

# Information seeking behavior: factors that affect the behavior of Greek astronomers

Hara Brindesi<sup>†</sup> and Sarantos Kapidakis<sup>‡</sup>

<sup>†</sup> *Ionian University. Archive and Library Sciences Department. Laboratory on Digital Libraries and Electronic Publishing., 49100, Corfu, Greece. hbrinde (at) eugenfound.edu.gr*

<sup>‡</sup> *Ionian University. Archive and Library Sciences Department. Laboratory on Digital Libraries and Electronic Publishing., 49100, Corfu, Greece. sarantos (at) ionio.gr*

**Abstract:** *What factors could affect the information seeking behavior of people despite of their being occupied in the same domain? This study aspires to shed some light on this question by examining, describing and exploring three aspects of information seeking behaviour of astronomers in Greece. The distinctive characteristic of this research is that an intradisciplinary approach has been adopted and the astronomers were grouped in various categories according to their respective characteristics such as, academic status, subfield-research area, and affiliated institution, all being regarded as factors that can affect behaviour. The analysis of the results revealed that although some similarities exist, there are significant variations in the behaviour of these different categories of our participants, e.g. among scholars with different academic status or research area, and the sources used or their tendency to submit papers in eprint archives.*

**Keywords:** *Information seeking behaviour, user studies, Greek astronomers.*

## I. INTRODUCTION

Information seeking behavior studies have always been of the main concerns of librarians and information scientists. The area of our study is the research related to information seeking behavior of astronomers, with an orientation to the concept of the domain-analytic paradigm in information science, which states that «the best way to understand information in IS, is to study the knowledge-domains as thought or discourse communities, which are parts of society's division of labor» (Hjorland 1995). Accordingly, we narrowed our research focus on astronomers, and particularly on astronomers of the area of Athens, for in-depth domain study and we detected their habits and needs.

This article presents part of the findings of the survey study which constitutes the first step of a PhD thesis. The main aim of this particular work is to shed some light on the question of what factors could affect the information seeking behavior of people despite their being occupied in the same domain. We worked on this aim by examining three aspects of information seeking behaviour of astronomers in Greece: a) the importance they place in keeping up-to-date with current developments, b) the information sources they mostly use, and c) their e-print depositing behaviour. Astronomers had been divided into various groups

according to the following traits: academic status, subfield-research area of astronomy, and affiliated institution, all being regarded as factors that can affect behaviour.

## II. LITERATURE REVIEW

Unfortunately, there is not much bibliography concerning the information seeking behavior of astronomers. What we have noticed is mainly studies about scientists in general, with no particular emphasis on information about astronomers and their seeking behaviour. For example, as Tenopir (2005) mentions, «preferences of physicists are often studied, but astronomers are less often singled out for study.

Furthermore, we have not noticed works that study differences among people of the same discipline, apart from that of Jamali and Nicholas (2008). The two researchers examined two aspects of information seeking behaviour of physicists and astronomers including methods applied for keeping up-to-date and methods used for finding articles. They concluded that «there are significant differences among subfields of physics and astronomy with regard to information-seeking behaviour in terms of their reliance on different methods used for keeping up-to-date as well as methods used for finding articles.

To this end, this study aims to fill the gap by studying seeking habits, with a focus on similarities or differences among astronomers, showing respect to their academic status, research area, or affiliated institution.

## III. METHODOLOGY

The population of our study was restricted to the area of Athens, so we came into contact with the 18 professors of the Department of Physics and Astronomy of the University of Athens, as well as the 41 researchers of the Academy of Athens and of the National Observatory. In our sample we also included the 25 PhD and the 22 MSc students of the University of Athens. The total number of people that constitute our population is 106.

Initially, thirteen (13) face-to-face semi-structured interviews were conducted. The analysis of these interviews, as well as the study of the corresponding bibliography, helped us to set the online questionnaire, which was filled in by 71 recipients (68.8% response rate).

### III. MAIN RESULTS

We present our results in three sections. The three sections are the following: A) Interest in keeping up-to-date with current developments, B) Information sources usage, and C) e-print depositing behaviour.

#### A. Interest in keeping up to date with current developments

In this section we present the results from the two relative questions we included in our questionnaire. The first question was: «How important is rapid awareness of new papers for you?». The participants had to choose among the following range of options (*Not at all important /A little important/ Somewhat important /Quite important/ Absolutely important*). The second question was: «How many hours a week do you spend for keeping up with current developments?».

The majority of the respondents to our research, as it might be expected, deem absolutely necessary keeping up-to-date with the latest papers, as 52.1% ticked the option «absolutely important» for the first question. Moreover, nobody (0%) chose the option «not at all important». The rest of the responses to that same question were the following: «a little important» (2.8%), «somewhat important» (18.3%), «quite important» (26.8%).

Further statistical analysis of our results revealed and confirmed that levels of importance depend on the academic status of the respondents. Professors and researchers show greater interest in keeping in touch with current developments in comparison to PhD and MSc students. «Absolutely important» was the most popular answer (75%) among the 12 professors and among the 25 researchers (64%) who answered the question. MSc students (<sup>66</sup>N = 11) were the only group of which the majority of respondents ticked «somewhat important» (36.4%) and «quite important» (36.4%).

Moreover, levels of importance varied when examining different subfields of astronomy. The evidence was supported by statistical analysis, since there seems to be a significant correlation ( $\chi^2=30.31$ ,  $df=15$ ,  $p<0.05$ ). 100% of astronomers in the subfields of Cosmology (N=6) expressed the view that *keeping up-to-date* is of quite to absolute importance to them. However, the rest of the participants valued keeping up to date less: that is, 90.5% of participants in Space physics (N=21), 76.9% in Stars (N=13), 70% in Astrophysics (N=10), 66.7% in Extragalactic astronomy (N=6), and 60% in Dynamical astronomy (N=5) stressed that keeping up to date is of quite to absolute importance.

Statistical manipulation of responses on the second question, i.e. «How many hours a week do you spend for keeping up with current developments?» revealed that astronomers in Greece spend on average 7 hours per week in keeping up to date.

Looking into the amount of hours per week astronomers in Greece spend keeping up to date on average, varies according to their status. Specifically, professors spend on average more time than any other group, as we can see in the following table.

Academic status	N	h/week mean	<sup>67</sup> Lb	UB	St. dev
Professors	12	9.33	5.56	13.11	5.94
Researchers	23	6.96	3.98	9.94	6.89
Phd	22	7.59	5.39	9.80	4.97
MSc	11	4.18	2.02	6.34	3.21

Table 1

These findings resemble the results of the former question «How important is rapid awareness of new papers for you?», where we found that professors show greater interest in keeping up with current developments, in comparison to any other group.

The amount of hours per week astronomers in Greece spend *keeping up to date* on average, seems to be related also to the subfield of astronomy on which they work. Cosmologists spend the biggest amount of hours keeping up-to date than any other category, as we can see in the following table.

Subfield	N	h/week mean	Lb	UB	St. dev
Cosmologists	6	14.33	4.91	23.76	8.981
Space physics	20	7.30	4.67	9.93	5.611
Dynamical astronomy	5	7.00	0.98	13.02	4.848
Extragalactic astronomy	6	6.00	1.12	10.88	4.648
Astrophysics	10	5.90	2.70	9.07	4.433
Stars	12	5.08	2.55	7.62	3.988

Table 2

These findings resemble the results of the former question «How important is rapid awareness of new papers for you?», where we found that astronomers in the subfield of Cosmology expressed the view that *keeping up-to-date* is of quite to absolute importance to them, more strongly than any other category.

Differences in the levels of the time spent for *keeping up-to-date* are observed also among the respondents occupied in different institutions, although they all rated highly the importance of that. Statistical manipulation revealed that there is significant correlation ( $\chi^2=10.370$ ,  $df=2$ ,  $p<0.01$ ) between time spent for *keeping up-to-date* and the institution that astronomers are occupied. Researchers of the Academy of Athens dedicate the most time in comparison to the scholars of the other two institutions (Table 3).

<sup>67</sup> Lower bound and Upper bound of confidence interval for mean.

<sup>66</sup> N= Number of participants that answered the question.

Institution	N	Mean	<sup>68</sup> LB	UB	St. dev
Academy	11	12.82	7.65	17.99	7.92
University	45	6.67	5.04	8.29	5.41
Observatory	13	4.23	3.02	5.44	0.55

Table 3

## B. Information sources usage

In order to investigate the aspect of information seeking behaviour of Greek astronomers we included in our questionnaire the question «How often do you use each of the following information resources for identifying the necessary information you need?». For each of the cited numbered sources, the participants had to choose among the following rate of options: Never/ once or twice a month/ 4-5 times a month/ 2-3 times a week/ Daily.

By analysing the question, the results showed that the information sources mostly used (at least 2 to 3 times a week) are as follows: Google 88.20%, ADS 67.6%, websites 64.2%, electronic reference material 60.9%, ArXiv 58.6%, e-journals 55.40% and citations 54.3%. Lower on this list are printed books (38.80%), electronic books (31.80%), Google Scholar (29.70%), colleagues' recommendations (25.40%), library catalogs (22.10%), printed journals (21.70%), printed reference material (20.60%), databases for observations (17.10%), occupational meetings (conferences etc) (11.60%), ISI Web of Science (7,40%), and Web of knowledge (4,30%).

The main special characteristics of our results are that ADS and Google is used by everyone in our sample, regardless of the subfield of astronomy they work on, Google Scholar is not used so often, especially if compared to the use of Google, Databases such as "ISI Web of Science" or "Web of Knowledge" are not so popular among the Greek astronomers, and the use of printed material limited to a minimum, with the only exception of the printed books that are more popular than e-books.

Significant statistical evidence is also that the more hours a week the participants spend for research, the more they use ADS, ArXiv and e-journals.

The main results concerning the usage of the information sources in comparison to the academic status of the participants are as follows:

- Unlike the majority of astronomers, MSc students don't use ADS neither do they use arXiv.org database heavily, but they use mainly Google, reference material in electronic format and printed books.
- Books in electronic format are used mainly by PhD and MSc students.
- Citations are used heavily by researchers.

<sup>68</sup> Lower bound and Upper bound of confidence interval for mean

Statistically significant correlation was found to the following:

- Journals in printed format are used mainly by professors.
- PhD students show strong confidence to the recommendations of their colleagues.
- Professors and researchers rely heavily on the occupational meetings, such as conferences and seminars.

Differences were also observed while analyzing the results concerning usage of the information sources by the subfield-research area of the participants:

- The participants in the subfield of Dynamical astronomy don't use arXiv.org database so heavily, in comparison to the participants of the other subfields. Furthermore, Dynamical astronomy scholars use e-journals less often than the rest.
- Cosmologists use ADS less often than everyone. They equally cling on arXiv.org and e-journals as often as they cling on Google.

## C. e-print depositing behaviour

In general, physicists and astronomers are heavy users of e-print archives (Jamali and Nicholas, 2009), especially of the arXiv.org e-print archive, originally developed by Paul Ginsparg at the Los Alamos National Laboratory (Tenopir, 2005). As our study revealed, this tendency is valid for the Greek astronomers too, as the majority of our participants (56.4%) answered positively to the question «Do you deposit most of your articles in arXiv.org?».

A comparison of the answers on the basis of the participants' academic status, revealed to us that the majority of those who answered positively to this question were researchers (14 out of 24 researchers, means 58.3%) followed by PhD students (10 out of 19 students, means 52.6%). The majority of professors (6 out of 11, means 54.5%) answered negatively to the same question.

A comparison of the answers on the basis of the research field, showed us that the astronomers occupied in the subfields of Astrophysics (85.7% answered yes, N=7) and Cosmology (80%, N=5) are more prone to depositing in arXiv.org than their colleagues occupied in other subfields such as that of Stars (54.5%, N=11) and Space physics (36.8%, N= 19).

Furthermore, 58.1% of the scholars of University of Athens avoid depositing, as 18 out of 31 scholars answered negatively to that question, unlike researchers in Athens Academy, where every one of the 10 researchers who answered the question (100%) willingly deposits in arXiv.org, or researchers in Athens Observatory, where a large percentage, that is, 8 out of 14 (57.1%) deposits, as well.

62% of the participants, who answered positively to the above question, declared also that they deposit their articles in arXiv.org after their articles have been accepted by a journal, 29% declared that they deposit at

the same time they submit their articles to a journal and 9% before the submission.

Although statistical tests didn't reveal any significant relation, the following results are of great interest. Analysis on the basis of the academic status of the participants showed us that just the researchers in a little percentage (13.3%, N=15) responded that they deposit their articles in arXiv.org before they submit them to a journal, while 60% of the professors (N=5) answered that they deposit at the same time they submit their articles to a journal.

Differences located also when examining the results on the basis of the research field of the participants. The scholars that usually deposit their articles in arXiv.org before they submit them to a journal are those occupied in the subfields of Cosmology (N=4, 25%) and Space physics (N=8, 12.5%). Furthermore, the majority (N=7, 42.9%) of them who replied that deposit at the same time they submit their articles to a journal, were Astrophysicists.

Finally, statistically supported is the evidence that the more hours a week participants spend keeping up to date, the more prone they are to depositing in arXiv.org before their articles have been accepted by a journal.

### III. CONCLUSIONS

The main aim of our study was to investigate what factors could affect the information seeking behavior of people occupied in the same domain. For this reason, we investigated similarities and differences in information seeking behaviour among astronomers in Greece. We considered and examined them as groups with different characteristics. These characteristics included academic status, subfield-research area of astronomy, and affiliated institution, all being regarded as factors that can affect behaviour. The analysis of our results showed that although some similarities exist, each of the above groups has its own specific traits. This was confirmed through the analysis of all of the three aspects of information seeking behaviour we examined, that is:

a) the importance they place in keeping up-to-date with current developments, b) the information sources they mostly use, and c) their e-print depositing behaviour.

As we described in detail in the previous sections, differences have been observed depending on academic status, research area, or the affiliated institution that our participants are occupied. As an example, Cosmologists proved to be more prone to depositing in arXiv.org compared to their colleagues occupied in other subfields such as that of Stars. Furthermore, and unlike the others, they usually deposit their articles in arXiv.org before they submit them to a journal. Additionally, they expressed the view, more than all the others, that *keeping up-to-date* is of more importance to them. Consequently, they spend the biggest amount of hours for that purpose. The above mentioned findings

concerning cosmologists, underscore our statistically supported evidence that the more hours a week participants spend keeping up to date, the more prone they are to depositing in arXiv.org before their articles have been accepted by a journal. All these findings concerning cosmologists can be justified because of the nature of their subfield, which is more competitive and faster in development compared to the others (Jamali, 2009).

Concluding, our work has revealed that our assumption that there are factors that affect the information seeking behavior of people occupied in the same domain of astronomy is true. Furthermore, the study has revealed the need for deeper investigation of narrower subject communities within domains-disciplines, so that deeper and profound understanding of the information seeking behavior of the particular users we study could be acquired.

### REFERENCES

- [Brown, C.M., "Information seeking behavior of scientists in the electronic information age: astronomers, chemists, mathematicians, and physicists," \*J Am Soc Inform Sci\*, \*\*50\*\*\(10\), 929-943 \(1999\).](#)
- [Hemminger, B.M., Lu, D., Vaughan, K.T.L. and Adams, S.J., "Information seeking behavior of academic scientists," \*J Am Soc Inf Sci Tec\*, \*\*58\*\*\(14\), 2205-2225 \(2007\).](#)
- [Hjørland, B. and Hanne Albrechtsen, "Toward a new horizon in information science: Domain-analysis," \*J Am Soc Inform Sci\*, \*\*46\*\*\(6\), 400-425 \(1995\).](#)
- [Jamali, H.R. and Nicholas, David, "Information-seeking behaviour of physicists and astronomers," \*Aslib Proceedings: new information perspectives\*, \*\*60\*\*\(5\), 444-462 \(2008\).](#)
- [Jamali, H. R. and Nicholas, D., "E-print depositing behavior of physicists and astronomers: an intradisciplinary study," \*J Acad Libr\*, \*\*35\*\*\(2\), 117-125 \(2009\).](#)
- [Tenopir, C., King, D. W., Boyce, P., Grayson, M. and Paulson, K.-L., "Relying on electronic journals: Reading patterns of astronomers," \*J Am Soc Inf Sci Tec\*, \*\*56\*\*, 786-802 \(2005\).](#)