Web Information Sources in Nuclear Physics: An Analytical Study

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Abstract. The present study aims to identify and analyse different information sources in the subject field Nuclear Physics which are available online. From the study it clear that, documentary sources contributed 72% of total web resources in the field of Nuclear Physics. Out of which 64% were primary sources and e-journals contributed more than half of them. General Physics was the most observed subject area in which the web resources of Nuclear Physics appeared followed by Nuclear Physics itself and Condensed Matter Physics. USA ranks first in the publication of e-resources in Nuclear Physics followed by UK. Most of the publications were monthly and publishing companies were the lead publishers of them. Institute of Physics, Elsevier and Springer publish more than half of the e-journal resources in Nuclear Physics whereas rest half of the e-journal resources were published by 31 publishers.

Keywords
Information Sources, E-resources, Webometric analysis, Online resources, Nuclear Physics

1 Introduction

Information, in its most restricted technical sense, is a sequence of symbols that can be interpreted as a message. Information can be recorded as signs, or transmitted as signals and is any kind of event that affects the state of a dynamic system [1]. Conceptually, information is the message (utterance or expression) being conveyed. This concept has numerous other meanings in different contexts [2]. World Wide Web is the home for a rapidly expanding variety of information sources. It carries an extensive range of information resources and services and is a source of any kind of information. The present study is an attempt to find the major information sources in Nuclear Physics available through internet. Major search engines like Google and Yahoo were used to search information. Besides these, special search engines like Scirus, Scopus, BUBL and Intute, Websites of Associations/Organizations, Universities, Institutions, Web-portals etc were used to retrieve information more accurately and efficiently. All these sources helped in the selection and retrieval of appropriate sources. Nuclear physics is the discipline involving the structure of atomic nuclei and their interactions with each other, with

their constituent particles, and with the whole spectrum of elementary particles that is provided by very large accelerators [3]. As the name implies, it deals with the model and mechanics of the nucleus. In the broad sense, Nuclear Physics can be categorized under Modern Physics which consists of Atomic, Nuclear and Molecular Physics. So that most of the sources collected for the present study are from the domain Modern Physics.

2. Review of Literature

Rakhi[4] (2011) gives an overview of the information sources in Homeopathy including web resources. The paper introduces a brief history of Homeopathy with a focus on providing insight into various classical literature and information sources. The paper also provides suggestions for their effective utilization of the web resources. A study done on The Food and Drug Administration (FDA) and other Health and Human Services agencies by Jesano [5] (2010) discussed some of the drug-related databases that are available for free from governmental agencies. It includes databases produced by the National Library of Medicine, Some of these sources may be very familiar to librarians, whereas others may be a bit more obscure. Hospital librarians have to be generalists and it may be hard for them to keep up in every subject area, especially with all the changes that are occurring in information resources.

A study of open access sources in Bio-technology including journals, books, databases, dictionaries, directories, etc. conducted by Veena [6] (2010). The study informs that open access journals constitute the predominant medium of information and most of the open access sources originated after the year 2000. Also the study pointed out that India has a significant role in the production of sources in Bio-technology, because of large number of institutes. A study on the web resources in Psychology conducted by Parvathy [7] (2009) conducted. The study explored the total number of web resources retrieved from three search engines (Google, Yahoo and Alta Vista). The analysis gave a complete picture of various web sources in psychology and also analysis the overlap of these sources among three search engines. The study reveals that Google produce more web resources and most of them are in English. Tallgren & Bäcklund [8] (2009) established that the internet is a frequently consulted source of health information. Using the Google search engine, they searched for patient information about general anesthesia on the World Wide Web, using four synonyms of the term in four languages and analysing the top 20 results. Peterlin, B. Lee [9] (2008) evaluates the quality of websites providing cluster headache

information for patients and healthcare providers. Of the first 40 websites found on MetaCrawler, 72.5% were advertisements, unrelated to headache, or repeated websites. Roth [10] (2008) provides a general description of various fee-based and free chemical compound resources. The free resources generally offer an acceptable alternative to fee-based resources for quick retrieval. It is assumed that readers will be familiar with The Merck Index, Handbook of Chemistry and Physics, and Knovel Critical Tables.

A collaborative study done by Kumar, Kademani & Kumar [11] (2008) this paper attempts to analyze the growth and development of web-resources in INSPEC database during 1995-2005. In his study titled 'Webomnetrics: ten years of expansion', Ingverson [12] (2006) examined the developments in the field. Webometrics has increased dramatically not only the terms used major often there are more articles and even monographs on the topics and at least one profession has been appointed in the file. To measure the amount of web resources used for scholarly contributions in the area of library and information science (LIS), the study examined by Maharana, Nayak & Sahu [13] (2006) in India. It further aims to make an analysis of the nature and type of web resources and studied the various standards for web citations.

3. Objectives of the study

The main aim of the study is to identify major information sources on internet in the domain of Nuclear physics and analytically evaluate them. The main objectives of the study can be coined as:

i. To identify major information sources in Nuclear physics which are available on internet.

ii. To analyze the characteristics of these source and to identify:

- The proportion of primary, secondary and tertiary sources.
- The scattering of e-journals in Nuclear Physics among different subject fields in Physics.
- The distribution of e-journals on the basis of their characteristics such as sponsoring body, country of origin and frequency of publication.
- Subject wise distribution of databases and their country of origin.
- Extent of ready reference sources such as encyclopedia and dictionaries.
- The different categories of tertiary sources available on internet.
- The institutional resources available on internet in the field of Nuclear physics and their features such as country wise distribution and nature of the bodies etc.

4. Research Methodology

The data required for conducting the study were collected from the World Wide Web, even though it was scattered and unorganized. For that, tools such as search engines, subject directories, virtual libraries and portals of certain institutions were made use of. The collected data were compiled using Microsoft Excel 2007. After compilation data were analysed for different parameters and the corresponding findings were recorded.

5. Analysis of Data

About 301 top ranking sites were selected and their URLs are noted. The sources include electronic equivalents of primary, secondary and tertiary sources and institutional repositories. These selected sources are named as documentary and non-documentary sources in Modern Physics.

5.1 Documentary vs. Non-Documentary Sources in Nuclear Physics

Web sources are mainly divided into documentary and non-documentary sources. Documentary sources consists of standards, e-journals, e-books, reference sources like dictionaries, encyclopedias, glossaries, databases, directories, guide to literatures, preprints, software etc. Non-documentary sources include institutional repositories like universities, institutions, learned societies, associations, organizations, laboratories, libraries and also online services, preprint server, discussion forums, blogs/portals of scientists, lectures, subject gateways, softwares are other sources.

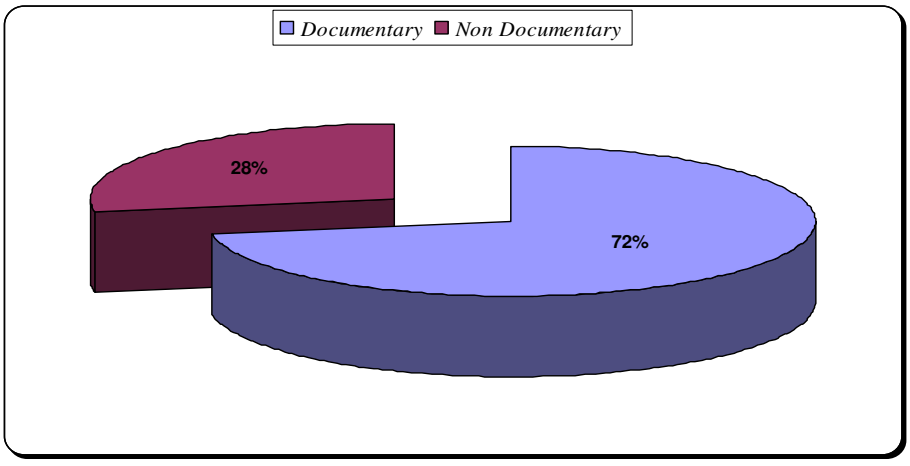

Figure 1: Categorization of Web Sources in Nuclear Physics into Documentary and Non-documentary Sources

Out of the 301 sources selected, 217(72%) comes under documentary sources, including e-journals, standards, preprints, databases, references sources, e-books, directories and handbooks. 84(28%) are non-documentary sources, including institutional sources like universities, research institutions, research laboratories, libraries and associations/groups/organization.

5.2 Documentary Sources in Nuclear Physics

Documentary sources of information are traditionally categorized into primary, secondary and tertiary sources. Primary sources are original information of research and development or description of new application, new interpretation of an idea. They are from the time period involved and have not been filtered through interpretation or evaluation. They are usually the first formal appearance of results in physical, print or electronic format. They present the original thinking, report a discovery or share new information. Journals, Standards, newsletters, patents, theses and dissertations, conference papers etc are some primary source of information.

Secondary sources depend on the nature of information contained in primary sources. These are mainly the writings about the information contained in primary sources. Databases, e-books and reference sources like dictionaries, encyclopedias, glossaries, biographies etc, are secondary sources. Tertiary sources provide overview of topics by synthesizing information from primary and secondary sources. Basic purposes of such sources are to guide the user to the primary and secondary sources of information. The categorization is depicted in the figure 2.

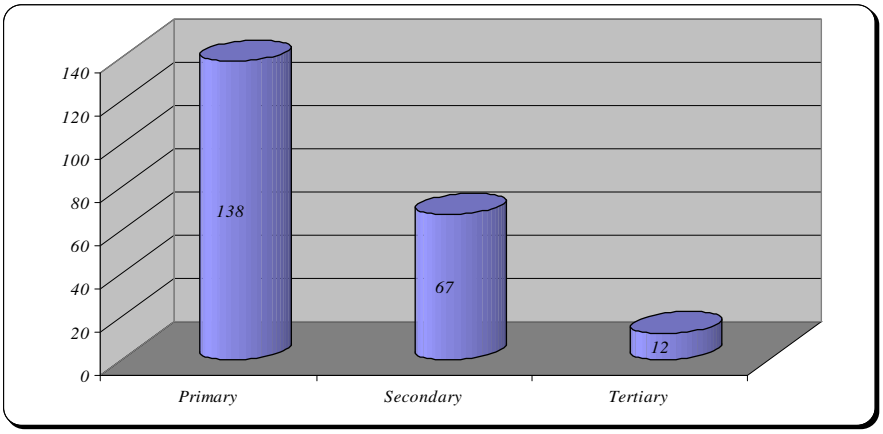

Figure 2: Categorization of Documentary Sources in Nuclear Physics

Out of 217 documentary sources, 138 are primary sources, 67 are secondary and 12 are tertiary sources.

5.3 Primary Sources in Nuclear Physics

Mainly, 133 e-journals, 4 preprints and 1 standard were taken for the subject field Nuclear Physics. They can be considered as the primary sources in Nuclear Physics. E-journals contributed majority of the primary sources in Nuclear Physics. Out of these most of the journals are published by publishing companies and rest of them by some institutions.

5.4 Categorization of E-journals in Nuclear Physics by sponsoring bodies

The sponsoring agencies of e journals can be grouped into four categories: Organizations, Publishing companies, Universities/Institutions and Government/Information Centers.

Table 1: Categorization of E-journals in Nuclear Physics by sponsoring bodies

SL No.	Sponsoring Bodies	Number of Journals	Percentage%
1	Organizations	15	11.28
2	Publishing Companies	74	55.64
3	Universities/Institutions	42	31.57
4	Govt./Information Centres	2	01.51
Total		**133**	**100.0**

Among 133 e-Journals 74(55.64%) were published by publishing companies. Elsevier, Springer and Wiley are leading companies among them. Research Organizations have their own 15(11.28%) e-journals. Universities and research institutes published 42(31.57%) e-journals and most of them are from Institute of Physics (IOP).

5.5 Subject-wise Distribution of E-journals in Nuclear Physics

Information sources on Nuclear Physics are scattered in different subject fields in Physics like General Physics, Atomic and Molecular Physics, Nuclear Physics, Quantum Physics, Condensed Matter Physics, Particle Physics and Astrophysics and Cosmology. The subject wise distribution of e-journals in Nuclear Physics is given in the table 2.

Table 2: Subject wise Distribution of E-journals

S. No.	Name of Subject Field	Total Number	Percentage %
1	General Physics	49	36.84
2	Nuclear Physics	30	22.55
3	Condensed Matter Physics	23	17.30
4	Astrophysics and Cosmology	11	08.27
5	Atomic, Molecular Physics	7	05.26
6	Quantum Physics	7	05.26
7	Particle Physics	6	04.52
TOTAL		**133**	**100**

Subject wise distribution reveals that 3/4th of the total e-journals, containing information in Nuclear Physics comes under the subject fields General Physics, Nuclear Physics and Condensed Matter Physics, among which, 49(36.84%) of the e journals were in General Physics. The subject Nuclear Physics comes next with 30(22.55%) e-journals and Condensed Matter Physics ranks 3rd with 23(17.30%) e-journals. Rest of the e-journals is from other 4 subject fields such as Atomic and Molecular Physics, Quantum Physics, Particle Physics and Astrophysics and Cosmology. Among these, e-journals are comparatively more in the subject Astrophysics and Cosmology (08.27%).

5.6 Country of Origin of e-journals in Nuclear Physics

Major publishers and institutes have their publishing centers all over the world. By analyzing their contacts, editorial board and the domain of URL, the country of origin was identified and listed in the table 3.

Table 3: Country of Origin of E-journals in Nuclear Physics

SL No.	Name of the Country	Total No.	Rank	Percentage %
1	USA	50	1	37.60
2	United Kingdom	28	2	21.10
3	China	8	3	06.01
4	India	7	4	05.26
5	Germany	7	4	05.26
6	Singapore	7	4	05.26
7	North-Holland	5	5	03.76
8	Russia	3	6	02.25
9	UAE	3	6	02.25
10	Japan	2	7	01.50
11	Egypt	2	7	01.50
12	Netherlands	1	8	0.75
13	Switzerland	1	8	0.75
14	Sweden	1	8	0.75
15	Croatia	1	8	0.75
16	France	1	8	0.75
17	Italy	1	8	0.75
18	Ukraine	1	8	0.75
19	Armenia	1	8	0.75
20	Austria	1	8	0.75
21	Brazil	1	8	0.75
22	Serbia	1	8	0.75
	TOTAL	**133**		**100.0**

By publishing 50(37.60%) e-journals in Nuclear Physics, USA ranks first in the production of Nuclear Physics e-journals in the world. UK ranks second, next to USA with 28(21.10%) e-journals. Both these countries contribute nearly 60% of the total e-journals published in Nuclear Physics all over the world. China ranks third with 8(06.01%) e-journals.

The most significant thing is that India shares 4th position with Germany and Singapore by publishing 7(05.26%) journals in Nuclear Physics. The major journals published from India are *'Indian Journal of Radio and Space Physics', 'Indian Journal of Pure and Applied Physics'* (Both are published by NISCAIR, New Delhi), *'Indian Journal of Physics'* (Published by Indian Association for Cultivation of Science, Kolkata*), 'IOSR Journal of Applied Physics'* (Published by International Organization of Scientific Research)*, 'Pramana', 'Indian Journal of Nuclear Physics'* (Both are published by Springer)*, and 'Journal of Nuclear Engineering and Technology'* (STM Journals).

5.7 Publisher wise distribution of e-journals in Nuclear Physics

It is found that, 34 publishers are involved in publishing Nuclear Physics journals. Out of which 50% of the total journals were published by three publishing companies and the remaining 50% by 31 publishing companies. Name of the publishers and the number of journals in the decreasing order is given in the table 4.

Table 4: Publisher-wise Distribution of E-journals in Nuclear Physics

S. No.	Name of the Publisher	Total Number	Percentage %
1	Institute of Physics	28	21.05
2	Elsevier	20	15.03
3	Springer	19	14.28
4	American Institute of Physics	8	06.01
5	World Scientific	7	05.26
6	American Physical Society	6	04.51
7	Scientific Research Open Access	5	03.76
8	Hindawi	4	03.01
9	American Nuclear Society	3	02.25
10	Cambridge University Press	3	02.25
11	Bentham Open	3	02.25
12	Annual Reviews	2	01.50
13	NISCAIR	2	01.50
14	Wiley	2	01.50
15	Remaining 20 publishers	1 (each)	0.75 (each)
TOTAL		**133**	**100**

It is found that, Institute of Physics published more than 1/5th of the e-journals in Nuclear Physics 28(21.05%). Elsevier comes next with 20(15.03%) e-journals and Springer ranks third with 19(14.28%) e-journals. They together contribute 50% of the total e- journals in Nuclear Physics. Out of 133 journals 28(21.05%) were published by Institute of Physics, 20(15.03%) by Elsevier and 19(14.28%) by Springer and rest of the journals were published by American Institute of Physics, American Physical Society, World Scientific Publishers, etc. Among them, American Institute of Physics has the 8(06.01%) e-journals.

5.8 Frequency of Publication of E-journals in Nuclear Physics

E-journals are analyzed according to the frequency of publication and are listed according to its decreasing order of periodicity, starting from weekly to yearly and irregular.

Table 5: Frequency of Publication of e-journals

S. No	Type of Frequency of Journals	Frequency	Percentage
1	52 issues/year	6	04.51
2	48 issues/year	1	0.75
3	40 issues/year	1	0.75
4	36 issues/year	2	01.51
5	32 issues/year	5	03.75
6	24 issues/year	10	07.51
8	16 issues /year	1	0.75
9	14 issues/year	1	0.75
10	Monthly	54	40.60
11	10 issues/year	1	0.75
12	9 issues/year	1	0.75
13	8 issues/year	4	03.01
14	Bimonthly	10	07.51
15	Quarterly	11	08.27
16	2 issues/year	1	0.75
17	Yearly	7	05.26
18	Irregularly	16	12.03
TOTAL		**133**	**100**

It is found from the study that 2/5th (40.60%) of the total journals are monthly. Next in the order are quarterly journals (08.27%). Journals having the periodicity of bi-monthly and 24 issues per year share equal percentage (07.51%). Journals having irregular periodicity contribute 12.03% of the total.

5.9 Secondary Sources in Nuclear Physics

Secondary sources are mainly categorized into Databases, Ready Reference sources and E-Books on the basis of collected data. The main sources of secondary data on web are the

databases. E-books and reference sources also play an important role in providing secondary information.

Table 6: Categorization of Secondary Sources in Nuclear Physics

SL No.	Name of Sources	Number of Sources	Percentage %
1	Databases	32	47.76
2	Reference Sources	8	11.94
3	E Books	27	40.30
TOTAL		**67**	**100.00**

Around half (47.76%) of the secondary sources are databases (32 databases), 2/5th (40.30%) are e-books and reference sources are the least with 11.94% of the total secondary sources. The pie chart given below depicts the actual picture of categorization of secondary sources.

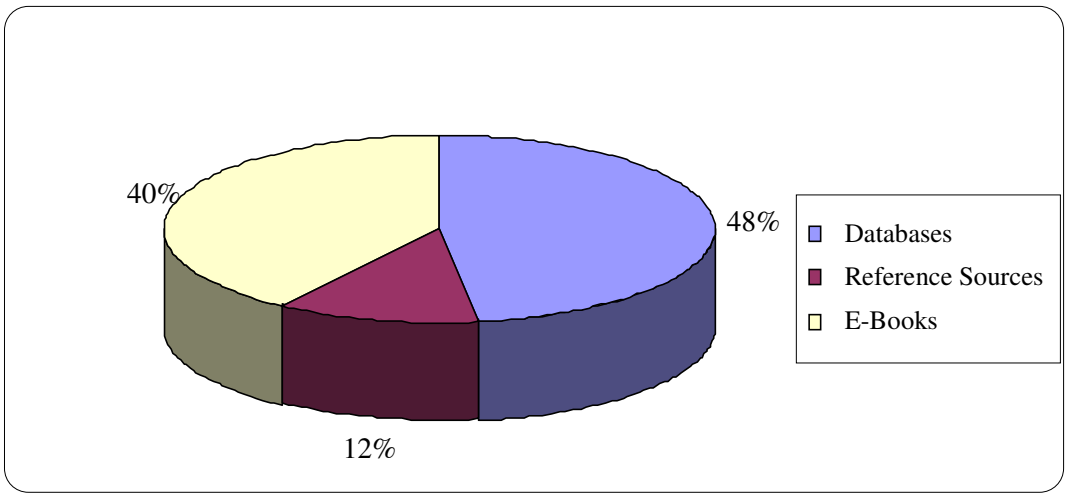

Figure 3: Categorization of Secondary Sources in Nuclear Physics

5.10 Databases in Nuclear Physics

Most of the databases are produced by research organization. These include both bibliographical and full-text databases. Databases are produced by some sponsoring bodies**.** Sponsoring bodies include, Universities/Academic Institutions, Government Departments & Information Centers, Companies and Associations/Organizations. In general most of the databases were published by Government Departments & Information Centers. The categorization of databases according to the sponsoring bodies is given in table 7.

Table 7: Categorization of databases in Nuclear Physics by sponsoring bodies

S. No.	Name of Sponsoring Bodies	Total	Percentage %
1	Universities, Academic Institutions	7	21.86

2	Govt. Dept. & Information Centers	16	50.00
3	Companies	3	09.36
4	Associations/Organizations	6	18.76
Total		**32**	**100.00**

Half 16(50.00%) of the databases were produced by Governmental bodies and Information centers. Universities/Academic Institutions produced 7(21.86%) databases. The rest of the databases were produced by Associations/Organizations 6(18.76%) and Companies 3(09.36%)

5.11 Subject-wise Distribution of Databases in Nuclear Physics

Databases were analyzed according to the specialization in a subject field. The information in Nuclear Physics was not be found in Nuclear Physics databases only, but were scattered in different subject fields. The subject wise distribution of databases is given in the table 8.

Table 8: Subject wise Distribution of Databases in Nuclear Physics

S. No.	Name of Subject Field	Total Number	Percentage
1	Nuclear Physics	14	43.75
2	Atomic and Molecular Physics	10	31.25
3	General Physics	5	15.64
4	Quantum Physics	1	03.12
5	Particle Physics	1	03.12
6	Astrophysics and Cosmology	1	03.12
Total		**32**	**100.0**

5.12 Country of Origin of Databases in Nuclear Physics

The databases were produced from different countries. USA ranks first in the production of databases in all subject fields. Here also, in the case of Nuclear Physics, USA ranks first in the production of databases. The country wise distribution of databases is listed in the table 9.

Table 9: Country of Origin of Databases in Nuclear Physics

SL No.	Name of Country	Number of Databases	Percentage
1	USA	14	43.76
2	Austria	9	28.13
3	UK	4	12.5
4	France	2	06.25
5	Korea	1	03.12
6	Israel	1	03.12
7	Sweden	1	03.12
Total		**32**	**100**

5.13 Tertiary Sources in Nuclear Physics

Tertiary sources found collected data are very less. It is about 8 sources only. Among these 7 are directories and 5 are handbooks. The distribution of tertiary sources is given in the table 10.

Table 10: Types of Tertiary Sources in Nuclear Physics

S. No.	Name of Tertiary Source	Number of Source	Percentage
1	Directories	7	58.33%
2	Handbook	5	41.67%
TOTAL		**12**	**100%**

5.14 Non documentary Sources in Nuclear Physics

Non-documentary sources are mainly institutional resources such as Universities, Research Institutions, National and International Organizations/Associations and Research groups, Laboratories, Libraries and some other sources. Categorization of Institutional sources is listed in the table 11.

Table 11: Categorization of Institutional resources in Nuclear Physics

SL No.	Type Institution	Number of Institution	Percentage %
1	Universities	24	32.00
2	Research Institutions	21	28.00
3	Org/Asso/Groups	7	09.33
4	Laboratories	12	16.00
5	Libraries	11	14.67
Total		**75**	**100**

From the study, it is clear that, 3/5th (60%) of the institutional sources are universities and research institutions, among which, there are 24 universities and 21 research institutions. The remaining 40% includes, laboratories 12(16.00%), libraries 11(14.67%) and associations/organizations/groups 7(09.33%).

5.15 Country wise distribution of Institutional resources in Nuclear Physics

The Institutional sources can be distributed according to the country of origin. Most of the resources are from USA (29). Israel and UK rank second and third in with 8 and 7 institutions respectively. The country wise list of institutional resources are given in the table 12.

Table 12: Country wise Distribution of Institutional Sources in Nuclear Physics

SL NO	Name of Country	University Depts.	Institutions	Org/Ass/Groups	Laboratories	Libraries
1	USA	9	4	3	9	4
2	UK	2	2	1	1	1
3	Australia	1				2
4	China		2			
5	India		2			1
6	Russia		1			
7	France	1	1			
8	Sweden		1			
9	Germany	1	2			1
10	Netherlands				1	
11	South Africa	1	1			
12	Finland	1				
13	Canada	1				
14	Switzerland		1	1		
15	Japan	3	2		1	
16	Israel	3	1	2		2
17	Italy		1			
18	Turkey	1				
Total		**24**	**21**	**7**	**12**	**11**

Among the 24 universities, 9 were from USA, 3 each from Israel and Japan and 2 from UK and rest of them were from other countries. Among the 21 Research institutions, 4 were from USA, 2 each from UK, China, India, Germany and Japan and rest of them from other countries. Among 7 Associations/Organization/Groups, 3 were from USA, 2 from Israel and 1 each from UK and Switzerland. Among 12 Laboratories, 9 were from USA, 1 each from UK, Netherlands and Japan. Among 11 Libraries, 4 are from USA, 2 each from Australia and Israel and 1 each from UK, India and Germany.

5.16 Other Non documentary Sources in Nuclear Physics

Other non documentary sources include software and web portals. From the selected sources, there were 4 software and 5 web portals. Their composition is shown in the table

Table 13: Other Non documentary Sources in Nuclear Physics

S. No.	Name of the Source	Number of Sources	Percentage %
1	Software	4	44.44
2	Web Portals	5	55.56
Total		**9**	**100**

6. Conclusions

The study mainly focused on web information resources in Nuclear Physics. From the study, it is clear that journal sources contributed the most in the field of Nuclear Physics.

Another thing which can be found out from the study is that the resources are mainly contained in the subject field General Physics. Also most of the information sources had their origin in USA followed by UK.

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