

Online Journals: Utility of ToCs vs. Fulltext

George S. Porter and Ed Sponsler

Introduction

Tenopir and King (2000) give an excellent overview of the development of electronic journals. Numerous authors have attempted to assess the impact of e-journals on scholarly communications. Harter (Harter and Kim 1996a, 1996b; Harter 1996, 1998) has consistently used citation analysis, primarily through the ISI citation databases, to assess the impact of e-journals in different fields. A different tactic was employed by Morse and Clintworth (2000) and McDonald (2000), comparing print and electronic use of journals held by their academic libraries in both formats, specifically for titles where electronic use statistics were available from the vendor(s). Vendor supplied statistics remain difficult to acquire and compare in spite of the publication of the ICOLC guidelines (1998) more than two years ago.

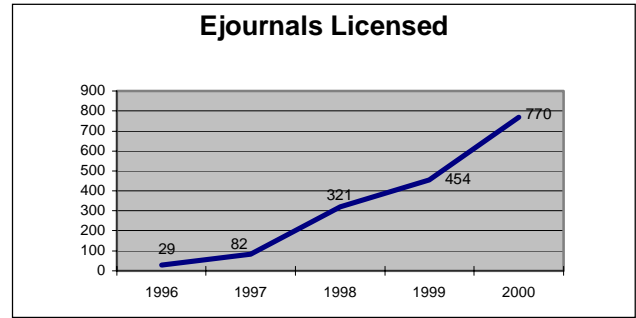
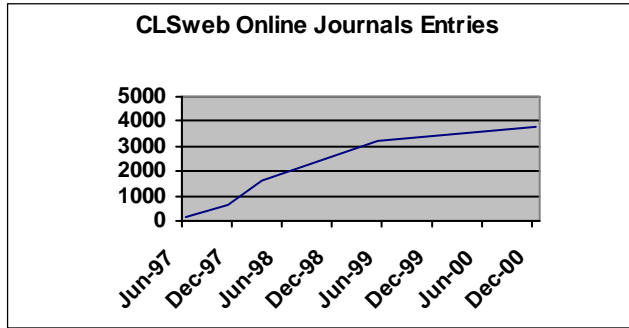
Much of the research on e-journals over the past several years has focused on the role of paid e-journal subscriptions. Recently Fossmire has been actively researching the questionable assumption that paid e-journal subscriptions are inherently superior to free scholarly electronic journals (Fossmire and Young 2000a, 2000b; Fossmire and Yu 2000).

Local Situation

The Caltech Library System Web site (CLSweb) has included an online journals list since March 1997. The number of journal Web sites documented in the online journals list has grown explosively over the last 4 years. The entries serve several purposes. Like all library e-journal lists, the CLSweb version provides access to licensed online content. In addition, free scholarly e-journals are included. Since its inception, the CLSweb online journals lists have included entries to provide access to the tables of contents (ToCs) and/or abstracts of journals whose subscriptions have been cancelled in the library. Over the years, it has come to include entries for additional journal titles which are deemed to be of potential interest to the campus.

The extensive online journals lists require considerable effort to create and maintain. The CLS web committee wanted to introduce additional functionality: limit to fulltext titles; search by words or phrases in journal titles. Anecdotal evidence has been less than clear-cut with regard to the utility of non-fulltext titles. Walsh and Bayma (1996) reported sociological differences in the use of computers and computer-based communications between practitioners of different scientific disciplines, which might account for the

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mixed feedback received or it could boil down to personal preferences.

An online journal database (OJDB) was created with the information from the original static web pages. Following the tenets of usability guru, Jakob Nielsen (2000), an effort was made to retain all of the functionality of a simple, browsable listing. At the same time, it became possible to gather more data about the utility of the system. Simple web log analysis had demonstrated the online journal pages were the most heavily trafficked pages on the CLSweb, both on-campus and off-campus (Porter *et al.* 1999). Porter also established that the Caltech community was not expending significant effort to create personal web pages to access ejournals. Now it would be possible to determine if web page visitors were finding resources of interest.

OJDB Technical Review

OJDB Administrator

Administration of the OJDB (Online Journal Database) is accomplished with Active Server Pages (ASP) which are essentially Visual Basic scripts running on the web server to generate web forms and respond to their actions. The administrator ASP scripts connect to the OJDB in order to add, change or delete records. The administrator ASP interacts with the Archive Table exclusively.

OJDB Changes are Preserved

When the administrator ASP changes a journal record (such as assigning a new URL to the journal title's Web site), there are quite a few events happening behind the scenes:

- The original record remains unchanged, except that the current date/time is entered in its EndTime field.
- The contents of the original record are used in the creation of a new record (without an EndTime assigned, of course).
- The PersistentID is carried over from the original, however a new UniqueID is generated for this version of the record.

- The administrator then edits this new record and saves it.

It is important that the PersistentID remain unchanged from the original to maintain persistent URLs, since journal title URLs are constructed by passing the PersistentID to the URL Processing script. (See URL Processing, page 6.)

The UniqueID is the same as the PersistentID for new journal titles, but changes anytime edits are made to the journal record. Since the UniqueID is entered in the usage logs, usage patterns may be compared before and after a change in subscription status, for example, when a journal title upgrades from Table of Contents to Fulltext.

The administrator UI may trigger an "Update Display Table" event. This event recreates the entire Display Table by copying all records in the Archive Table whose EndTime value is NULL. The Display Table records are then accessed by the user via the OJDB user interface and serves as the data source for the static HTML views of the OJDB.

OJDB User Interface

Like the OJDB Administrator, the OJDB User Interface is implemented as an Active Server Page, designed using Microsoft Visual Interdev. It allows the user to view journals by starting letter, search titles and filter fulltext only. If the Fulltext checkbox on the user interface is selected, journal records must contain the phrase 'fulltext' in the Notes field. See: <http://library.caltech.edu/online/onlinejrnl.asp>.

Scripts

Static HTML Views

Static HTML views of all journals in the Display Table are generated nightly through the use of SQL queries on the OJDB, Perl and DOS batch scripts and HTML templates, all coordinated automatically by Microsoft SQL's Data Transformation Service.

The process generates a web page for all journal titles beginning with 'A', 'B', and so on. Figure 1 shows the query

SQL Database Design

Display Table		
Column Name	Data Type	Length
ID	int	4
Code	varchar	3
Title	varchar	256
Notes	varchar	512
PURL	varchar	256
SearchTitle	varchar	128

Column Name	Data Value
ID	167
Code	OP
Title	The Anatomical Record
Notes	Fulltext v247+ (1997+); Tables of contents and Abstracts v244+ (1996+)
PURL	http://dungeon.caltech.edu/cgi-bin/fetch/log.pl?guid=E067B351-304D-11D4-879C-00A0C9EA3676
SearchTitle	Anatomical Record

Archive Table		
Column Name	Data Type	Length
Code	varchar	3
Title	varchar	256
Notes	varchar	512
URL	varchar	128
SearchTitle	varchar	128
UniqueID	varchar	37
PersistentID	varchar	37
StartTime	datetime	8
EndTime	datetime	8

Column Name	Data Value
Code	OP
Title	The Anatomical Record
Notes	Fulltext v247+ (1997+); Tables of contents and Abstracts v244+ 1996+)
URL	http://www.interscience.wiley.com/jpages/0003-276X/
SearchTitle	Anatomical Record
UniqueID*	E067B351-304D-11D4-879C-00A0C9EA3676
PersistentID	E067B351-304D-11D4-879C-00A0C9EA3676
StartTime**	2000-07-17 10:57:18.327
EndTime	

*The value is automatically returned by the MS SQL newid() function for each new record.
 **The value is automatically returned by the MS SQL getdate() function for each new record.

Logs Table		
Column Name	Data Type	Length
ID	int	4
UniqueID	varchar	37
TimeStamp	datetime	8
RequestorIP	varchar	128
ReferringURL	varchar	128
BrowserType	varchar	128

Column Name	Data Value
ID	11001
UniqueID	E067B69C-304D-11D4-879C-00A0C9EA3676
TimeStamp*	2000-07-12 20:12:44.937
RequestorIP	131.215.105.43
ReferringURL	http://library.caltech.edu/online/onlineN.htm
BrowserType	Mozilla/4.08 [en] (Win98; I)

**The value is automatically returned by the MS SQL getdate() function for each new record.*

used to extract all journals beginning with 'A'. The results are transformed into a tab delimited text file. A single record is shown in figure 2.

All 26 text files (for titles 'A'-'Z') are written to a folder k:\ojdb. A DOS batch script (figure 3) copies 26 HTML template files (figure 4) to a temporary working folder and executes a Perl script (figure 5). The Perl script imports the tab delimited text files and outputs tables appended to each HTML template file. The template files contain page banners and navigation to all other static HTML pages. All of the completed files are then copied over to the appropriate web folder for viewing (figure 6). See: <http://library.caltech.edu/online/onlineA.htm>.

URL Processing

Journal title hyperlinks in both the static HTML and dy-

namc ASP pages trigger a Perl script, taking as an argument the journal's PersistentID (a GUID⁴ number). The script uses the GUID to look up the journal's URL from the OJDB, logs the event then uses the URL to redirect the browser to the journal title's Web site (figure 7). The OJDB connection parameters are defined using the ODBC Administrator in the MS Windows Control Panel. The Perl script was inspired by the work of Bucknall (1999) and Schwartz (1998).

Data Analysis

Click-through tracking data has been collected since the OJDB went live on 23 June 2000. The current dataset comprises slightly more than six months continuous use, 115,726 transactions. Slightly less than half (46% or 53,423) of the hits were from browsers which appeared

Figure 1. A SQL Query to Extract 'A' Journals from the Display Table

```
SELECT Code, Title, Notes, PURL
FROM Display
WHERE (SearchTitle LIKE 'a%') ORDER BY SearchTitle
```

Figure 2. One Record of the Tab-delimited Output of Figure 1.

```
OP
The Anatomical Record
Fulltext v247+ (1997+); Tables of contents and Abstracts v244+ (1996+)
http://dungeon.caltech.edu/cgi-bin/fetch/log.pl?guid=E067B351-304D-11D4-879C-00A0C9EA3676
```

Figure 3. A DOS Batch Script Copies HTML Templates to a Working Folder and Starts the Makepage Perl Script.

```
k:
cd k:\ojdb
copy templates\*.htm .
k:\perl5\bin\perl makepage.pl
```

to be on the Caltech campus (IP addresses in the 131.215.*.* range). Browsing a list of journal titles beginning with a single letter, the only method previously available, remains the dominant mode of access (98+% or 52,512).

The observed user preference for browsing can be partially explained in a couple of ways. The search feature is still relatively new. User rates of adoption of new technologies and techniques tend to exhibit exponential curves. In addition, when first introduced, the search function was limited to 12 titles/screen, necessitating the generation of additional dynamic ASP pages to view larger retrieval sets. Programming was changed on 4 October 2000 to generate a single ASP page with the complete retrieval results. These two factors, increased adoption rates and improved user interface, may account for the observed increase in use of the search function during the latter half of the study period.

More than 76% of the searches occurred in the October–December 2000 period.

Table 1 lists the 25 ejournal titles that generated the most traffic from the OJDB to the publishers' Web sites. An assessment of these titles reveals a few surprises. *Nature* and *Nature BioTechnology* appear on the list despite the cumbersome username/password access system in place during the study period. *Angewandte Chemie (International Edition)*, like the *Nature* titles, is limited to a single user at a time. *Tetrahedron Letters* is another special case, a portion of the Tetrahedron Information System, which Elsevier licenses separately from the ScienceDirect package. *Tetrahedron Letters* is another password controlled ejournal.

Academic Medicine is the major surprise in the group. Hosted by HighWire Press, *Academic Medicine* has been providing free access to the fulltext of the journal since 4 August 2000. The free trial period will end in mid-January 2001. Only one of the recorded visits to *Academic Medicine* originated at Caltech.

Table 2 lists the ejournal titles most frequently visited by Caltech users of the OJDB. The rankings compare very closely with the global traffic, especially through the first 13 entries. *Nature BioTechnology* soars from 21st to 14th rank and *Neuron* moves from 20th to 15th, when only Caltech user interests are measured. The spike of off-campus interest in

Figure 4. End Part of the HTML Template for 'A' Titles.

```
<!-- PAGE BANNER GOES HERE --!>

<table border="1" style="font-family: Verdana; font-size: 8pt">
<tr>
  <td><b><font size="2">Key</font></b></td>
  <td><b><font size="2">Journal Title</font></b></td>
  <td><b><font size="2">Notes</font></b></td>
</tr>
<tr>
  <td colspan="3" background="images/FineSpeckled.gif"><p align="center"><font
size="6">A</font><strong><br>
  A <a href="onlineB.htm">B</a> <a href="onlineC.htm">C</a> <a href="onlineD.htm">D</a>
<a
  href="onlineE.htm">E</a> <a href="onlineF.htm">F</a> <a href="onlineG.htm">G</a> <a
  href="onlineH.htm">H</a> <a href="onlineI.htm">I</a> <a href="onlineJ.htm">J</a> <a
  href="onlineK.htm">K</a> <a href="onlineL.htm">L</a> <a href="onlineM.htm">M</a> <a
  href="onlineN.htm">N</a> <a href="onlineO.htm">O</a> <a href="onlineP.htm">P</a> <a
  href="onlineQ.htm">Q</a> <a href="onlineR.htm">R</a> <a href="onlineS.htm">S</a> <a
  href="onlineT.htm">T</a> <a href="onlineU.htm">U</a> <a href="onlineV.htm">V</a> <a
  href="onlineW.htm">W</a> <a href="onlineX.htm">X</a> <a href="onlineY.htm">Y</a> <a
  href="onlineZ.htm">Z</a></strong></td>
</tr>

<!-- PERL SCRIPT BEGINS APPENDING HERE --!>
```

Figure 5. A Perl Script Imports Journal Records and Outputs an HTML Table.

```

# Create a static HTML version of the OJ pages.
#
# Last edited: 3/30/2000, Ed Sponsler

sub MakeTable
{
    $TitleLetter = shift(@_);
    $Data = $TitleLetter . ".txt";
    $HTML = "online" . $TitleLetter . ".htm";
    open (IN, "<$Data") || die "Can't open $Data";
    open (OUT, ">>$HTML") || die "Can't open $HTML";

    while (<IN>)
    {
        ($Code,$Title,$Notes,$URL) = split('\t',$_);
        print OUT "<tr>\n<td><b>$Code</b></td>\n";
        print OUT "<td><a href=\"$URL\">$Title</a></td>\n";
        print OUT "<td>$Notes</td>\n</tr>\n";
    }

    print OUT "<tr>\n<td colspan=\"3\"><p align=\"center\"><br><strong><a
href=\"onlinea.htm\">A</a> ";
    print OUT "<a href=\"onlineB.htm\">B</a> <a href=\"onlined.htm\">D</a> ";
    print OUT "<a href=\"onlinee.htm\">E</a> <a href=\"onlinef.htm\">F</a> <a
href=\"onlineg.htm\">G</a> ";
    print OUT "<a href=\"onlineh.htm\">H</a> <a href=\"onlinei.htm\">I</a> <a
href=\"onlinej.htm\">J</a> ";
    print OUT "<a href=\"onlinek.htm\">K</a> <a href=\"onlinel.htm\">L</a> <a
href=\"onlinem.htm\">M</a> ";
    print OUT "<a href=\"onlinen.htm\">N</a> <a href=\"onlineo.htm\">O</a> <a
href=\"onlinep.htm\">P</a> ";
    print OUT "<a href=\"onlineq.htm\">Q</a> <a href=\"onliner.htm\">R</a> <a
href=\"onlines.htm\">S</a> ";
    print OUT "<a href=\"onlinet.htm\">T</a> <a href=\"onlineu.htm\">U</a> <a
href=\"onlinev.htm\">V</a> ";
    print OUT "<a href=\"onlinew.htm\">W</a> <a href=\"onlinex.htm\">X</a> <a
href=\"onliney.htm\">Y</a> ";
    print OUT "<a href=\"onlinez.htm\">Z</strong></p>";
    print OUT "</td>\n</tr>\n";
    print OUT "</table>\n</center>\n</div>\n";
    print OUT "<br>\n<b><font face=\"Verdana\" size=\"1\">";
    print OUT "Send <a href=\"http://library.caltech.edu/feedback\">";
    print OUT "Comments</a> or <a href=\"mailto:web@library.caltech.edu\">";
    print OUT "Email</a> the CLSweb Team</font></b>";
    print OUT "</body>\n</html>\n";

    close (OUT);
    close (IN);
}

%Letters = (1,'A',2,'B',3,'C',4,'D',5,'E',6,'F',7,'G',8,'H',9,'I',10,'J',
            11,'K',12,'L',13,'M',14,'N',15,'O',16,'P',17,'Q',18,'R',
            19,'S',20,'T',21,'U',22,'V',23,'W',24,'X',25,'Y',26,'Z');

for ($index=1;$index<=26;$index++) {MakeTable ($Letters{$index})};

```

**Figure 6. Move HTML Files to the
 \Online Web Folder.**

```
k:
cd k:\ojdb
xcopy /i *.htm k:\inetpub\wwwroot\online
```

Academic Medicine displaced *Development* (419 total hits) from the global tally.

The number of hits in these tables reflects a certain level of interest in the journals indicated. However, there is no firm evidence that visits to ejournal Web sites result in users achieving satisfaction, or even of quantifying what a successful ejournal use might constitute. The best measure of ejournal use satisfaction available to the library is the number of journal articles downloaded or displayed from the publisher's Web site. As noted, these statistics are not universally available. It should also be noted, the click-through data is for the final 27 weeks of 2000, while the article download data in table 3

(McDonald 2000) is a calendar year 2000 extrapolation based upon the January–September 2000 period. Article download reports were provided by the American Chemical Society (ACS), HighWire Press, Cell Press, the American Physical Society, and the Institute of Physics, providing insight into use of 72 journals from five major publishers.

Seven of Caltech's ten most frequently visited fulltext ejournal sites are represented in the reports. The first five entries in Table 3 appear in the same order as they do in Tables 1 and 2. Multidisciplinary journals (*Nature*, *Science*, and *PNAS*), along with *JACS* exhibit exceptional click-through rates and, from the available data, reliably display a similar numeric edge in downloads.

How do ejournal Web sites offering less than fulltext fare? A unique aspect of the CLSweb online journals lists, and the OJDB, has been the entrée to publisher's Web sites providing tables of contents information. Table 4 provides titles and click-through counts for the 10 ejournal sites most commonly visited by the Caltech community. The top value

Figure 7. URL Processing and Usage Logging CGI Script

```
# Track usage of OJDB links & redirect user to journal site.
# Ed Sponsler
# Created: June 19, 2000

use Win32::ODBC;
use CGI;

$p=new CGI;

$db_archive = new Win32::ODBC("ojdb");
$get_unique_guid = "SELECT UniqueID, URL from Archive where PersistentID = `` . $p-
>param('guid') . `` and EndTime is NULL";
$db_archive->Sql($get_unique_guid);
$db_archive->FetchRow();
$UniqueID = $db_archive->Data("UniqueID");
$url = $db_archive->Data("URL");
$db_archive->Close();

$db_logs=new Win32::ODBC("ojdb");
$log_event = "INSERT INTO Logs (UniqueID, RequestorIP, ReferringURL, BrowserType) VALUES
(`` . $UniqueID . `` , `` . $ENV{REMOTE_ADDR} . `` , `` . $ENV{HTTP_REFERER} . `` , `` .
$ENV{HTTP_USER_AGENT} . ``)";
$db_logs->Sql($log_event);
$db_logs->Close();

print
    $p->redirect($url),
    $p->start_html,
    $p->end_html;
```

Table 1. Most Frequently Visited Ejournals Offering Fulltext (World)

Nature	3583
Science	3085
Journal of the American Chemical Society	2275
Proceedings of the National Academy of Sciences of the United States of America	1705
Cell	1217
Journal of Biological Chemistry	1165
Angewandte Chemie (International Edition)	1107
Physical Review Letters	973
Biochemistry	900
Journal of Chemical Physics	825
Applied Physics Letters	699
Journal of Molecular Biology	623
Journal of Physical Chemistry. A	604
Nature BioTechnology	529
Neuron	508
Journal of Neuroscience	489
Physical Review B	487
Tetrahedron Letters	485
Journal of Physical Chemistry. B	477
Journal of Organic Chemistry	469
Genes & Development	455
Journal of Applied Physics	453
Academic Medicine	446
EMBO Journal	439
Nucleic Acids Research	422

Table 2. Most Frequently Visited Ejournals (Caltech)

Nature	2966
Science	2648
Journal of the American Chemical Society	1934
Proceedings of the National Academy of Sciences of the United States of America	1450
Cell	1084
Angewandte Chemie (International Edition)	1015
Journal of Biological Chemistry	995
Physical Review Letters	866
Journal of Chemical Physics	735
Biochemistry	724
Applied Physics Letters	609
Journal of Physical Chemistry. A	545
Journal of Molecular Biology	542
Tetrahedron Letters	427
Journal of Physical Chemistry. B	415
Journal of Organic Chemistry	413
Journal of Neuroscience	412
Physical Review B	411
Genes & Development	404
Neuron	404
Nature BioTechnology	390
EMBO Journal	389
Development	381
Nucleic Acids Research	362
Journal of Applied Physics	361

of *Molecular & Cellular Biology* (301) is only 17% lower than the 25th ranked fulltext journal, *Journal of Applied Physics*. Not surprisingly, considering the level of demonstrated interest and utility to the campus, half of the titles (*) have been licensed for fulltext access.

Chemical & Engineering News is somewhat anomalous. ACS does not provide a complete fulltext version for site license. In addition to the current issue's table of contents, *C&EN*'s website provides a rotating selection of "Hot Articles" in fulltext.

Conclusions

The Caltech Library System, in one or more formats, currently receives all of the ejournals whose sites exhibited significant traffic. Documenting campus interest, or lack thereof, in online access to tables of contents information can aid in collection management decisions and resource allocation.

The data indicate strong interest in, and use of, high quality multidisciplinary journal titles. Chemistry, physics, and biology were well represented in the rankings, commensurate with the size and research activity of the disci-

plines on campus. Astronomy and geology ejournal use was less spectacular, but strong, and includes some portion of the *Science* and *Nature* figures. Two geology titles were among the 10 most heavily visited tables of contents Web sites. Mathematics and astronomy ejournals both exhibited click-through rates of 400–500; roughly 70–80 ejournal site visits from campus per month. Engineering is spread over a broad variety of titles, and much of the engineering literature cites basic science articles. As a result, it is difficult to assess the level of ejournal use within the engineering disciplines. Owing to the idiosyncrasies of its small size and multidisciplinary research programs, Caltech may not be the perfect model for sociology of science studies.

Click-through tracking technology can provide valuable data for collection management and resource allocation. The ejournal use measures employed in this study, while far from comprehensive, jibe well with the harder to acquire vendor-supplied use statistics. Ejournal use from users' bookmarks and other methods which bypass the library's website can only be captured by vendors. The data naturally sorted into ejournals of high interest and those of lower interest,

Table 3. Articles Downloaded from Ejournals as Reported by Publishers

Science	19703
Journal of the American Chemical Society	14406
Proceedings of the National Academy of Sciences of the United States of America	10709
Cell	8974
Journal of Biological Chemistry	8505
Journal of Physical Chemistry. A	5180
Physical Review Letters	4853
Neuron	3994
Biochemistry	3330
Organometallics	3031
Journal of Organic Chemistry	2692
Macromolecules	2163
Inorganic Chemistry	1907
Chemical Reviews	1880
Analytical Chemistry	1588
Molecular Cell	1529
Accounts of Chemical Research	1446
Journal of Cell Biology	1415
Physical Review B	1407
Langmuir	1267
Journal of Neurophysiology	1190
Physical Review A	879
Immunity	869
Molecular Biology of the Cell	810
Chemistry of Materials	757

whether measured against the global demand, campus use of fulltext resources, articles downloaded, or campus use of tables of contents. It would not be unreasonable to make assumptions about the likely magnitude of article downloads based upon the measured click-through traffic in the absence of hard data from publishers.

Notes

1. GUID: A Globally Unique Identifier is a computer-generated string of letters and digits guaranteed to be unique. An example: E067B351-304D-11D4-879C-00A0C9EA3676.

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Table 4. Most Frequently Visited Ejournals Offering Tables of Contents & Abstracts

Molecular & Cellular Biology *	301
Developmental Biology *	224
Chemical Physics Letters	177
Geochimica et Cosmochimica Acta	136
European Journal of Biochemistry *	134
Biochemical & Biophysical Research Communications *	113
Analytical Biochemistry *	111
Chemical Geology	104
Chemical & Engineering News	101
Nuclear Physics A	101

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