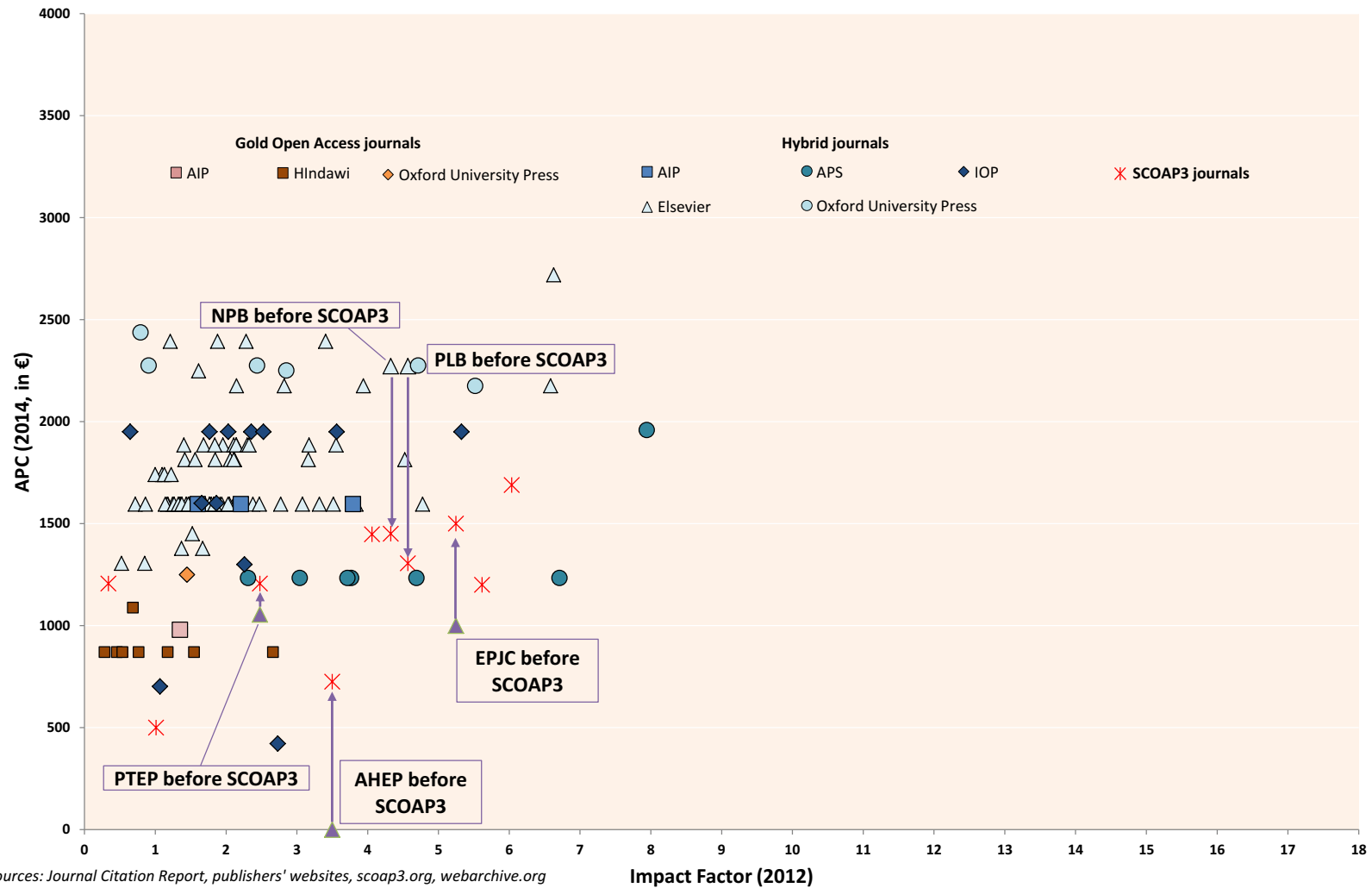


Figure 2. Article Processing Charges (2014) as a function of the Impact Factor (2012) for 131 physics journals, including the SCOAP3 titles. The arrows indicate the change in APCs of five journals (PLB – *Physics Letters B*, NPB – *Nuclear Physics B*, EPJC – *The European Physical Journal C*, PTEP – *Progress of Theoretical and Experimental Physics* and AHEP – *Advances in High Energy Physics*) before and after their participation in SCOAP3. The exchange rates applied for NPB, PLB and PTEP are those of January 1<sup>st</sup>, 2013 (source: Oanda)



Figure 3. Article Processing Charges (2014) as a function of the Impact Factor (2012) for 1'321 hybrid journals and comparison with the SCOAP3 titles. The jagged line indicates the 75% contour for the distribution of 1'182 Elsevier titles. It is built by using steps of 0.25 in IF and €250 in APC, starting from the population maximum, and connecting contiguous cells in decreasing order of population, till 75% of the sample is included.

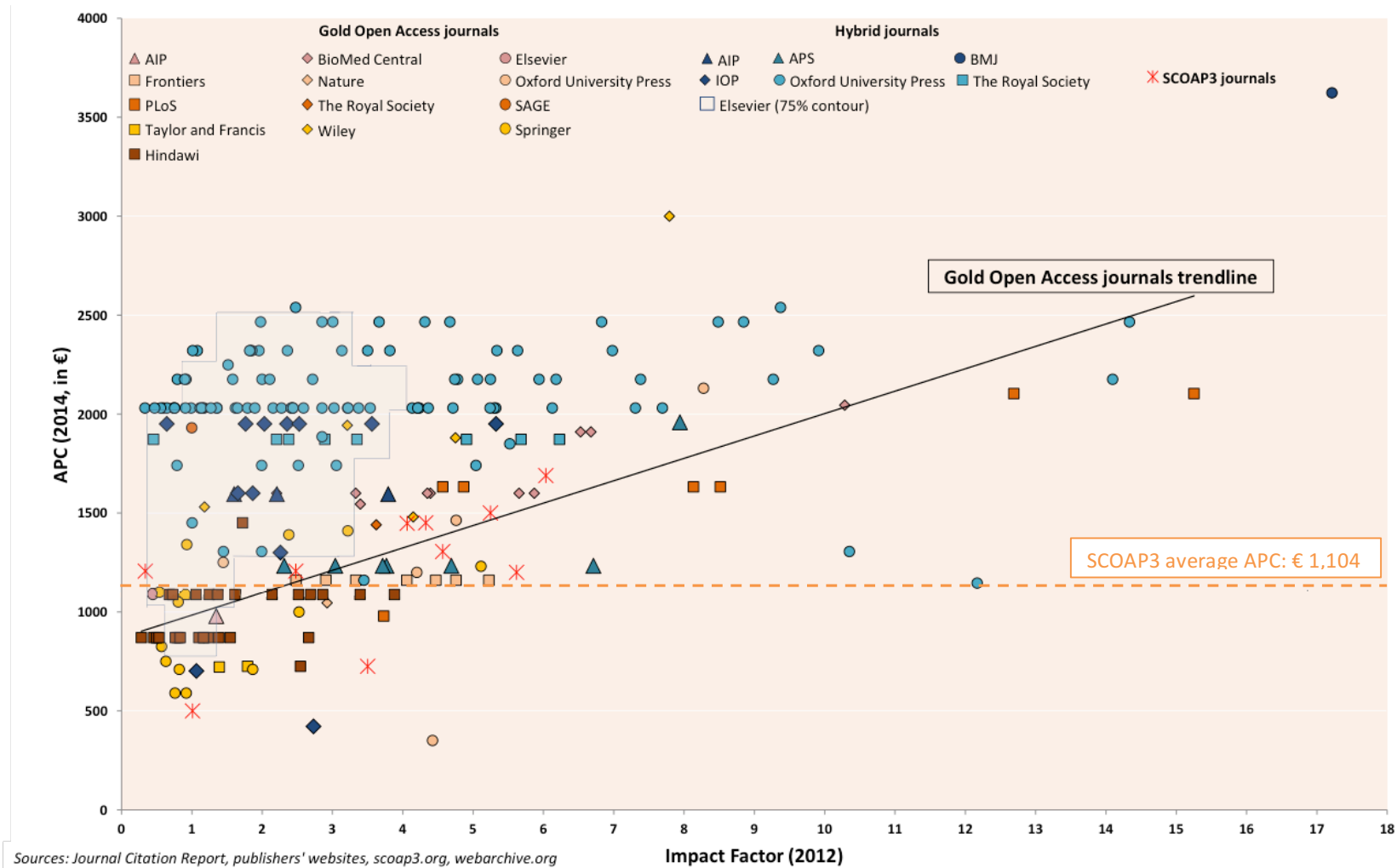


Figure 4. Article Processing Charges (2014) as a function of the Impact Factor (2012) for all journals in the sample (n=1'410), and comparison with the average APC SCOAP3 paid in 2014-2015 (€1'104, horizontal dashed line). The jagged line indicates the 75% contour for the distribution of the 1'182 Elsevier titles. It is built by using steps of 0.25 in IF and €250 in APC, starting from the population maximum, and connecting contiguous cells in decreasing order of population, till 75% of the sample is included. The continuous line represents the 0.71 (n=89) correlation coefficient for the Gold Open Access journals.