International performance of UK physics research

Bibliometric analysis of research publication output and citation impact

Thed van Leeuwen and Robert Tijssen

Center for Science and Technology Studies (CWTS)

Leiden University

The Netherlands

==========

CWTS report for Research Councils UK

Version May 6th 2008

==========

Contents

Summary introduction

This technical report provides background information on the CWTS data deliveries for the bibliometric study of UK physics research performance commissioned by the *Research Councils UK* (henceforth indicated by RC UK).

Its content briefly describes, in a non-technical fashion, the main features of the CWTS information system and methodology that was used to produce quantitative indicators-based data for RC UK on the UK research performance in physics within an international comparative perspective during the years 1997-2006. This 'bibliometric' approach extracts its statistical data from data mining relevant bibliographical information contained within the research journals in physics (and adjacent overlapping fields of science). This statistics refer to the volume of research – in terms of quantities of research publications in peer-reviewed international journals – as well as the impact of the research described in those publications on the physics research community worldwide as expressed in a range of citation impact indicators.

The assembled findings provide empirical evidence of the UK's major contribution to physics research worldwide, and its excellent research performance in terms of international citation impact.

Part 1: Background and bibliometric methodology

1.1 CWTS information system

The publication output data and citation impact data were extracted from CWTS's proprietary version of the database *Web of Science* (WoS). This source of information is specifically designed for statistical 'bibliometric' analyses of the worldwide research literature.[1] The WoS database contains selected bibliographic information from all research papers published in about 12,000 'sources', including the paper's title and abstract, author names[2], author affiliations, full text, reference list, document type, and other bibliographic identifiers such as the journal's ISSN number. Some 8,500 of these sources are fully covered peer-reviewed international scientific and technical journals, the remainder being journals and conference proceedings that are often only partially covered.

The CWTS/WoS database is an upgraded and dedicated 'bibliometric' version of the widely available online/offline 'bibliographic' versions of the database provided by Thomson Scientific to its customers. The CWTS/WoS database covers the years 1980 up to and including the most recent publication year (currently 2007). The WoS is one of very few international multidisciplinary databases that offer a broad and high-quality coverage of the worldwide research literature, and has effectively been the common source for all large scale comparative bibliometric studies over the last two decades. The only other comparable database is *SCOPUS*, a relatively recent source produced by the science publisher *Elsevier* of thus far unknown added value compared to the WoS. Numerous other databases have a limited disciplinary scope, often focusing on specific scientific fields or research domains, such as *Inspec* (for physics and electrical engineering), *Medline* (medicine and health care), to name a few.

[1] CWTS holds a license agreement with the database producer, *Thomson Scientific* (now *ThomsonReuters Scientific*) to supply WoS-based bibliometric information to clients worldwide on a commercial basis.

[2] Authors are institutional authors, i.e. a person and his or her institutional address at the time of the publication and listed in the heading or in a footnote of a research publication.

The CWTS bibliometric information system integrates the CWTS/WoS database and a series of software routines and research performance indicators based on publication output and citation impact statistics (section 6 provides more details about these indicators). Note that these indicator-based statistics may differ slightly from the results of similar citation analysis which are performed with other, on-line of off-line, 'bibliographic' (campus license) editions of the *Web of Science*, or CD-ROM versions of WoS predecessor databases such as the *Science Citation Index*, because of minor differences in coverage, definitions of admissible document types, time spans, or data upgrading by CWTS to improve the quality the WoS database.

1.2 Data pre-processing for bibliometric analysis

CWTS invests considerable resources and efforts, on a continuous basis, to upgrade the *Thomson Scientific's* bibliographic edition of the WoS into a CWTS bibliometric version thus improving the accuracy and comprehensiveness of the data. Part of this computerized procedure includes the cleaning and standardization of the names of organizations listed in the author affiliate address information.

Yet another step in the data processing is the 'unification' of the research output in the WoS for England, Scotland, Wales and Northern Ireland to the UK. These four parts of the UK are treated as quasi countries, and need to be re-attributed before analysis.

1.3 Defining the fields of science

Each source journal within the CWTS/WoS database is attributed to one or more Thomson Scientific-defined *Journal Categories*, a collection of journals covering the same, or closely related, research topics or areas. *Thomson Scientific* has assigned these journals to these categories according to the opinions of subject experts and inter-journal citation patterns (more about citations in section 6.2). Each journal category is, basically, equivalent to a subfield of science. Wide-scope journals are often assigned to more than one subfield. The prestigious general journals with broad multidisciplinary scopes, such as *Nature* and *Science*, are assigned to a journal category of their own, denoted by *Thomson Scientific* as 'Multidisciplinary Sciences' and included in the CWTS system under the heading 'Multidisciplinary journals'. Publications form these journals are selected on the basis of the citing behavior of the authors of papers in *Nature* and *Science*. So if the references indicate through the journals used a strong focus on physics, we included the publications in the study as part of physics.

The CWTS bibliometric information system offers customers the possibility to tailor research fields and design their own classification systems based on the groupings of the journal categories. This option was used by RC UK to co-design a fully exhaustive classification system describing the field of physics (see section 3.1) consisting of 27 fields of physical science, which are not mutually exclusive, that is one journal can be classified in various subfields. The other option used by RC UK was to define eth field of physics by grouping together all *Journal Subject Categories* (JSC's) dealing with physics as one main field (see section 3.2).

1.4 Selecting benchmark countries

In this study, the choice was made to compare the UK performance in the field of physics research with the national output and impact of the following countries: Canada, France, Germany, Japan, the Netherlands, and the USA.

1.5 Database year and publication year

All calculations and statistics refer to database years – i.e. the year in which *Thomson Scientific* processed the publications for its WoS database. These measurements differ from those based on publication years, which refer to the publishing date of the journal issue. Some 5-10% of the publications that were issued in publication year *t* are processed by *Thomson Scientific* for the WoS database in the following two years *t+1* and *t+2*.

1.6 CWTS Bibliometric indicators

The package of quantitative indicators defined by RC UK for this study comprises of a set of country level 'macro' indicators, comparing the research performance in physics of the UK with other countries (see section 4). These indicators can subdivided into two classes: publication output indicators and citation impact indicators.

1.6.1 Publication output indicators

Each journal publication that is indexed by the CWTS/WoS database is fully attributed to all countries listed in the author address list of the publication. The same applies to all affiliate main organizations in the author address list as well as the corresponding (main) institutional sectors of each organization. A publication that lists different units of an identical main organization is counted only once (e.g. different research departments of the same university, or subsidiaries of the same parent company).

The publication output is equal to the total number of papers published by a country during the entire period under investigation. These papers relate only to research-based publications that are published in peer-reviewed international scientific and technical journals (see section 1). Only publications reporting on original research findings are included – i.e. the document types 'normal article', 'letter', 'note', and 'review article'. 'Meeting abstracts', 'Corrections', 'Editorials' and other document types are not included. Apart from this selection, all publications are treated equally in the computations. In a very few cases publications are published in a journal that is not fully indexed within the CWTS/WoS database; such publications are not included in analyses (see section 1).

1.6.2 *Citation impact indicators*

Each research publication may or may not be read by other scientists and scholars, and its contents may or may not be used in their follow-up research – either by the author(s) or by others. In the event this follow-up research is published in a research article in an international journal, the corresponding researchers and scholars tend to acknowledge the value of the research publication by adding its bibliographic details to in their list of relevant literature (the 'reference list'). These 'citations' to the previous literature can be used as measure of the (international) intellectual influence and scientific impact of a piece of published research.

Hence, the international scientific impact of a country or organization is calculated on the basis of the quantity of citations received by its research papers. A cited publication is assigned in full to all countries and regions included in the author address list. The citation frequency counts in this study refer only to citations that were recorded within the WoS-indexed set of international peer-reviewed journals.

A heavily cited research publication has made a significant impact on the (international) scientific community. Many publications are never cited. At aggregate levels, a significant positive correlation

exists between citation impact frequency and scientific 'quality'. The number of observed citations obviously depends on the time span of measurement. The number of citations received also tends to be field-dependent.

The citation frequency distribution of research publications worldwide is also highly skewed: at high aggregate levels some 20% of the publications tend to receive about 80% of all citations. The top percentiles of most heavily cited publications reflect the best research worldwide. The share of a country within these top publications indicates its contribution to cutting edge research worldwide and provides a crude indicator of research excellence within a domestic science system. The publications in the top percentiles are determined separately for each subfield of science. Each publication is assigned in full to all countries included in its author address list.

The citation frequencies depend on the time-interval after the publication date during which the citations will accumulate and are counted. The accumulation of citations is counted within a pre-set time-interval – the 'citation window', which can be defined according to several operational criteria. These windows tend to vary from 1-2 years (short term impact, as measured in the Impact Factor) to as much as 10 years of longer (long term impact). A period of 4-6 years is generally considered to be of appropriate length in most fields of science to assess medium-term impact levels with a sufficient degree of validity. In this study the window was aligned to the publication window – i.e. the set of publication years and citation years are identical.

These citation counts may or may not include author self-citations – i.e. a citation to a paper is a citation given in a publication of which at least one of the authors (either first author or a co-author) is also an author of the cited paper (again either first author or a co-author). These self citations were excluded in this study. When focusing on 'external' impact, the counts should always exclude the author self-citations.

The analysis of highly cited publications is based on single publication years, in combination with a fixed four year citation window. This needs to be fixed, as this every single publication in every single year an equal change to contribute to the top-down ranking per field, and to make annual analyses easier.

We define the follow four citation impact indicators:

1a. The average number of Citations Per (citable) Publication (CPP) within the standard *Web of Science*-defined fields of physics research. This *citation per publication rate* is denoted by the technical acronym **CPP (WoS)**.

1b. Some of the citation analyses are based on RC UK customized definitions derived from the IOP classification of physics subfields. See section 3.1 for details about the subfield delineations. The customized CPP value is denoted by **CPP** (**IOP)**.

2. The *field normalized impact score* of a set of publications is based on the attribution of the corresponding journals to the WoS-defined *Journal Subject Categories* (the WoS 'fields'). For each field we compute the *mean Field Citation Score* (FCSm) as a baseline value for all journals attributed to that field. Hence this indicator corrects for the citation characteristics of (sub)fields. It is denoted as by **CPP/FCSm (WoS)**.

3. The *relative journal impact score*. For each WoS-indexed journal we compute the *mean Journal Citation Score* (JCSm) as a baseline value for the citation impact of all publications within that

journal. A comparison of the JCSm and the FCSm scores is indicative of the impact ranking of a journal with its field of science. This indicator is denoted by **JCSm/FCSm (WoS)**.

1.7 RC UK defined bibliometric indicators

CWTS will supply the following data for the period 1997-2006 inclusive:

a) Annual publication output counts attributed to the research field physics for the following countries: Canada, Germany, France, Japan, The Netherlands, UK and the USA.

b) Annual output counts of the countries specified above as a percentage of the world total counts in physics.

c) For each country the normalized citation impact scores relative to the world average citation impact. The normalization will be journal-based (derived from the *Web of Science* journal classification system) as well as sub-fields that are based on RC UK defined sets of research journals.

d) For all physics research journals:
- e1) Percentage of UK-authored (or co-authored) research papers over a period of 10 years;
- e2) Average number of citations per UK-authored (or co-authored) research papers against Average number of citations per paper worldwide (including or excluding the UK).

e) A comparison between: (i) the annual paper counts (also expressed as % of UK papers) for UK papers that fall within the 1% most frequently cited papers for Physics and (ii) the annual paper counts (again expressed as % of UK papers) that fall within the 1% most frequently cited papers within each of the comparator broad fields of Chemistry, Biology and Geology. These three disciplines resemble the output volume of physics field. The classification scheme of these three disciplines, based on *Web of Science* related *Journal Subject Categories*, is described in section 3.3

f) Annual output count (also expressed as % of UK papers) for UK papers that fall within the world's top 1%, 5% and 10% most frequently cited papers for physics, alongside the proportion of UK non-cited articles.

Part 2: Bibliometric statistics

2.1 Annual publication output for the UK and comparator countries

This section present annual publication output frequency data for the UK and the six comparator countries: Canada, Germany, France, Japan, The Netherlands, and the USA.

The annual trend data are displayed in Table 2.1 for all physics publication output. This grand total includes both the WoS-defined physics journals and the journals according to the RC UK definition. The trend data is also shown in Figure 2.2.

The annual worldwide output numbers per RC UK defined subfield of physics research are presented in Table 2.3. The corresponding data per RC UK defined subfield of physics research are in Table 2.4.

Table 2.1: Annual publication output frequencies in all of Physics (RC UK and Journal Subject Category based), 1997-2006

	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Canada	3887	3759	3645	3779	3724	4026	4448	4418	5485	5620
France	10013	9873	10376	10341	10782	10401	11236	10357	12133	11671
Germany	14306	15662	15453	15118	15417	15403	16602	15078	17686	16890
Japan	15303	15736	16809	16340	17663	17316	20047	17482	18804	17844
The Netherlands	2653	2692	2720	2755	2925	2927	3082	3162	3513	3314
UK	9396	9957	10073	10006	10117	10130	10487	10398	11788	11533
USA	34897	34920	36035	35020	36761	36742	39705	38715	44832	43711
All Physics (RC UK & JSC)	120769	123552	127164	124829	131582	133428	146573	141754	165092	166257

Figure 2.2: Graphical representation of publication output trends, 1997-2006

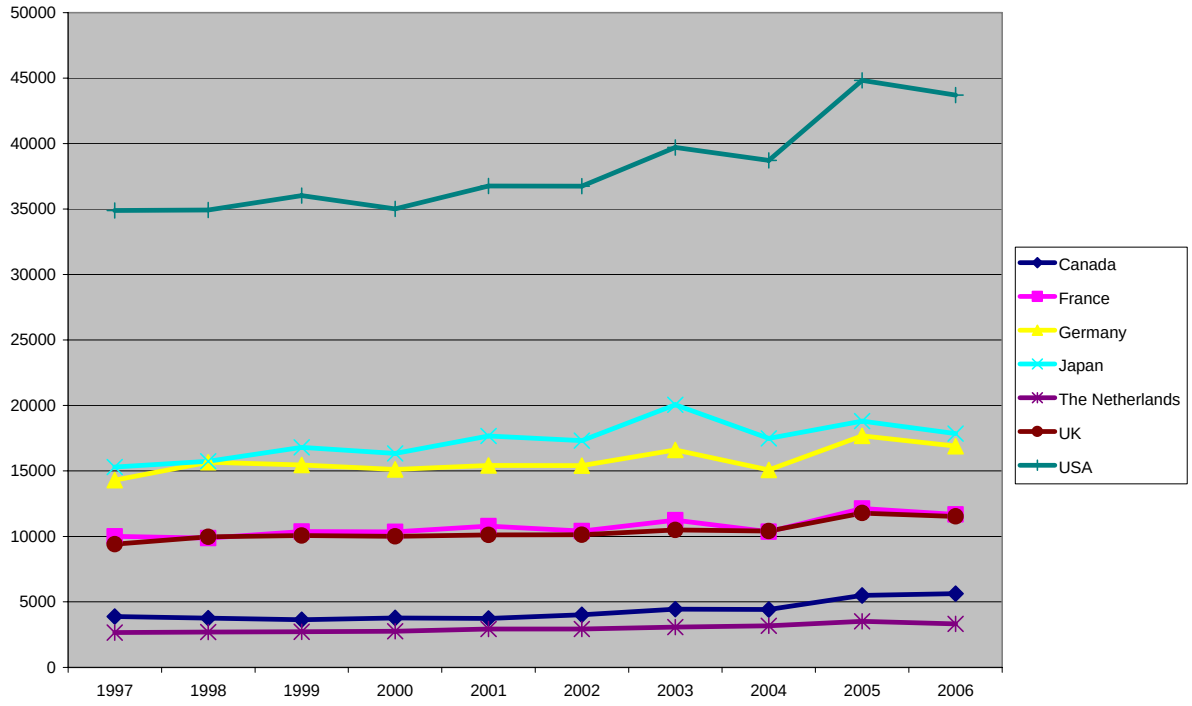

Table 2.3: Annual publication output frequencies per research field (RC UK defined subfields), 1997-2006

	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
01. Accelerators, beams & electromagnetism	3303	3666	3416	3544	3969	4042	4482	4804	4641	5104
02. Astrophysics & astroparticles	17888	15787	16431	15867	16235	15151	16690	15972	18583	18816
03. Atomic & molecular physics	23848	24642	23798	23898	25316	24912	27967	27199	31438	31434
04. Biological physics	13946	16213	17126	18548	20011	21020	23682	24347	31384	30913
05. Chemical physics & physical chemistry	26836	28903	28762	29351	30777	29630	32197	32306	36916	35429
06. Computational physics	45361	47369	45666	48176	46858	45326	48452	47858	55123	52609
07. Electronics & devices	68607	71177	72867	75050	75833	75866	82305	81748	96129	96842
08. Education & communication	268	217	247	228	355	391	382	429	433	483
09. Environmental & earth science	2158	2119	2284	2376	2507	2304	2586	2340	2774	2750
10. Fluid dynamics	7415	9025	10289	11088	12824	13771	14458	15178	19961	19764
11. Gravitation & cosmology	8544	6424	8365	7464	7946	7751	8004	8095	8632	8836
12. Instrumentation & measurement	3711	3840	4075	3904	4912	4756	5338	5812	6648	7080
13. Condensed matter: electrical, magnetic & optical	37069	37248	39692	40209	40113	39730	42808	42389	50232	51665
14. Condensed matter: structural, mechanical & thermal	51391	52953	55269	57392	57946	59141	63444	63614	76379	75953
15. Mathematical physics	9270	10907	12183	13191	14968	15377	16255	16674	21962	21566
16. Medical physics	2049	2320	2140	2350	2223	2426	2749	2880	3162	3139
17. Nanoscale science & low-D systems	22114	21449	23808	22785	23212	25089	27494	27918	31882	35830
18. Nuclear physics	12745	14238	13221	13352	13568	12398	13851	13359	14600	13787
19. Optics, quantum optics & lasers	29010	28242	29348	29797	30443	31260	32431	32347	39832	40740
20. Particle physics & field theory	16238	16968	16218	16075	16412	15748	17080	16665	18285	17787
21. Plasma physics	14096	15473	17836	18018	20429	21661	24351	23909	29999	32402
22. Quantum information & quantum mechanics	43839	43738	45426	46723	44426	45053	48283	47253	53608	55596
23. Semiconductors	62226	63161	63591	64857	64002	63008	68759	67591	77624	78562
24. Soft matter, liquids & polymers	16803	19151	20784	21937	23834	24954	27079	27456	33309	33848
25. Statistical physics & nonlinear systems	22527	23700	23742	26114	27583	28304	29699	29296	37896	35894
26. Superconductivity	46350	46994	48265	48772	47274	46942	51306	50364	57556	59414
27. Surfaces, interfaces & thin films	68607	71051	71840	74008	74022	73860	80017	79067	92763	93008

Table 2.4: Annual publication output frequencies per country and research field (RC UK defined subfields), 1997-2006

	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
01. Accelerators, beams & electromagnetism										
Canada	116	111	127	97	106	107	123	164	166	233
France	200	260	184	236	258	246	204	270	272	301
Germany	281	359	288	345	382	392	373	421	413	449
Japan	378	389	385	378	499	420	474	592	478	500
The Netherlands	57	67	85	80	71	84	107	84	70	118
UK	218	203	272	297	234	290	315	256	293	315
USA	1120	1337	1188	1150	1264	1349	1624	1649	1615	1677
02. Astrophysics & astroparticles										
Canada	501	429	506	483	454	478	520	472	626	616
France	1223	912	851	812	862	824	856	884	1026	952
Germany	2172	1701	1498	1631	1622	1370	1572	1363	1776	1730
Japan	1196	1324	1480	1409	1525	1190	1585	1442	1349	1569
The Netherlands	406	308	291	285	308	276	291	265	325	343
UK	1479	1363	1379	1338	1344	1302	1301	1339	1534	1511
USA	6270	5480	6259	5644	5851	5621	6029	5718	6439	6418
03. Atomic & molecular physics										
Canada	757	801	685	700	706	742	788	771	991	987
France	1573	1558	1619	1679	1742	1649	1721	1626	1960	1936
Germany	2462	2553	2441	2338	2449	2384	2693	2395	2948	2647
Japan	2686	2904	2609	2601	2987	2782	3338	3144	3244	2905
The Netherlands	533	558	474	479	490	520	545	568	639	552
UK	1788	1881	1885	1987	1900	1957	2045	1959	2136	2137
USA	7903	7976	7644	7456	7815	7874	8719	8578	9971	9804
04. Biological physics										
Canada	513	577	534	599	636	667	770	835	996	1057
France	783	1032	1086	1189	1388	1318	1488	1410	1939	1797
Germany	1264	1884	2053	2186	2239	2366	2623	2453	3301	3224
Japan	1314	1544	1632	1798	1877	2052	2266	2251	2671	2488
The Netherlands	318	330	394	401	431	463	568	552	687	650
UK	827	949	1113	1286	1358	1399	1483	1595	2002	2006
USA	5624	6067	6270	6625	6981	7275	8145	8420	10444	10206

Table 2.4 (continued)

	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
05. Chemical physics & physical chemistry										
Canada	923	950	902	925	862	900	977	981	1243	1200
France	2006	2092	2117	2075	2262	2046	2128	2077	2470	2282
Germany	2802	3310	3248	3086	3264	3188	3297	3185	3658	3367
Japan	2627	3224	3058	2951	3318	3098	3595	3506	3636	3311
The Netherlands	665	681	634	663	650	620	680	721	766	687
UK	2190	2274	2402	2452	2416	2408	2425	2408	2536	2451
USA	8574	8983	8745	9059	9307	8892	9684	9612	11358	10676
06. Computational physics										
Canada	1368	1384	1336	1330	1227	1315	1434	1372	1859	1772
France	3464	3421	3288	3474	3415	3221	3131	3213	3752	3402
Germany	5002	5299	4826	5070	4958	4641	4856	4581	5540	5127
Japan	4476	5153	5118	5412	5213	4779	5330	5221	5248	5093
The Netherlands	971	1031	908	1008	949	927	968	1002	1126	983
UK	3568	3658	3621	3906	3501	3474	3546	3449	3767	3544
USA	13829	14299	13586	13817	13732	13570	14709	14228	16551	15349
07. Electronics & devices										
Canada	2038	2006	2032	2028	1939	2127	2327	2348	3038	3033
France	4991	4941	4967	5176	5291	5071	5127	5088	6141	5845
Germany	7229	7767	7594	7842	7818	7612	8117	7639	9333	8926
Japan	7083	7701	7946	8280	8301	8102	8835	8617	9104	8939
The Netherlands	1474	1386	1406	1455	1458	1440	1568	1565	1805	1758
UK	4918	5256	5404	5741	5333	5310	5532	5428	6289	6207
USA	22049	22209	23127	22950	23351	23555	25526	25394	29644	28713
08. Education & communication										
Canada	6	5	8	10	13	8	10	18	11	10
France	3	5	7	4	13	14	16	8	19	18
Germany	8	8	7	8	6	26	11	21	21	21
Japan	0	3	2	0	4	11	14	15	13	15
The Netherlands	2	3	5	2	3	4	4	1	3	5
UK	13	15	11	13	25	25	32	18	19	22
USA	154	122	164	125	191	185	179	222	183	221
09. Environmental & earth science										
Canada	115	130	127	120	130	137	125	129	147	163
France	101	128	110	108	154	110	117	118	187	129
Germany	115	113	119	128	122	134	136	121	169	176
Japan	73	88	77	98	109	107	115	116	134	144
The Netherlands	39	48	60	56	47	40	49	42	60	45
UK	163	131	167	186	203	146	178	151	199	201
USA	1012	1000	1108	1148	1129	1068	1199	1122	1188	1207

Table 2.4 (continued)

	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
10. Fluid dynamics										
Canada	216	230	263	287	306	364	392	437	578	566
France	503	674	788	864	1071	989	1111	1037	1363	1303
Germany	696	1286	1442	1543	1647	1748	1873	1717	2249	2131
Japan	617	701	863	920	1020	1233	1205	1233	1564	1440
The Netherlands	167	145	200	195	253	275	340	306	379	416
UK	496	595	800	849	1013	1016	1026	1088	1419	1409
USA	2748	3000	3292	3557	3942	4140	4186	4590	5952	5766
11. Gravitation & cosmology										
Canada	289	188	289	255	240	270	278	267	321	373
France	547	259	318	302	292	317	311	342	369	377
Germany	967	593	666	593	659	594	645	600	671	681
Japan	449	407	552	529	574	487	589	576	578	557
The Netherlands	209	112	137	135	134	105	117	108	118	140
UK	839	759	860	802	849	874	884	907	915	931
USA	3253	2561	3698	3096	3423	3293	3400	3450	3603	3650
12. Instrumentation & measurement										
Canada	84	74	104	90	83	107	127	130	227	202
France	259	308	254	278	326	325	306	369	430	455
Germany	354	387	372	377	495	461	448	542	574	636
Japan	333	367	431	477	552	523	517	648	604	660
The Netherlands	70	68	85	67	91	99	119	94	119	148
UK	303	269	280	320	355	361	423	427	436	522
USA	1212	1224	1457	1136	1567	1497	1664	1734	1999	2061
13. Condensed matter: electrical, magnetic & optical										
Canada	1045	998	1007	1017	945	1019	1139	1171	1435	1513
France	2951	2744	2857	2978	2969	2874	2805	2756	3355	3294
Germany	4166	3938	4158	4184	4210	4087	4212	4017	4993	4676
Japan	4254	4421	4538	4786	4626	4577	4780	4637	4996	4870
The Netherlands	835	717	760	772	770	698	752	776	899	895
UK	2328	2627	2760	2936	2507	2428	2616	2501	3114	3004
USA	11180	10909	12107	11600	11796	11772	12715	12747	15032	14763
14. Condensed matter: structural, mechanical & thermal										
Canada	1571	1590	1557	1605	1540	1711	1813	1906	2396	2415
France	3666	3645	3769	3999	4018	3961	3969	3898	4857	4638
Germany	5504	5796	5873	6113	6098	6050	6432	6033	7577	7116
Japan	5512	5934	6029	6567	6333	6448	6982	6793	7381	6965
The Netherlands	1103	990	1054	1101	1091	1108	1176	1189	1395	1372
UK	3689	4044	4225	4405	4241	4192	4350	4356	5134	5082
USA	16848	16808	17962	17937	18338	18648	19989	20191	23895	23122

Table 2.4 (continued)

	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
15. Mathematical physics										
Canada	301	293	332	351	378	425	444	490	666	623
France	629	777	910	1015	1223	1059	1229	1139	1484	1404
Germany	962	1597	1754	1804	1922	1966	2134	1923	2549	2416
Japan	724	814	986	1051	1163	1348	1347	1338	1702	1601
The Netherlands	218	207	246	227	304	303	354	337	400	433
UK	542	641	859	937	1081	1081	1110	1142	1383	1396
USA	3077	3346	3629	3978	4383	4501	4622	4885	6417	6153
16. Medical physics										
Canada	111	142	127	147	122	130	145	140	207	195
France	62	69	88	81	87	89	110	95	126	117
Germany	113	145	152	156	165	192	231	231	279	274
Japan	133	149	115	121	116	137	132	127	128	129
The Netherlands	81	91	77	93	93	126	132	153	171	163
UK	104	152	156	159	186	192	191	190	187	237
USA	1114	1168	1106	1197	1104	1102	1239	1301	1429	1373
17. Nanoscale science & low-D systems										
Canada	621	555	629	587	545	631	706	805	922	1029
France	1628	1545	1506	1444	1438	1505	1533	1521	1781	1880
Germany	2092	1860	1991	1871	1840	1942	2079	2107	2457	2704
Japan	2631	2574	2828	2707	2783	3144	3152	3111	3359	3619
The Netherlands	481	356	425	412	386	404	431	443	507	558
UK	1545	1681	1656	1673	1516	1560	1676	1623	2045	2152
USA	7149	6594	8010	7392	7486	7982	8894	9134	10139	10532
18. Nuclear physics										
Canada	328	359	364	324	315	331	345	286	452	381
France	922	981	883	903	959	860	844	938	1016	829
Germany	1433	1731	1380	1500	1578	1345	1518	1395	1536	1462
Japan	1253	1521	1553	1451	1674	1342	1685	1620	1437	1579
The Netherlands	246	281	246	240	258	236	290	269	295	270
UK	889	876	937	986	810	781	839	754	844	741
USA	4046	4416	4100	3902	3943	3787	4275	3992	4373	3955
19. Optics, quantum optics & lasers										
Canada	812	724	789	770	781	870	915	919	1272	1209
France	2025	1816	1885	1948	2017	1989	1927	1881	2438	2441
Germany	3173	2943	3067	3096	3086	3140	3152	2906	3690	3644
Japan	2894	2857	2945	2974	3167	3270	3250	3143	3589	3443
The Netherlands	603	487	507	503	558	533	526	539	655	657
UK	1768	1982	1970	2127	1894	1879	1960	1924	2342	2433
USA	9866	9343	10145	9907	10064	10275	10586	10753	12605	12523

Table 2.4 (continued)

	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
20. Particle physics & field theory										
Canada	440	411	463	417	404	444	481	431	605	575
France	1056	1118	1010	991	1027	1025	944	1033	1107	976
Germany	1708	1868	1602	1659	1701	1596	1669	1566	1791	1651
Japan	1452	1644	1690	1571	1794	1497	1787	1730	1580	1808
The Netherlands	300	318	288	294	298	309	356	308	357	341
UK	1207	1198	1253	1300	1191	1161	1162	1098	1196	1137
USA	5173	5228	4977	4691	4805	4724	5083	4939	5346	5029
21. Plasma physics										
Canada	381	364	404	409	424	494	554	645	775	839
France	837	1012	1164	1185	1432	1360	1566	1388	1842	1840
Germany	1319	1825	2094	2110	2299	2385	2717	2376	3105	2986
Japan	1868	1784	2029	1973	2306	2423	2760	2592	2980	2993
The Netherlands	263	225	310	293	350	372	463	410	496	564
UK	733	805	1094	1174	1287	1321	1382	1384	1736	1804
USA	4813	5082	5698	5816	6144	6518	7135	7287	9106	9128
22. Quantum information & quantum mechanics										
Canada	1204	1118	1219	1158	1087	1207	1308	1250	1684	1647
France	3251	2948	2951	3105	2917	2884	2839	2877	3305	3216
Germany	4674	4610	4409	4655	4317	4211	4420	4189	4862	4829
Japan	4684	4742	5146	5553	5112	5006	5247	5079	5269	5417
The Netherlands	898	791	834	860	823	807	819	841	934	941
UK	2967	3175	3090	3388	2801	2826	2960	2835	3208	3256
USA	13857	13613	14672	14193	13878	14245	15255	15012	16707	16352
23. Semiconductors										
Canada	1846	1798	1795	1764	1652	1788	1965	1949	2503	2522
France	4589	4362	4287	4404	4338	4187	4112	4162	4905	4684
Germany	6593	6559	6209	6342	6226	5915	6322	5990	7198	6917
Japan	6514	7039	7138	7409	7326	6905	7672	7436	7603	7563
The Netherlands	1331	1267	1223	1278	1229	1185	1256	1283	1462	1378
UK	4540	4766	4710	5001	4439	4402	4606	4471	5138	5055
USA	19786	19645	20307	19788	19826	19788	21681	21197	24185	23440
24. Soft matter, liquids & polymers										
Canada	563	619	617	659	645	714	830	851	1050	1068
France	1267	1561	1557	1650	1903	1811	1935	1817	2288	2086
Germany	1534	2241	2419	2489	2592	2768	2951	2718	3346	3276
Japan	1700	1887	2094	2101	2242	2458	2515	2502	2870	2856
The Netherlands	426	402	484	509	511	539	640	621	727	689
UK	1143	1175	1428	1590	1663	1695	1705	1756	2052	2056
USA	5464	5835	6272	6583	7010	7191	7812	7998	9797	9562

Table 2.4 (continued)

	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
25. Statistical physics & nonlinear systems										
Canada	686	708	679	740	759	844	883	889	1227	1131
France	1522	1595	1645	1884	2076	1904	2006	1898	2565	2328
Germany	2528	3018	2952	3234	3321	3371	3505	3164	4187	3811
Japan	1984	2193	2219	2539	2559	2699	2981	2804	3306	2850
The Netherlands	472	466	451	506	579	579	617	604	748	716
UK	1582	1699	1830	1946	2105	2081	2093	2140	2533	2489
USA	7690	7788	7680	8317	8664	8998	9304	9236	11767	10908
26. Superconductivity										
Canada	1290	1197	1262	1211	1120	1254	1375	1363	1753	1775
France	3522	3227	3223	3324	3161	3146	3042	3104	3654	3555
Germany	4945	4872	4680	4807	4636	4402	4713	4505	5375	5187
Japan	5199	5554	5712	5841	5750	5399	5847	5761	5838	5834
The Netherlands	940	850	888	896	856	837	892	895	1023	1003
UK	3161	3448	3378	3599	3030	2997	3171	3011	3571	3493
USA	14131	14075	14988	14419	14237	14327	15648	15405	17360	17036
27. Surfaces, interfaces & thin films										
Canada	2038	2001	2009	1999	1891	2087	2256	2262	2920	2907
France	4991	4936	4884	5092	5075	4889	4881	4875	5894	5605
Germany	7229	7760	7417	7654	7517	7287	7783	7337	8955	8522
Japan	7083	7697	7855	8184	8142	7914	8662	8406	8865	8648
The Netherlands	1474	1386	1387	1438	1430	1402	1517	1516	1742	1667
UK	4918	5250	5228	5557	5115	5090	5311	5156	5995	5852
USA	22049	22140	22985	22802	23043	23173	25040	24767	28767	27666

2.2 Publication output share of countries within world total

This section presents the trends in the annual output of the countries as a % share of the world publication output (Table 2.5).
The output shares per RC UK defined subfields of physics research are listed in Table 2.6.

Table 2.5: Annual shares of the world output numbers in Physics as a whole (RC UK and Journal Subject Category based), 1997-2006 (% of world publication output in physics)

	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Canada	3.2	3.0	2.9	3.0	2.8	3.0	3.0	3.1	3.3	3.4
France	8.3	8.0	8.2	8.3	8.2	7.8	7.7	7.3	7.3	7.0
Germany	11.8	12.7	12.2	12.1	11.7	11.5	11.3	10.6	10.7	10.2
Japan	12.7	12.7	13.2	13.1	13.4	13.0	13.7	12.3	11.4	10.7
The Netherlands	2.2	2.2	2.1	2.2	2.2	2.2	2.1	2.2	2.1	2.0
UK	7.8	8.1	7.9	8.0	7.7	7.6	7.2	7.3	7.1	6.9
USA	28.9	28.3	28.3	28.1	27.9	27.5	27.1	27.3	27.2	26.3

Table 2.6: Annual output shares per country and research field (defined by RC UK), 1997-2006 (% of world publication output)

	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
01. Accelerators. beams & electromagnetism										
Canada	3.5	3.0	3.7	2.7	2.7	2.6	2.7	3.4	3.6	4.6
France	6.1	7.1	5.4	6.7	6.5	6.1	4.6	5.6	5.9	5.9
Germany	8.5	9.8	8.4	9.7	9.6	9.7	8.3	8.8	8.9	8.8
Japan	11.4	10.6	11.3	10.7	12.6	10.4	10.6	12.3	10.3	9.8
The Netherlands	1.7	1.8	2.5	2.3	1.8	2.1	2.4	1.7	1.5	2.3
UK	6.6	5.5	8.0	8.4	5.9	7.2	7.0	5.3	6.3	6.2
USA	33.9	36.5	34.8	32.4	31.8	33.4	36.2	34.3	34.8	32.9
02. Astrophysics & astroparticles										
Canada	2.8	2.7	3.1	3.0	2.8	3.2	3.1	3.0	3.4	3.3
France	6.8	5.8	5.2	5.1	5.3	5.4	5.1	5.5	5.5	5.1
Germany	12.1	10.8	9.1	10.3	10.0	9.0	9.4	8.5	9.6	9.2
Japan	6.7	8.4	9.0	8.9	9.4	7.9	9.5	9.0	7.3	8.3
The Netherlands	2.3	2.0	1.8	1.8	1.9	1.8	1.7	1.7	1.7	1.8
UK	8.3	8.6	8.4	8.4	8.3	8.6	7.8	8.4	8.3	8.0
USA	35.1	34.7	38.1	35.6	36.0	37.1	36.1	35.8	34.6	34.1
03. Atomic & molecular physics										
Canada	3.2	3.3	2.9	2.9	2.8	3.0	2.8	2.8	3.2	3.1
France	6.6	6.3	6.8	7.0	6.9	6.6	6.2	6.0	6.2	6.2
Germany	10.3	10.4	10.3	9.8	9.7	9.6	9.6	8.8	9.4	8.4
Japan	11.3	11.8	11.0	10.9	11.8	11.2	11.9	11.6	10.3	9.2
The Netherlands	2.2	2.3	2.0	2.0	1.9	2.1	1.9	2.1	2.0	1.8
UK	7.5	7.6	7.9	8.3	7.5	7.9	7.3	7.2	6.8	6.8
USA	33.1	32.4	32.1	31.2	30.9	31.6	31.2	31.5	31.7	31.2
04. Biological physics										
Canada	3.7	3.6	3.1	3.2	3.2	3.2	3.3	3.4	3.2	3.4
France	5.6	6.4	6.3	6.4	6.9	6.3	6.3	5.8	6.2	5.8
Germany	9.1	11.6	12.0	11.8	11.2	11.3	11.1	10.1	10.5	10.4
Japan	9.4	9.5	9.5	9.7	9.4	9.8	9.6	9.2	8.5	8.0
The Netherlands	2.3	2.0	2.3	2.2	2.2	2.2	2.4	2.3	2.2	2.1
UK	5.9	5.9	6.5	6.9	6.8	6.7	6.3	6.6	6.4	6.5
USA	40.3	37.4	36.6	35.7	34.9	34.6	34.4	34.6	33.3	33.0

Table 2.6 (continued)

	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
05. Chemical physics & physical chemistry										
Canada	3.4	3.3	3.1	3.2	2.8	3.0	3.0	3.0	3.4	3.4
France	7.5	7.2	7.4	7.1	7.3	6.9	6.6	6.4	6.7	6.4
Germany	10.4	11.5	11.3	10.5	10.6	10.8	10.2	9.9	9.9	9.5
Japan	9.8	11.2	10.6	10.1	10.8	10.5	11.2	10.9	9.8	9.3
The Netherlands	2.5	2.4	2.2	2.3	2.1	2.1	2.1	2.2	2.1	1.9
UK	8.2	7.9	8.4	8.4	7.9	8.1	7.5	7.5	6.9	6.9
USA	31.9	31.1	30.4	30.9	30.2	30.0	30.1	29.8	30.8	30.1
06. Computational physics										
Canada	3.0	2.9	2.9	2.8	2.6	2.9	3.0	2.9	3.4	3.4
France	7.6	7.2	7.2	7.2	7.3	7.1	6.5	6.7	6.8	6.5
Germany	11.0	11.2	10.6	10.5	10.6	10.2	10.0	9.6	10.1	9.7
Japan	9.9	10.9	11.2	11.2	11.1	10.5	11.0	10.9	9.5	9.7
The Netherlands	2.1	2.2	2.0	2.1	2.0	2.0	2.0	2.1	2.0	1.9
UK	7.9	7.7	7.9	8.1	7.5	7.7	7.3	7.2	6.8	6.7
USA	30.5	30.2	29.8	28.7	29.3	29.9	30.4	29.7	30.0	29.2
07. Electronics & devices										
Canada	3.0	2.8	2.8	2.7	2.6	2.8	2.8	2.9	3.2	3.1
France	7.3	6.9	6.8	6.9	7.0	6.7	6.2	6.2	6.4	6.0
Germany	10.5	10.9	10.4	10.4	10.3	10.0	9.9	9.3	9.7	9.2
Japan	10.3	10.8	10.9	11.0	10.9	10.7	10.7	10.5	9.5	9.2
The Netherlands	2.1	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.8
UK	7.2	7.4	7.4	7.6	7.0	7.0	6.7	6.6	6.5	6.4
USA	32.1	31.2	31.7	30.6	30.8	31.0	31.0	31.1	30.8	29.6
08. Education & communication										
Canada	2.2	2.3	3.2	4.4	3.7	2.0	2.6	4.2	2.5	2.1
France	1.1	2.3	2.8	1.8	3.7	3.6	4.2	1.9	4.4	3.7
Germany	3.0	3.7	2.8	3.5	1.7	6.6	2.9	4.9	4.8	4.3
Japan	0.0	1.4	0.8	0.0	1.1	2.8	3.7	3.5	3.0	3.1
The Netherlands	0.7	1.4	2.0	0.9	0.8	1.0	1.0	0.2	0.7	1.0
UK	4.9	6.9	4.5	5.7	7.0	6.4	8.4	4.2	4.4	4.6
USA	57.5	56.2	66.4	54.8	53.8	47.3	46.9	51.7	42.3	45.8
09. Environmental & earth science										
Canada	5.3	6.1	5.6	5.1	5.2	5.9	4.8	5.5	5.3	5.9
France	4.7	6.0	4.8	4.5	6.1	4.8	4.5	5.0	6.7	4.7
Germany	5.3	5.3	5.2	5.4	4.9	5.8	5.3	5.2	6.1	6.4
Japan	3.4	4.2	3.4	4.1	4.3	4.6	4.4	5.0	4.8	5.2
The Netherlands	1.8	2.3	2.6	2.4	1.9	1.7	1.9	1.8	2.2	1.6
UK	7.6	6.2	7.3	7.8	8.1	6.3	6.9	6.5	7.2	7.3
USA	46.9	47.2	48.5	48.3	45.0	46.4	46.4	47.9	42.8	43.9

Table 2.6 (continued)

	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
10. Fluid dynamics										
Canada	2.9	2.5	2.6	2.6	2.4	2.6	2.7	2.9	2.9	2.9
France	6.8	7.5	7.7	7.8	8.4	7.2	7.7	6.8	6.8	6.6
Germany	9.4	14.2	14.0	13.9	12.8	12.7	13.0	11.3	11.3	10.8
Japan	8.3	7.8	8.4	8.3	8.0	9.0	8.3	8.1	7.8	7.3
The Netherlands	2.3	1.6	1.9	1.8	2.0	2.0	2.4	2.0	1.9	2.1
UK	6.7	6.6	7.8	7.7	7.9	7.4	7.1	7.2	7.1	7.1
USA	37.1	33.2	32.0	32.1	30.7	30.1	29.0	30.2	29.8	29.2
11. Gravitation & cosmology										
Canada	3.4	2.9	3.5	3.4	3.0	3.5	3.5	3.3	3.7	4.2
France	6.4	4.0	3.8	4.0	3.7	4.1	3.9	4.2	4.3	4.3
Germany	11.3	9.2	8.0	7.9	8.3	7.7	8.1	7.4	7.8	7.7
Japan	5.3	6.3	6.6	7.1	7.2	6.3	7.4	7.1	6.7	6.3
The Netherlands	2.4	1.7	1.6	1.8	1.7	1.4	1.5	1.3	1.4	1.6
UK	9.8	11.8	10.3	10.7	10.7	11.3	11.0	11.2	10.6	10.5
USA	38.1	39.9	44.2	41.5	43.1	42.5	42.5	42.6	41.7	41.3
12. Instrumentation & measurement										
Canada	2.3	1.9	2.6	2.3	1.7	2.2	2.4	2.2	3.4	2.9
France	7.0	8.0	6.2	7.1	6.6	6.8	5.7	6.3	6.5	6.4
Germany	9.5	10.1	9.1	9.7	10.1	9.7	8.4	9.3	8.6	9.0
Japan	9.0	9.6	10.6	12.2	11.2	11.0	9.7	11.1	9.1	9.3
The Netherlands	1.9	1.8	2.1	1.7	1.9	2.1	2.2	1.6	1.8	2.1
UK	8.2	7.0	6.9	8.2	7.2	7.6	7.9	7.3	6.6	7.4
USA	32.7	31.9	35.8	29.1	31.9	31.5	31.2	29.8	30.1	29.1
13. Condensed matter: electrical, magnetic & optical										
Canada	2.8	2.7	2.5	2.5	2.4	2.6	2.7	2.8	2.9	2.9
France	8.0	7.4	7.2	7.4	7.4	7.2	6.6	6.5	6.7	6.4
Germany	11.2	10.6	10.5	10.4	10.5	10.3	9.8	9.5	9.9	9.1
Japan	11.5	11.9	11.4	11.9	11.5	11.5	11.2	10.9	9.9	9.4
The Netherlands	2.3	1.9	1.9	1.9	1.9	1.8	1.8	1.8	1.8	1.7
UK	6.3	7.1	7.0	7.3	6.2	6.1	6.1	5.9	6.2	5.8
USA	30.2	29.3	30.5	28.8	29.4	29.6	29.7	30.1	29.9	28.6
14. Condensed matter: structural, mechanical & thermal										
Canada	3.1	3.0	2.8	2.8	2.7	2.9	2.9	3.0	3.1	3.2
France	7.1	6.9	6.8	7.0	6.9	6.7	6.3	6.1	6.4	6.1
Germany	10.7	10.9	10.6	10.7	10.5	10.2	10.1	9.5	9.9	9.4
Japan	10.7	11.2	10.9	11.4	10.9	10.9	11.0	10.7	9.7	9.2
The Netherlands	2.1	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.8	1.8
UK	7.2	7.6	7.6	7.7	7.3	7.1	6.9	6.8	6.7	6.7
USA	32.8	31.7	32.5	31.3	31.6	31.5	31.5	31.7	31.3	30.4

Table 2.6 (continued)

	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
15. Mathematical physics										
Canada	3.2	2.7	2.7	2.7	2.5	2.8	2.7	2.9	3.0	2.9
France	6.8	7.1	7.5	7.7	8.2	6.9	7.6	6.8	6.8	6.5
Germany	10.4	14.6	14.4	13.7	12.8	12.8	13.1	11.5	11.6	11.2
Japan	7.8	7.5	8.1	8.0	7.8	8.8	8.3	8.0	7.7	7.4
The Netherlands	2.4	1.9	2.0	1.7	2.0	2.0	2.2	2.0	1.8	2.0
UK	5.8	5.9	7.1	7.1	7.2	7.0	6.8	6.8	6.3	6.5
USA	33.2	30.7	29.8	30.2	29.3	29.3	28.4	29.3	29.2	28.5
16. Medical physics										
Canada	5.4	6.1	5.9	6.3	5.5	5.4	5.3	4.9	6.5	6.2
France	3.0	3.0	4.1	3.4	3.9	3.7	4.0	3.3	4.0	3.7
Germany	5.5	6.3	7.1	6.6	7.4	7.9	8.4	8.0	8.8	8.7
Japan	6.5	6.4	5.4	5.1	5.2	5.6	4.8	4.4	4.0	4.1
The Netherlands	4.0	3.9	3.6	4.0	4.2	5.2	4.8	5.3	5.4	5.2
UK	5.1	6.6	7.3	6.8	8.4	7.9	6.9	6.6	5.9	7.6
USA	54.4	50.3	51.7	50.9	49.7	45.4	45.1	45.2	45.2	43.7
17. Nanoscale science & low-D systems										
Canada	2.8	2.6	2.6	2.6	2.3	2.5	2.6	2.9	2.9	2.9
France	7.4	7.2	6.3	6.3	6.2	6.0	5.6	5.4	5.6	5.2
Germany	9.5	8.7	8.4	8.2	7.9	7.7	7.6	7.5	7.7	7.5
Japan	11.9	12.0	11.9	11.9	12.0	12.5	11.5	11.1	10.5	10.1
The Netherlands	2.2	1.7	1.8	1.8	1.7	1.6	1.6	1.6	1.6	1.6
UK	7.0	7.8	7.0	7.3	6.5	6.2	6.1	5.8	6.4	6.0
USA	32.3	30.7	33.6	32.4	32.3	31.8	32.3	32.7	31.8	29.4
18. Nuclear physics										
Canada	2.6	2.5	2.8	2.4	2.3	2.7	2.5	2.1	3.1	2.8
France	7.2	6.9	6.7	6.8	7.1	6.9	6.1	7.0	7.0	6.0
Germany	11.2	12.2	10.4	11.2	11.6	10.8	11.0	10.4	10.5	10.6
Japan	9.8	10.7	11.7	10.9	12.3	10.8	12.2	12.1	9.8	11.5
The Netherlands	1.9	2.0	1.9	1.8	1.9	1.9	2.1	2.0	2.0	2.0
UK	7.0	6.2	7.1	7.4	6.0	6.3	6.1	5.6	5.8	5.4
USA	31.7	31.0	31.0	29.2	29.1	30.5	30.9	29.9	30.0	28.7
19. Optics. quantum optics & lasers										
Canada	2.8	2.6	2.7	2.6	2.6	2.8	2.8	2.8	3.2	3.0
France	7.0	6.4	6.4	6.5	6.6	6.4	5.9	5.8	6.1	6.0
Germany	10.9	10.4	10.5	10.4	10.1	10.0	9.7	9.0	9.3	8.9
Japan	10.0	10.1	10.0	10.0	10.4	10.5	10.0	9.7	9.0	8.5
The Netherlands	2.1	1.7	1.7	1.7	1.8	1.7	1.6	1.7	1.6	1.6
UK	6.1	7.0	6.7	7.1	6.2	6.0	6.0	5.9	5.9	6.0
USA	34.0	33.1	34.6	33.2	33.1	32.9	32.6	33.2	31.6	30.7

Table 2.6 (continued)

	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
20. Particle physics & field theory										
Canada	2.7	2.4	2.9	2.6	2.5	2.8	2.8	2.6	3.3	3.2
France	6.5	6.6	6.2	6.2	6.3	6.5	5.5	6.2	6.1	5.5
Germany	10.5	11.0	9.9	10.3	10.4	10.1	9.8	9.4	9.8	9.3
Japan	8.9	9.7	10.4	9.8	10.9	9.5	10.5	10.4	8.6	10.2
The Netherlands	1.8	1.9	1.8	1.8	1.8	2.0	2.1	1.8	2.0	1.9
UK	7.4	7.1	7.7	8.1	7.3	7.4	6.8	6.6	6.5	6.4
USA	31.9	30.8	30.7	29.2	29.3	30.0	29.8	29.6	29.2	28.3
21. Plasma physics										
Canada	2.7	2.4	2.3	2.3	2.1	2.3	2.3	2.7	2.6	2.6
France	5.9	6.5	6.5	6.6	7.0	6.3	6.4	5.8	6.1	5.7
Germany	9.4	11.8	11.7	11.7	11.3	11.0	11.2	9.9	10.4	9.2
Japan	13.3	11.5	11.4	11.0	11.3	11.2	11.3	10.8	9.9	9.2
The Netherlands	1.9	1.5	1.7	1.6	1.7	1.7	1.9	1.7	1.7	1.7
UK	5.2	5.2	6.1	6.5	6.3	6.1	5.7	5.8	5.8	5.6
USA	34.1	32.8	31.9	32.3	30.1	30.1	29.3	30.5	30.4	28.2
22. Quantum information & quantum mechanics										
Canada	2.7	2.6	2.7	2.5	2.4	2.7	2.7	2.6	3.1	3.0
France	7.4	6.7	6.5	6.6	6.6	6.4	5.9	6.1	6.2	5.8
Germany	10.7	10.5	9.7	10.0	9.7	9.3	9.2	8.9	9.1	8.7
Japan	10.7	10.8	11.3	11.9	11.5	11.1	10.9	10.7	9.8	9.7
The Netherlands	2.0	1.8	1.8	1.8	1.9	1.8	1.7	1.8	1.7	1.7
UK	6.8	7.3	6.8	7.3	6.3	6.3	6.1	6.0	6.0	5.9
USA	31.6	31.1	32.3	30.4	31.2	31.6	31.6	31.8	31.2	29.4
23. Semiconductors										
Canada	3.0	2.8	2.8	2.7	2.6	2.8	2.9	2.9	3.2	3.2
France	7.4	6.9	6.7	6.8	6.8	6.6	6.0	6.2	6.3	6.0
Germany	10.6	10.4	9.8	9.8	9.7	9.4	9.2	8.9	9.3	8.8
Japan	10.5	11.1	11.2	11.4	11.4	11.0	11.2	11.0	9.8	9.6
The Netherlands	2.1	2.0	1.9	2.0	1.9	1.9	1.8	1.9	1.9	1.8
UK	7.3	7.5	7.4	7.7	6.9	7.0	6.7	6.6	6.6	6.4
USA	31.8	31.1	31.9	30.5	31.0	31.4	31.5	31.4	31.2	29.8
24. Soft matter, liquids & polymers										
Canada	3.4	3.2	3.0	3.0	2.7	2.9	3.1	3.1	3.2	3.2
France	7.5	8.2	7.5	7.5	8.0	7.3	7.1	6.6	6.9	6.2
Germany	9.1	11.7	11.6	11.3	10.9	11.1	10.9	9.9	10.0	9.7
Japan	10.1	9.9	10.1	9.6	9.4	9.9	9.3	9.1	8.6	8.4
The Netherlands	2.5	2.1	2.3	2.3	2.1	2.2	2.4	2.3	2.2	2.0
UK	6.8	6.1	6.9	7.2	7.0	6.8	6.3	6.4	6.2	6.1
USA	32.5	30.5	30.2	30.0	29.4	28.8	28.8	29.1	29.4	28.2

Table 2.6 (continued)

	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
25. Statistical physics & nonlinear systems										
Canada	3.0	3.0	2.9	2.8	2.8	3.0	3.0	3.0	3.2	3.2
France	6.8	6.7	6.9	7.2	7.5	6.7	6.8	6.5	6.8	6.5
Germany	11.2	12.7	12.4	12.4	12.0	11.9	11.8	10.8	11.0	10.6
Japan	8.8	9.3	9.3	9.7	9.3	9.5	10.0	9.6	8.7	7.9
The Netherlands	2.1	2.0	1.9	1.9	2.1	2.0	2.1	2.1	2.0	2.0
UK	7.0	7.2	7.7	7.5	7.6	7.4	7.0	7.3	6.7	6.9
USA	34.1	32.9	32.3	31.8	31.4	31.8	31.3	31.5	31.1	30.4
26. Superconductivity										
Canada	2.8	2.5	2.6	2.5	2.4	2.7	2.7	2.7	3.0	3.0
France	7.6	6.9	6.7	6.8	6.7	6.7	5.9	6.2	6.3	6.0
Germany	10.7	10.4	9.7	9.9	9.8	9.4	9.2	8.9	9.3	8.7
Japan	11.2	11.8	11.8	12.0	12.2	11.5	11.4	11.4	10.1	9.8
The Netherlands	2.0	1.8	1.8	1.8	1.8	1.8	1.7	1.8	1.8	1.7
UK	6.8	7.3	7.0	7.4	6.4	6.4	6.2	6.0	6.2	5.9
USA	30.5	30.0	31.1	29.6	30.1	30.5	30.5	30.6	30.2	28.7
27. Surfaces, interfaces & thin films										
Canada	3.0	2.8	2.8	2.7	2.6	2.8	2.8	2.9	3.1	3.1
France	7.3	6.9	6.8	6.9	6.9	6.6	6.1	6.2	6.4	6.0
Germany	10.5	10.9	10.3	10.3	10.2	9.9	9.7	9.3	9.7	9.2
Japan	10.3	10.8	10.9	11.1	11.0	10.7	10.8	10.6	9.6	9.3
The Netherlands	2.1	2.0	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.8
UK	7.2	7.4	7.3	7.5	6.9	6.9	6.6	6.5	6.5	6.3
USA	32.1	31.2	32.0	30.8	31.1	31.4	31.3	31.3	31.0	29.7

2.3 Normalized citation impact score of countries

This section presents the overall impact scores related to the output for the countries involved in this study for all physics output (Table 2.7). This total includes performance measures for research output worldwide according to the IOP definition of research subfields. Brief technical descriptions of indicators are given in section 1.6.2 and in the legend at the bottom of each table.

A very small but high impact share of physics research is published outside the core 'disciplinary' journals. The impact scores related to the publications published in the highly prestigious multidisciplinary general journals *Nature* and *Science* is of particular significance. The results are presented in Table 2.8.

Table 2.9 contains the citation impact scores for all research publications worldwide broken down by IOP defined subfield. These world level scores constitute a baseline to compare the impact scores of the countries which are presented in Table 2.10.

Table 2.7 Output and citation impact scores of countries in physics, 1997-2006

	Publication output	CPP (WoS)	CPP (IOP)	CPP/FCSm (WoS)	JCSm/FCSm (WoS)
World (IOP)	1,381,000	6.18		1.17	1.17
Canada	42,791	7.97	1.29	1.42	1.37
France	107,183	6.67	1.08	1.23	1.18
Germany	157,615	7.77	1.26	1.37	1.26
Japan	173,344	5.40	0.87	1.04	1.12
The Netherlands	29,743	9.32	1.51	1.63	1.39
UK	103,885	8.09	1.31	1.39	1.25
USA	381,338	10.09	1.63	1.73	1.48

CPP Citation rate indicator: average number of citations per publication.
CPP/FCSm WoS Field corrected citation impact indicator: normalized citation impact score (based on Web of Science definition of physics research)
JCSm/FCSm Journal quality indicator: journal-to-field citation impact indicator (based on Web of Science definition of physics research)

Table 2.8: Performance indicators for physics papers published in *Nature* or *Science*, 1997-2006

	Publication output	CPP (WoS)	CPP (IOP)	CPP/FCSm (WoS)	JCSm/FCSm (WoS)
Canada	66	55.20	8.94	1.56	3.09
France	199	57.04	9.23	2.07	3.09
Germany	281	64.57	10.45	2.25	3.11
Japan	231	82.21	13.31	2.77	3.12
The Netherlands	136	101.85	16.49	3.29	3.19
UK	233	76.63	12.41	2.59	3.22
USA	1,710	79.60	12.89	2.55	3.14

CPP Citation rate indicator: average number of citations per publication.
CPP/FCSm WoS Field corrected citation impact indicator: normalized citation impact score (based on Web of Science definition of physics research)
JCSm/FCSm Journal quality indicator: journal-to-field citation impact indicator (based on Web of Science definition of physics research)

Table 2.9: Citation impact rates for IOP defined physics subfields, world scores 1997-2006

	CPP (IOP)
01. Accelerators, beams & electromagnetism	4.05
02. Astrophysics & astroparticles	9.71
03. Atomic & molecular physics	8.71
04. Biological physics	9.90
05. Chemical physics & physical chemistry	9.22
06. Computational physics	7.95
07. Electronics & devices	7.94
08. Education & communication	1.98
09. Environmental & earth science	7.07
10. Fluid dynamics	7.80
11. Gravitation & cosmology	12.77
12. Instrumentation & measurement	4.43
13. Condensed matter: electrical, magnetic & optical	7.14
14. Condensed matter: structural, mechanical & thermal	8.35
15. Mathematical physics	7.59
16. Medical physics	9.27
17. Nanoscale science & low-D systems	7.84
18. Nuclear physics	6.28
19. Optics, quantum optics & lasers	7.53
20. Particle physics & field theory	7.31
21. Plasma physics	7.40
22. Quantum information & quantum mechanics	7.44
23. Semiconductors	7.94
24. Soft matter, liquids & polymers	8.14
25. Statistical physics & nonlinear systems	9.21
26. Superconductivity	7.12
27. Surfaces, interfaces & thin films	8.03

CPP Citation rate indicator: average number of citations per publication.

Table 2.10: Country-level citation impact scores across IOP defined physics fields, 1997-2006

	CPP (IOP)	CPP/FCSm (WoS)	JCSm/FCSm (WoS)
01. Accelerators, beams & electromagnetism			
Canada	1.38	1.24	1.23
France	0.87	0.88	0.87
Germany	1.03	1.00	0.90
Japan	0.67	0.72	0.92
The Netherlands	1.06	1.01	1.01
UK	1.39	1.16	0.99
USA	1.31	1.29	1.13
02. Astrophysics & astroparticles			
Canada	0.93	1.20	1.35
France	0.92	1.30	1.25
Germany	1.04	1.41	1.28
Japan	0.67	1.01	1.30
The Netherlands	1.18	1.47	1.36
UK	1.15	1.41	1.27
USA	1.38	1.66	1.45
03. Atomic & molecular physics			
Canada	0.98	1.45	1.62
France	0.83	1.33	1.38
Germany	1.01	1.52	1.44
Japan	0.86	1.37	1.57
The Netherlands	1.19	1.74	1.54
UK	1.06	1.44	1.39
USA	1.40	2.06	1.81
04. Biological physics			
Canada	0.99	1.62	1.77
France	0.84	1.46	1.54
Germany	1.01	1.65	1.67
Japan	0.92	1.51	1.79
The Netherlands	1.12	1.95	1.74
UK	0.91	1.55	1.57
USA	1.33	2.11	1.85
05. Chemical physics & physical chemistry			
Canada	0.99	1.49	1.62
France	0.85	1.36	1.40
Germany	1.08	1.59	1.54
Japan	0.83	1.33	1.56
The Netherlands	1.21	1.77	1.58
UK	1.07	1.49	1.43
USA	1.37	1.97	1.73
06. Computational physics			
Canada	1.03	1.41	1.51
France	0.89	1.31	1.32
Germany	1.05	1.46	1.35
Japan	0.82	1.21	1.39
The Netherlands	1.15	1.59	1.46
UK	1.11	1.43	1.33
USA	1.39	1.86	1.60

CPP Citation rate indicator: average number of citations per publication.
CPP/FCSm WoS Field corrected citation impact indicator: normalized citation impact score (based on Web of Science definition of physics research)
JCSm/FCSm Journal quality indicator: journal-to-field citation impact indicator (based on Web of Science definition of physics research)

Table 2.10 (continued)

	CPP (IOP)	CPP/ FCSm (WoS)	JCSm/FCSm (WoS)
07. Electronics & devices			
Canada	0.98	1.36	1.48
France	0.90	1.31	1.33
Germany	1.07	1.48	1.41
Japan	0.84	1.23	1.41
The Netherlands	1.19	1.63	1.47
UK	1.06	1.42	1.35
USA	1.40	1.85	1.59
08. Education & communication			
Canada	1.11	0.59	0.58
France	0.89	0.47	0.44
Germany	1.08	0.62	0.49
Japan	0.42	0.23	0.44
The Netherlands	1.17	0.63	0.72
UK	1.68	0.95	0.76
USA	1.16	0.55	0.50
09. Environmental & earth science			
Canada	1.02	1.20	1.23
France	0.83	1.06	1.25
Germany	0.99	1.21	1.13
Japan	0.54	0.78	1.04
The Netherlands	0.94	1.08	1.14
UK	1.26	1.49	1.25
USA	1.23	1.40	1.29
10. Fluid dynamics			
Canada	0.92	1.39	1.52
France	0.93	1.39	1.37
Germany	1.17	1.60	1.61
Japan	0.87	1.24	1.52
The Netherlands	1.17	1.78	1.63
UK	0.96	1.40	1.45
USA	1.32	1.90	1.58
11. Gravitation & cosmology			
Canada	0.82	1.21	1.40
France	0.98	1.42	1.34
Germany	1.05	1.50	1.37
Japan	0.81	1.21	1.53
The Netherlands	1.14	1.47	1.39
UK	1.07	1.50	1.32
USA	1.28	1.76	1.53
12. Instrumentation & measurement			
Canada	1.11	1.15	1.15
France	0.92	1.08	1.09
Germany	0.99	1.15	1.05
Japan	0.67	0.81	1.04
The Netherlands	1.04	1.21	1.10
UK	1.13	1.29	1.29
USA	1.45	1.46	1.19

CPP Citation rate indicator: average number of citations per publication.
CPP/FCSm WoS Field corrected citation impact indicator: normalized citation impact score (based on Web of Science definition of physics research)
JCSm/FCSm Journal quality indicator: journal-to-field citation impact indicator (based on Web of Science definition of physics research)

Table 2.10 (continued)

	CPP (IOP)	CPP/ FCSm (WoS)	JCSm/FCSm (WoS)
13. Condensed matter: electrical, magnetic & optical			
Canada	0.97	1.27	1.36
France	0.90	1.23	1.26
Germany	1.08	1.42	1.33
Japan	0.85	1.17	1.31
The Netherlands	1.24	1.54	1.36
UK	1.00	1.35	1.28
USA	1.45	1.77	1.52
14. Condensed matter: structural, mechanical & thermal			
Canada	0.96	1.37	1.52
France	0.87	1.33	1.36
Germany	1.05	1.51	1.46
Japan	0.84	1.28	1.46
The Netherlands	1.18	1.67	1.51
UK	1.04	1.44	1.38
USA	1.41	1.90	1.63
15. Mathematical physics			
Canada	0.91	1.31	1.44
France	0.93	1.32	1.30
Germany	1.15	1.53	1.54
Japan	0.86	1.19	1.47
The Netherlands	1.20	1.68	1.50
UK	1.04	1.45	1.42
USA	1.33	1.83	1.52
16. Medical physics			
Canada	0.90	1.40	1.42
France	0.98	1.59	1.69
Germany	1.18	1.97	1.63
Japan	0.96	1.33	1.63
The Netherlands	0.95	1.57	1.54
UK	0.85	1.27	1.22
USA	1.13	1.72	1.65
17. Nanoscale science & low-D systems			
Canada	0.95	1.32	1.44
France	0.88	1.27	1.35
Germany	1.10	1.52	1.44
Japan	0.84	1.28	1.42
The Netherlands	1.29	1.66	1.49
UK	1.01	1.48	1.41
USA	1.47	1.85	1.61
18. Nuclear physics			
Canada	1.07	1.25	1.29
France	1.03	1.27	1.17
Germany	1.12	1.33	1.16
Japan	0.70	0.93	1.15
The Netherlands	1.17	1.39	1.32
UK	1.08	1.20	1.16
USA	1.34	1.58	1.34

CPP Citation rate indicator: average number of citations per publication.
CPP/FCSm WoS Field corrected citation impact indicator: normalized citation impact score (based on Web of Science definition of physics research)
JCSm/FCSm Journal quality indicator: journal-to-field citation impact indicator (based on Web of Science definition of physics research)

Table 2.10 (continued)

	CPP (IOP)	CPP/ FCSm (WoS)	JCSm/FCSm (WoS)
19. Optics, quantum optics & lasers			
Canada	0.92	1.28	1.37
France	0.93	1.34	1.36
Germany	1.07	1.47	1.39
Japan	0.91	1.30	1.45
The Netherlands	1.26	1.63	1.39
UK	0.99	1.42	1.33
USA	1.38	1.75	1.51
20. Particle physics & field theory			
Canada	0.97	1.16	1.29
France	1.00	1.26	1.22
Germany	1.11	1.31	1.23
Japan	0.71	0.96	1.19
The Netherlands	1.05	1.34	1.33
UK	1.14	1.31	1.23
USA	1.39	1.66	1.33
21. Plasma physics			
Canada	0.88	1.34	1.50
France	0.94	1.38	1.42
Germany	1.16	1.61	1.64
Japan	0.91	1.38	1.57
The Netherlands	1.23	1.82	1.62
UK	1.04	1.48	1.52
USA	1.34	1.96	1.62
22. Quantum information & quantum mechanics			
Canada	0.96	1.26	1.37
France	0.93	1.27	1.28
Germany	1.06	1.39	1.32
Japan	0.84	1.18	1.32
The Netherlands	1.21	1.55	1.37
UK	1.05	1.40	1.29
USA	1.41	1.75	1.49
23. Semiconductors			
Canada	0.99	1.35	1.47
France	0.89	1.29	1.32
Germany	1.05	1.45	1.36
Japan	0.83	1.23	1.40
The Netherlands	1.19	1.60	1.45
UK	1.07	1.42	1.33
USA	1.41	1.83	1.59
24. Soft matter, liquids & polymers			
Canada	1.03	1.51	1.54
France	0.92	1.37	1.41
Germany	1.17	1.62	1.59
Japan	0.87	1.27	1.54
The Netherlands	1.22	1.79	1.64
UK	1.07	1.54	1.54
USA	1.32	1.88	1.59

CPP Citation rate indicator: average number of citations per publication.
CPP/FCSm WoS Field corrected citation impact indicator: normalized citation impact score (based on Web of Science definition of physics research)
JCSm/FCSm Journal quality indicator: journal-to-field citation impact indicator (based on Web of Science definition of physics research)

Table 2.10 (continued)

	CPP (IOP)	CPP/ FCSm (WoS)	JCSm/FCSm (WoS)
25. Statistical physics & nonlinear systems			
Canada	0.95	1.54	1.71
France	0.89	1.51	1.52
Germany	1.04	1.66	1.63
Japan	0.94	1.52	1.75
The Netherlands	1.13	1.83	1.68
UK	1.06	1.51	1.48
USA	1.34	2.09	1.81
26. Superconductivity			
Canada	0.97	1.23	1.34
France	0.92	1.23	1.24
Germany	1.06	1.36	1.28
Japan	0.83	1.13	1.27
The Netherlands	1.21	1.51	1.35
UK	1.04	1.34	1.24
USA	1.44	1.73	1.47
27. Surfaces, interfaces & thin films			
Canada	0.98	1.36	1.48
France	0.90	1.31	1.33
Germany	1.07	1.49	1.42
Japan	0.83	1.24	1.42
The Netherlands	1.19	1.63	1.48
UK	1.07	1.43	1.36
USA	1.40	1.85	1.59

CPP	Citation rate indicator: average number of citations per publication.
CPP/FCSm WoS	Field corrected citation impact indicator: normalized citation impact score (based on Web of Science definition of physics research)
JCSm/FCSm	Journal quality indicator: journal-to-field citation impact indicator (based on Web of Science definition of physics research)

2.4 Publication output and citation impact of UK research by subfield

This section presents detailed information on UK physics research both in terms of publication output and citation impact.

Table 2.11 starts by providing the annual % share of the UK-authored publications within the worldwide publication output in physics (WoS based). Table 2.12 provides detail at the level of RC UK defined subfield of physics research.

Table 2.13 contains the average citation impact of UK physics research, compared to the fields in which the output was published. The computation is done according to the CPP (WoS) indicator. The value equal to 1 indicates world average value, where values larger than 1 indicate above average performance levels.

Table 2.14 contains similar impact scores for the IOP-defined subfields.

Table 2.11: Annual trends in UK shares of the world output in Physics (WoS), 1997-2006 (% of world publication output)

	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
UK	7.8	8.1	7.9	8.0	7.7	7.6	7.2	7.3	7.1	6.9

Table 2.12: Annual trends UK output shares per research subfield (IOP), 1997-2006 (% of world publication output)

	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
01. Accelerators. beams & electromagnetism	6.6	5.5	8.0	8.4	5.9	7.2	7.0	5.3	6.3	6.2
02. Astrophysics & astroparticles	8.3	8.6	8.4	8.4	8.3	8.6	7.8	8.4	8.3	8.0
03. Atomic & molecular physics	7.5	7.6	7.9	8.3	7.5	7.9	7.3	7.2	6.8	6.8
04. Biological physics	5.9	5.9	6.5	6.9	6.8	6.7	6.3	6.6	6.4	6.5
05. Chemical physics & physical chemistry	8.2	7.9	8.4	8.4	7.9	8.1	7.5	7.5	6.9	6.9
06.Computational physics	7.9	7.7	7.9	8.1	7.5	7.7	7.3	7.2	6.8	6.7
07. Electronics & devices	7.2	7.4	7.4	7.6	7.0	7.0	6.7	6.6	6.5	6.4
08. Education & communication	4.9	6.9	4.5	5.7	7.0	6.4	8.4	4.2	4.4	4.6
09. Environmental & earth science	7.6	6.2	7.3	7.8	8.1	6.3	6.9	6.5	7.2	7.3
10. Fluid dynamics	6.7	6.6	7.8	7.7	7.9	7.4	7.1	7.2	7.1	7.1
11. Gravitation & cosmology	9.8	11.8	10.3	10.7	10.7	11.3	11.0	11.2	10.6	10.5
12. Instrumentation & measurement	8.2	7.0	6.9	8.2	7.2	7.6	7.9	7.3	6.6	7.4
13. Condensed matter: electrical, magnetic & optical	6.3	7.1	7.0	7.3	6.2	6.1	6.1	5.9	6.2	5.8
14. Condensed matter: structural, mechanical & thermal	7.2	7.6	7.6	7.7	7.3	7.1	6.9	6.8	6.7	6.7
15. Mathematical physics	5.8	5.9	7.1	7.1	7.2	7.0	6.8	6.8	6.3	6.5
16. Medical physics	5.1	6.6	7.3	6.8	8.4	7.9	6.9	6.6	5.9	7.6
17. Nanoscale science & low-D systems	7.0	7.8	7.0	7.3	6.5	6.2	6.1	5.8	6.4	6.0
18. Nuclear physics	7.0	6.2	7.1	7.4	6.0	6.3	6.1	5.6	5.8	5.4
19. Optics. quantum optics & lasers	6.1	7.0	6.7	7.1	6.2	6.0	6.0	5.9	5.9	6.0
20. Particle physics & field theory	7.4	7.1	7.7	8.1	7.3	7.4	6.8	6.6	6.5	6.4
21. Plasma physics	5.2	5.2	6.1	6.5	6.3	6.1	5.7	5.8	5.8	5.6
22. Quantum information & quantum mechanics	6.8	7.3	6.8	7.3	6.3	6.3	6.1	6.0	6.0	5.9
23. Semiconductors	7.3	7.5	7.4	7.7	6.9	7.0	6.7	6.6	6.6	6.4
24. Soft matter, liquids & polymers	6.8	6.1	6.9	7.2	7.0	6.8	6.3	6.4	6.2	6.1
25. Statistical physics & nonlinear systems	7.0	7.2	7.7	7.5	7.6	7.4	7.0	7.3	6.7	6.9
26. Superconductivity	6.8	7.3	7.0	7.4	6.4	6.4	6.2	6.0	6.2	5.9
27. Surfaces, interfaces & thin films	7.2	7.4	7.3	7.5	6.9	6.9	6.6	6.5	6.5	6.3

Table 2.13: Annual trends in UK impact in Physics compared to world impact, 1997-2005 (*CPP WoS* indicator; based on a three year citation window)*

	1997	1998	1999	2000	2001	2002	2003	2004	2005
UK	1.36	1.43	1.42	1.50	1.46	1.56	1.42	1.42	1.42

* Impact scores are not available for 2006 publications due to the 3-year citation window. The citation window for 2005 spans the years 2005-2007.

Table 2.14: Annual trends in UK impact per research subfield (IOP), 1997-2006, *CPP(IOP)* indicator; based on a three year citation window)*

	1997	1998	1999	2000	2001	2002	2003	2004	2005
01. Accelerators, beams & electromagnetism	1.14	1.26	1.46	1.36	1.19	1.64	1.62	1.78	1.25
02. Astrophysics & astroparticles	1.11	1.25	1.08	1.22	1.22	1.28	1.20	1.06	1.07
03. Atomic & molecular physics	1.07	1.08	1.00	1.09	1.15	1.16	1.09	1.05	1.05
04. Biological physics	0.88	1.02	0.90	0.86	0.89	0.91	0.96	0.88	0.96
05. Chemical physics & physical chemistry	1.06	1.12	1.04	1.09	1.13	1.11	1.06	1.03	1.05
06. Computational physics	1.04	1.09	1.07	1.13	1.14	1.20	1.11	1.06	1.08
07. Electronics & devices	1.03	1.07	1.01	1.06	1.09	1.11	1.08	1.02	1.03
08. Education & communication	2.46	1.85	0.96	1.45	1.24	0.89	0.54	1.49	1.37
09. Environmental & earth science	1.34	1.09	1.32	1.36	1.04	1.11	1.61	0.94	1.08
10. Fluid dynamics	0.94	1.15	0.96	0.88	0.99	0.98	1.00	0.90	0.93
11. Gravitation & cosmology	1.07	1.08	1.00	1.15	1.08	1.18	1.04	0.98	1.00
12. Instrumentation & measurement	1.11	1.19	1.03	0.90	0.83	1.29	1.10	1.16	1.20
13. Condensed matter: electrical, magnetic & optical	1.00	0.99	0.93	0.96	1.04	0.95	0.99	0.98	0.96
14. Condensed matter: structural, mechanical & thermal	1.03	1.04	0.98	1.04	1.08	1.07	1.05	1.00	1.01
15. Mathematical physics	1.08	1.26	1.03	1.01	1.06	1.03	1.05	0.95	1.03
16. Medical physics	0.84	0.80	0.75	0.83	0.77	0.74	0.84	0.82	0.90
17. Nanoscale science & low-D systems	1.02	0.98	0.91	0.99	0.98	0.95	0.99	0.92	0.94
18. Nuclear physics	0.97	1.15	1.05	1.07	1.03	1.28	1.12	1.03	1.09
19. Optics, quantum optics & lasers	0.99	0.98	0.90	0.94	1.03	0.93	0.98	0.96	0.98
20. Particle physics & field theory	1.06	1.18	1.10	1.09	1.13	1.30	1.21	1.11	1.16
21. Plasma physics	1.11	1.21	1.05	0.99	1.05	1.05	1.11	1.02	1.06
22. Quantum information & quantum mechanics	0.99	1.02	0.98	1.04	1.06	1.07	1.09	0.99	1.01
23. Semiconductors	1.03	1.06	1.02	1.08	1.10	1.14	1.09	1.04	1.05
24. Soft matter, liquids & polymers	1.08	1.17	1.03	1.00	1.03	1.02	1.06	1.00	1.07
25. Statistical physics & nonlinear systems	1.08	1.13	1.07	1.07	1.12	1.16	1.07	1.00	1.06
26. Superconductivity	0.98	1.01	0.97	1.02	1.06	1.04	1.08	0.98	0.98
27. Surfaces, interfaces & thin films	1.03	1.07	1.02	1.06	1.09	1.12	1.08	1.02	1.03

* Impact scores are not available for 2006 publications due to the 3-year citation window. The citation window for 2005 spans the years 2005-2007.

2.5 The extremes in citation impact: UK share of highly cited publications and share of non cited publications

This section presents citation impact indicators dealing with the most highly cited publications and those not (yet) cited. The performance indicators include the annual publication output counts (P) of UK-authored publications that are amongst the 1%, 5% and 10% most frequently cited papers in physics research. The computations are restricted to the two document types that tend to draw the largest quantities of citations within the international scientific journal literature: *research articles* and *review articles*.

The top cited percentiles are calculated for physics as a whole and for each subfield separately. The scores in Table 2.15 are based on physics as a whole as defined according to the WoS-related *Journal Subject Categories*. Table 2.16 displays the findings for the *IOP defined subfields*. The bottom section of the tables includes the number of UK-authored research articles and review articles, alongside the proportion of those publications that were not cited during the specified time span.

Due to the fixed 4-year citation window that was applied in this particular analysis, 2003 is the last year for which we can determine the visibility among the top most highly cited publications within the database's time frame up to and including 2006 (citation window: 2003-2006).

Table 2.15: UK contribution to the world's most highly cited publications in physics (WoS), 1997-2003

	1997	1998	1999	2000	2001	2002	2003
Publication output							
P Top 10%	1,188	1,315	1,342	1,367	1,405	1,363	1,442
P Top 5%	612	645	682	705	722	706	734
P Top 1%	143	135	160	164	153	162	168
UK share in world output							
% P Top 10%	1.28	1.36	1.35	1.41	1.39	1.37	1.40
% P Top 5%	1.34	1.34	1.39	1.42	1.44	1.42	1.41
% P Top 1%	1.56	1.38	1.61	1.65	1.54	1.62	1.63
Total UK publication output							
P (art + rev)	9,130	9,701	9,860	9,852	9,967	10,032	10,375
% P non cited	35.8%	37.6%	36.3%	35.3%	35.1%	32.2%	30.1%

Table 2.16: UK visibility of highly cited publications in physics (IOP subfields), 1997-2003

RC UK subfield	1997	1998	1999	2000	2001	2002	2003
01. Accelerators, beams & electromagnetism							
P Top-10%	18	15	38	24	23	26	29
P Top-5%	8	8	23	12	9	16	17
P Top-1%	2	1	7	2	1	2	6
% P Top-10%	8.4	7.6	14.2	8.2	10.0	9.2	9.4
% P Top-5%	3.7	4.1	8.6	4.1	3.9	5.7	5.5
% P Top-1%	0.9	0.5	2.6	0.7	0.4	0.7	1.9
P (art+rev)	215	197	268	294	229	283	309
% P not cited	34.9%	38.4%	30.1%	35.4%	38.5%	41.4%	35.2%
02. Astrophysics & astroparticles							
P Top-10%	187	219	160	200	222	204	194
P Top-5%	89	108	85	110	119	104	87
P Top-1%	17	20	20	30	18	30	17
% P Top-10%	13.3	16.7	12.1	15.1	16.8	15.8	15.0
% P Top-5%	6.4	8.3	6.4	8.3	9.0	8.1	6.7
% P Top-1%	1.2	1.5	1.5	2.3	1.4	2.3	1.3
P (art+rev)	1401	1309	1321	1327	1324	1291	1292
% P not cited	24.7%	22.5%	21.2%	20.9%	19.0%	17.1%	16.9%
03. Atomic & molecular physics							
P Top-10%	252	284	253	313	298	306	349
P Top-5%	129	151	117	172	153	168	184
P Top-1%	35	38	23	48	33	41	38
% P Top-10%	14.8	15.8	13.9	16.0	15.9	15.7	17.2
% P Top-5%	7.6	8.4	6.4	8.8	8.2	8.6	9.1
% P Top-1%	2.1	2.1	1.3	2.5	1.8	2.1	1.9
P (art+rev)	1701	1800	1816	1956	1876	1949	2027
% P not cited	26.2%	27.5%	28.0%	27.4%	25.4%	23.2%	21.6%
04. Biological physics							
P Top-10%	150	195	187	215	227	220	256
P Top-5%	75	99	80	102	122	114	129
P Top-1%	20	30	14	21	27	18	32
% P Top-10%	18.4	20.8	17.0	17.0	17.0	15.9	17.6
% P Top-5%	9.2	10.6	7.3	8.1	9.1	8.2	8.8
% P Top-1%	2.5	3.2	1.3	1.7	2.0	1.3	2.2
P (art+rev)	814	936	1097	1262	1338	1385	1458
% P not cited	24.7%	23.8%	29.0%	24.6%	29.1%	21.4%	19.9%
05. Chemical physics & physical chemistry							
P Top-10%	317	378	364	405	395	359	405
P Top-5%	150	191	172	218	198	186	196
P Top-1%	40	47	39	57	37	43	36
% P Top-10%	15.2	17.3	15.7	16.8	16.6	15.0	16.8
% P Top-5%	7.2	8.8	7.4	9.1	8.3	7.8	8.1
% P Top-1%	1.9	2.2	1.7	2.4	1.6	1.8	1.5
P (art+rev)	2089	2180	2318	2408	2384	2390	2407
% P not cited	26.0%	26.1%	27.4%	24.6%	23.3%	21.9%	20.4%

Table 2.16 (continued)

	1997	1998	1999	2000	2001	2002	2003
06. Computational physics							
P Top-10%	492	536	518	558	553	537	562
P Top-5%	231	262	255	284	293	273	286
P Top-1%	49	55	59	73	55	66	58
% P Top-10%	14.4	15.2	14.8	14.5	16.1	15.6	16.0
% P Top-5%	6.7	7.5	7.3	7.4	8.5	8.0	8.2
% P Top-1%	1.4	1.6	1.7	1.9	1.6	1.9	1.7
P (art+rev)	3427	3515	3500	3836	3429	3433	3508
% P not cited	30.1%	30.3%	29.8%	29.9%	27.5%	25.3%	23.1%
07. Electronics & devices							
P Top-10%	670	783	764	826	834	791	848
P Top-5%	323	385	376	423	432	405	432
P Top-1%	77	92	86	102	85	91	96
% P Top-10%	14.1	15.3	14.5	14.6	15.9	15.0	15.5
% P Top-5%	6.8	7.5	7.1	7.5	8.2	7.7	7.9
% P Top-1%	1.6	1.8	1.6	1.8	1.6	1.7	1.8
P (art+rev)	4755	5105	5272	5650	5249	5256	5471
% P not cited	30.9%	32.8%	32.0%	31.6%	29.5%	26.1%	24.7%
08. Education & communication							
P Top-10%	3	3	0	1	3	2	1
P Top-5%	3	2	0	1	2	1	0
P Top-1%	0	2	0	0	1	0	0
% P Top-10%	25.0	20.0	0.0	7.7	13.0	8.7	3.1
% P Top-5%	25.0	13.3	0.0	7.7	8.7	4.3	0.0
% P Top-1%	0.0	13.3	0.0	0.0	4.3	0.0	0.0
P (art+rev)	12	15	9	13	23	23	32
% P not cited	53.8%	33.3%	45.5%	53.8%	56.0%	56.0%	59.4%
09. Environmental & earth science							
P Top-10%	25	18	25	27	22	22	33
P Top-5%	12	4	11	10	14	14	18
P Top-1%	4	2	6	3	3	1	5
% P Top-10%	15.7	13.8	15.2	14.7	10.9	15.2	18.8
% P Top-5%	7.5	3.1	6.7	5.4	7.0	9.7	10.2
% P Top-1%	2.5	1.5	3.7	1.6	1.5	0.7	2.8
P (art+rev)	159	130	164	184	201	145	176
% P not cited	27.0%	28.2%	24.6%	28.5%	29.6%	29.5%	21.9%
10. Fluid dynamics							
P Top-10%	73	114	105	112	138	140	149
P Top-5%	33	60	44	48	67	73	68
P Top-1%	9	17	7	11	15	13	15
% P Top-10%	14.9	19.3	13.2	13.4	13.8	13.9	14.7
% P Top-5%	6.7	10.2	5.5	5.8	6.7	7.2	6.7
% P Top-1%	1.8	2.9	0.9	1.3	1.5	1.3	1.5
P (art+rev)	489	590	793	833	1001	1007	1011
% P not cited	30.6%	29.1%	35.9%	31.9%	34.9%	24.7%	24.4%

Table 2.16 (continued)

	1997	1998	1999	2000	2001	2002	2003
11. Gravitation & cosmology							
P Top-10%	102	136	115	134	155	153	155
P Top-5%	55	74	71	83	88	93	76
P Top-1%	11	17	19	26	12	28	15
% P Top-10%	13.1	19.0	14.0	16.8	18.4	17.6	17.6
% P Top-5%	7.1	10.3	8.6	10.4	10.4	10.7	8.6
% P Top-1%	1.4	2.4	2.3	3.3	1.4	3.2	1.7
P (art+rev)	779	717	824	796	844	869	879
% P not cited	14.9%	12.0%	13.6%	13.0%	12.6%	12.6%	10.5%
12. Instrumentation & measurement							
P Top-10%	36	37	35	32	19	49	56
P Top-5%	18	21	21	12	12	30	34
P Top-1%	4	5	4	4	3	6	7
% P Top-10%	11.9	13.9	12.5	10.0	5.4	13.6	13.3
% P Top-5%	6.0	7.9	7.5	3.8	3.4	8.4	8.1
% P Top-1%	1.3	1.9	1.4	1.3	0.8	1.7	1.7
P (art+rev)	302	266	279	320	355	359	422
% P not cited	43.2%	52.0%	48.9%	49.1%	62.0%	34.9%	33.3%
13. Condensed matter: electrical, magnetic & optical							
P Top-10%	298	352	383	376	375	332	376
P Top-5%	149	169	192	206	187	166	187
P Top-1%	40	41	46	45	49	35	46
% P Top-10%	13.2	13.7	14.1	13.1	15.2	13.8	14.6
% P Top-5%	6.6	6.6	7.1	7.2	7.6	6.9	7.2
% P Top-1%	1.8	1.6	1.7	1.6	2.0	1.5	1.8
P (art+rev)	2255	2561	2710	2881	2469	2404	2584
% P not cited	34.3%	39.6%	37.3%	37.3%	32.1%	31.0%	28.6%
14. Condensed matter: structural, mechanical & thermal							
P Top-10%	506	598	608	637	675	617	678
P Top-5%	254	294	294	345	353	319	334
P Top-1%	63	71	68	86	74	68	72
% P Top-10%	14.2	15.2	14.7	14.7	16.1	14.8	15.8
% P Top-5%	7.1	7.5	7.1	8.0	8.4	7.7	7.8
% P Top-1%	1.8	1.8	1.6	2.0	1.8	1.6	1.7
P (art+rev)	3563	3925	4131	4335	4191	4156	4301
% P not cited	30.5%	33.5%	32.3%	32.0%	29.1%	25.5%	24.1%
15. Mathematical physics							
P Top-10%	85	115	120	145	161	160	165
P Top-5%	40	63	56	73	81	91	90
P Top-1%	13	25	8	16	19	14	23
% P Top-10%	15.9	18.1	14.1	15.8	15.1	14.9	15.1
% P Top-5%	7.5	9.9	6.6	7.9	7.6	8.5	8.2
% P Top-1%	2.4	3.9	0.9	1.7	1.8	1.3	2.1
P (art+rev)	533	634	853	920	1067	1072	1095
% P not cited	30.6%	28.5%	34.8%	30.3%	33.8%	24.9%	23.5%

Table 2.16 (continued)

	1997	1998	1999	2000	2001	2002	2003
16. Medical physics							
P Top-10%	17	20	17	23	21	21	27
P Top-5%	8	11	9	11	11	7	14
P Top-1%	2	2	4	1	2	1	3
% P Top-10%	17.9	13.8	12.1	15.0	11.9	11.6	15.6
% P Top-5%	8.4	7.6	6.4	7.2	6.2	3.9	8.1
% P Top-1%	2.1	1.4	2.8	0.7	1.1	0.6	1.7
P (art+rev)	95	145	141	153	177	181	173
% P not cited	27.9%	36.2%	26.9%	30.8%	30.6%	30.2%	26.2%
17. Nanoscale science & low-D systems							
P Top-10%	205	227	256	263	249	234	261
P Top-5%	108	103	129	141	117	117	139
P Top-1%	30	25	37	29	21	25	35
% P Top-10%	13.6	13.8	15.7	16.0	16.7	15.2	15.8
% P Top-5%	7.2	6.3	7.9	8.6	7.8	7.6	8.4
% P Top-1%	2.0	1.5	2.3	1.8	1.4	1.6	2.1
P (art+rev)	1506	1643	1633	1646	1493	1542	1655
% P not cited	34.6%	41.2%	36.3%	35.4%	31.5%	29.4%	27.4%
18. Nuclear physics							
P Top-10%	105	119	101	112	111	97	89
P Top-5%	39	57	49	44	57	46	47
P Top-1%	4	11	11	9	5	12	12
% P Top-10%	12.2	13.9	11.1	11.5	14.2	12.7	10.8
% P Top-5%	4.5	6.7	5.4	4.5	7.3	6.0	5.7
% P Top-1%	0.5	1.3	1.2	0.9	0.6	1.6	1.5
P (art+rev)	863	855	908	970	784	766	824
% P not cited	33.5%	32.8%	33.3%	32.9%	31.6%	31.6%	32.2%
19. Optics, quantum optics & lasers							
P Top-10%	264	305	292	330	320	282	299
P Top-5%	136	150	155	182	170	151	161
P Top-1%	35	41	34	41	43	30	36
% P Top-10%	15.1	15.5	14.9	15.6	17.0	15.1	15.3
% P Top-5%	7.8	7.6	7.9	8.6	9.0	8.1	8.2
% P Top-1%	2.0	2.1	1.7	1.9	2.3	1.6	1.8
P (art+rev)	1747	1974	1961	2110	1880	1872	1956
% P not cited	31.9%	37.4%	34.9%	34.8%	30.9%	29.5%	26.7%
20. Particle physics & field theory							
P Top-10%	150	172	145	155	166	168	143
P Top-5%	61	88	72	63	88	82	79
P Top-1%	9	15	15	15	8	22	20
% P Top-10%	12.7	14.7	11.9	12.1	14.2	14.7	12.5
% P Top-5%	5.2	7.5	5.9	4.9	7.6	7.2	6.9
% P Top-1%	0.8	1.3	1.2	1.2	0.7	1.9	1.7
P (art+rev)	1179	1173	1223	1285	1165	1144	1146
% P not cited	32.1%	30.0%	30.2%	28.8%	33.4%	25.7%	26.3%

Table 2.16 (continued)

	1997	1998	1999	2000	2001	2002	2003
21. Plasma physics							
P Top-10%	119	153	170	176	205	190	212
P Top-5%	63	77	80	86	104	105	106
P Top-1%	21	25	17	24	21	21	22
% P Top-10%	16.4	19.1	15.6	15.2	16.1	14.5	15.5
% P Top-5%	8.7	9.6	7.4	7.4	8.2	8.0	7.8
% P Top-1%	2.9	3.1	1.6	2.1	1.6	1.6	1.6
P (art+rev)	725	799	1088	1158	1275	1311	1365
% P not cited	32.3%	28.1%	35.3%	32.3%	33.5%	25.4%	25.6%
22. Quantum information & quantum mechanics							
P Top-10%	381	440	433	471	451	423	441
P Top-5%	181	214	227	236	236	207	241
P Top-1%	38	48	50	51	44	49	61
% P Top-10%	13.2	14.2	14.3	14.1	16.4	15.2	15.1
% P Top-5%	6.3	6.9	7.5	7.1	8.6	7.4	8.2
% P Top-1%	1.3	1.5	1.6	1.5	1.6	1.8	2.1
P (art+rev)	2894	3107	3034	3342	2747	2789	2927
% P not cited	33.5%	36.6%	33.3%	34.5%	30.7%	29.1%	27.2%
23. Semiconductors							
P Top-10%	608	686	668	722	706	662	717
P Top-5%	293	334	335	377	366	335	369
P Top-1%	68	75	79	91	70	80	81
% P Top-10%	13.9	14.9	14.6	14.7	16.2	15.2	15.7
% P Top-5%	6.7	7.2	7.3	7.7	8.4	7.7	8.1
% P Top-1%	1.6	1.6	1.7	1.8	1.6	1.8	1.8
P (art+rev)	4384	4619	4584	4926	4366	4357	4560
% P not cited	31.0%	33.4%	31.3%	31.8%	28.6%	26.6%	24.9%
24. Soft matter, liquids & polymers							
P Top-10%	195	224	229	258	267	260	287
P Top-5%	92	109	107	120	139	132	147
P Top-1%	26	33	26	28	26	26	33
% P Top-10%	17.3	19.4	16.3	16.5	16.3	15.5	17.1
% P Top-5%	8.2	9.4	7.6	7.7	8.5	7.8	8.7
% P Top-1%	2.3	2.9	1.9	1.8	1.6	1.5	2.0
P (art+rev)	1124	1156	1402	1562	1636	1682	1682
% P not cited	28.6%	26.6%	31.9%	26.9%	30.5%	23.6%	21.7%
25. Statistical physics & nonlinear systems							
P Top-10%	251	319	303	325	347	344	350
P Top-5%	120	161	134	165	190	182	165
P Top-1%	30	40	25	44	45	39	32
% P Top-10%	16.4	19.3	17.0	16.9	16.6	16.6	16.9
% P Top-5%	7.9	9.8	7.5	8.6	9.1	8.8	7.9
% P Top-1%	2.0	2.4	1.4	2.3	2.2	1.9	1.5
P (art+rev)	1527	1649	1782	1921	2088	2068	2076
% P not cited	26.1%	23.2%	25.8%	25.4%	27.0%	20.1%	19.1%

Table 2.16 (continued)

	1997	1998	1999	2000	2001	2002	2003
26. Superconductivity							
P Top-10%	382	451	443	469	451	410	443
P Top-5%	183	213	229	232	238	191	231
P Top-1%	37	43	50	50	44	46	55
% P Top-10%	12.5	13.5	13.4	13.3	15.2	13.9	14.1
% P Top-5%	6.0	6.4	6.9	6.6	8.0	6.5	7.4
% P Top-1%	1.2	1.3	1.5	1.4	1.5	1.6	1.8
P (art+rev)	3060	3351	3299	3534	2972	2956	3131
% P not cited	34.4%	38.3%	34.8%	35.7%	32.3%	30.9%	29.1%
27. Surfaces, interfaces & thin films							
P Top-10%	670	782	748	814	811	771	815
P Top-5%	323	384	372	418	424	396	416
P Top-1%	77	92	85	102	81	88	93
% P Top-10%	14.1	15.3	14.7	14.9	16.1	15.3	15.5
% P Top-5%	6.8	7.5	7.3	7.6	8.4	7.9	7.9
% P Top-1%	1.6	1.8	1.7	1.9	1.6	1.7	1.8
P (art+rev)	4755	5099	5096	5469	5032	5036	5250
% P not cited	30.9%	32.8%	31.7%	31.5%	29.4%	26.0%	24.5%

2.6 UK output in the world's top 1% most highly cited publications (comparison with UK performance within Chemistry, Biology and Geology)

This section presents indicators on the visibility of UK physics research within the top 1% most highly cited research papers worldwide. The results are compared to the UK performance in the top 1% in three other broad fields of science: Chemistry, Biology and Geology. The broad fields are delineated according to WoS-based Journal Subject Categories (see section 3.3).

Table 2.17 provides the annual trends in the UK contribution to the worldwide 1% most highly cited publications. Table 2.18 contains the share of the UK most highly cited publications, in comparison with the worldwide output per year.

Table 2.18 contains the absolute number of publications among the most highly cited ones per IOP defined subfield, while table 2.19 provides the percentage of publications among the most highly cited publications, in comparison with the annual UK publication output within those subfields.

Due to the fixed citation window of four years applied in this analysis, within the period 1997-2006, 2003 is the last year for which we can determine the visibility among the top 1% most highly cited publications.

Table 2.17: UK annual number of highly cited publications (top 1% cited in field), 1997-2003

	1997	1998	1999	2000	2001	2002	2003
PHYSICS (IOP)	143	135	160	164	153	162	168
BIOLOGY (WoS)	44	45	57	45	47	61	59
CHEMISTRY (WoS)	97	100	107	77	80	77	79
GEOLOGY (WoS)	34	34	33	41	39	49	51

Table 2.18: UK annual share of highly cited publications (top 1% cited in field), 1997-2003 (% of total UK publication output)

	1997	1998	1999	2000	2001	2002	2003
PHYSICS (IOP)	1.52	1.36	1.59	1.64	1.51	1.60	1.60
BIOLOGY (WoS)	1.14	1.03	1.32	1.07	1.09	1.35	1.28
CHEMISTRY (WoS)	1.37	1.35	1.42	1.07	1.11	1.10	1.11
GEOLOGY (WoS)	1.32	1.17	1.05	1.25	1.18	1.63	1.48

Table 2.19: Annual trends in number of highly cited UK-authored publications (top 1% cited in field): three broad fields and IOP defined subfields, 1997-2003

	1997	1998	1999	2000	2001	2002	2003
BIOLOGY (WoS)	44	45	57	45	47	61	59
CHEMISTRY (WoS)	97	100	107	77	80	77	79
GEOLOGY (WoS)	34	34	33	41	39	49	51
Physics subfields (IOP)							
01. Accelerators, beams & electromagnetism	2	1	7	2	1	2	6
02. Astrophysics & astroparticles	17	20	20	30	18	30	17
03. Atomic & molecular physics	35	38	23	48	33	41	38
04. Biological physics	20	30	14	21	27	18	32
05. Chemical physics & physical chemistry	40	47	39	57	37	43	36
06. Computational physics	49	55	59	73	55	66	58
07. Electronics & devices	77	92	86	102	85	91	96
08. Education & communication	0	2	0	0	1	0	0
09. Environmental & earth science	4	2	6	3	3	1	5
10. Fluid dynamics	9	17	7	11	15	13	15
11. Gravitation & cosmology	11	17	19	26	12	28	15
12. Instrumentation & measurement	4	5	4	4	3	6	7
13. Condensed matter: electrical, magnetic & optical	40	41	46	45	49	35	46
14. Condensed matter:structural, mechanical & thermal	63	71	68	86	74	68	72
15. Mathematical physics	13	25	8	16	19	14	23
16. Medical physics	2	2	4	1	2	1	3
17. Nanoscale science & low-D systems	30	25	37	29	21	25	35
18. Nuclear physics	4	11	11	9	5	12	12
19. Optics, quantum optics & lasers	35	41	34	41	43	30	36
20. Particle physics & field theory	9	15	15	15	8	22	20
21. Plasma physics	21	25	17	24	21	21	22
22. Quantum information & quantum mechanics	38	48	50	51	44	49	61
23. Semiconductors	68	75	79	91	70	80	81
24. Soft matter, liquids & polymers	26	33	26	28	26	26	33
25. Statistical physics & nonlinear systems	30	40	25	44	45	39	32
26. Superconductivity	37	43	50	50	44	46	55
27. Surfaces, interfaces & thin films	77	92	85	102	81	88	93

Table 2.20: Output share of highly cited UK-authored publications (top 1% cited worldwide): three broad fields and physics subfields, 1997-2003 (% of total UK publication output)

	1997	1998	1999	2000	2001	2002	2003
BIOLOGY (WoS)	1.14	1.03	1.32	1.07	1.09	1.35	1.28
CHEMISTRY (WoS)	1.37	1.35	1.42	1.07	1.11	1.10	1.11
GEOLOGY (WoS)	1.32	1.17	1.05	1.25	1.18	1.63	1.48
Physics subfields (IOP)							
01. Accelerators, beams & electromagnetism	0.92	0.49	2.57	0.67	0.43	0.69	1.90
02. Astrophysics & astroparticles	1.15	1.47	1.45	2.24	1.34	2.30	1.31
03. Atomic & molecular physics	1.96	2.02	1.22	2.42	1.74	2.10	1.86
04. Biological physics	2.42	3.16	1.26	1.63	1.99	1.29	2.16
05. Chemical physics & physical chemistry	1.83	2.07	1.62	2.32	1.53	1.79	1.48
06. Computational physics	1.37	1.50	1.63	1.87	1.57	1.90	1.64
07. Electronics & devices	1.57	1.75	1.59	1.78	1.59	1.71	1.74
08. Education & communication	0.00	13.33	0.00	0.00	4.00	0.00	0.00
09. Environmental & earth science	2.45	1.53	3.59	1.61	1.48	0.68	2.81
10. Fluid dynamics	1.81	2.86	0.88	1.30	1.48	1.28	1.46
11. Gravitation & cosmology	1.31	2.24	2.21	3.24	1.41	3.20	1.70
12. Instrumentation & measurement	1.32	1.86	1.43	1.25	0.85	1.66	1.65
13. Condensed matter: electrical, magnetic & optical	1.72	1.56	1.67	1.53	1.95	1.44	1.76
14. Condensed matter:structural, mechanical & thermal	1.71	1.76	1.61	1.95	1.74	1.62	1.66
15. Mathematical physics	2.40	3.90	0.93	1.71	1.76	1.30	2.07
16. Medical physics	1.92	1.32	2.56	0.63	1.08	0.52	1.57
17. Nanoscale science & low-D systems	1.94	1.49	2.23	1.73	1.39	1.60	2.09
18. Nuclear physics	0.45	1.26	1.17	0.91	0.62	1.54	1.43
19. Optics, quantum optics & lasers	1.98	2.07	1.73	1.93	2.27	1.60	1.84
20. Particle physics & field theory	0.75	1.25	1.20	1.15	0.67	1.89	1.72
21. Plasma physics	2.86	3.11	1.55	2.04	1.63	1.59	1.59
22. Quantum information & quantum mechanics	1.28	1.51	1.62	1.51	1.57	1.73	2.06
23. Semiconductors	1.50	1.57	1.68	1.82	1.58	1.82	1.76
24. Soft matter, liquids & polymers	2.27	2.81	1.82	1.76	1.56	1.53	1.94
25. Statistical physics & nonlinear systems	1.90	2.35	1.37	2.26	2.14	1.87	1.53
26. Superconductivity	1.17	1.25	1.48	1.39	1.45	1.53	1.73
27. Surfaces, interfaces & thin films	1.57	1.75	1.63	1.84	1.58	1.73	1.75

Part 3: Appendices

3.1 Delineation of physics subfields according to IOP-defined subject categories

This delineation is based on list of selected scientific journals by IOP *Science Subject Categories*. If applicable, the selected journals have been ranked within these categories according to the number of nominations (in brackets) as received from the UK academic physics and astronomy community.

1. Accelerators, beams & electromagnetism

- Nuclear Instruments and Methods in Physics Research A [3]
- IEEE Transactions on Nuclear Science
- Journal of Vacuum Science and Technology
- Particle Accelerator Conferences (proceedings published by JACoW www.JACoW.org)
- Physical Review Special Topics: Accelerators and Beams

2. Astrophysics & astroparticles

- Astronomy and Astrophysics [10]
- Astrophysical Journal [10]
- Monthly Notices of the Royal Astronomical Society [10]
- Astronomical Journal [7]
- Astroparticle Physics [4]
- Astrophysical Journal Letters [2]
- Physical Review D [2]
- Publications of the Astronomical Society of the Pacific [2]
- Solar Physics [2]
- Annual Review of Astronomy and Astrophysics
- Astronomical Journal Letters
- Journal of Cosmology and Astroparticle Physics
- Physics Letters B

3. Atomic & molecular physics

- Physical Review A [6]
- Journal of Physics B: Atomic, Molecular and Optical Physics [5]
- New Journal of Physics [3]
- Journal of Chemical Physics [2]
- Applied Physics Letters
- Chemical Physics Letters
- Europhysical Journal D
- Journal of Modern Optics
- Journal of the Optical Society of America A and B
- Nature Physics

4. Biological physics

- Biophysical Journal [7]
- Proceedings of the National Academy of Sciences [5]
- Physical Review E [3]

- Biomacromolecules [2]
- European Physical Journal E - Soft Matter [2]
- Journal of Structural Biology [2]
- Physical Biology [2]
- Bulletin of Mathematical Biology
- IET Systems Biology
- Interface
- Journal of the American Chemical Society
- Journal of Biological Physics
- Journal of Biomedical Optics
- Journal of Chemical Physics
- Journal of Theoretical Biology
- Macromolecules
- Nature Materials
- Polymer
- Soft Matter
- SPIE

5. Chemical physics & physical chemistry

- Journal of Chemical Physics [5]
- Journal of Physical Chemistry (A, B and C) [5]
- Chemical Physics [3]
- Chemical Physics Letters [3]
- Journal of the American Chemical Society [2]
- Langmuir [2]
- Advanced Materials
- Angewandte Chemie International Edition
- Discussions of the Faraday Society
- Europhysics Letters
- Physical Chemistry

6. Computational physics

- Computer Physics Communications [2]
- Journal of Chemical Physics [2]
- Physical Review B [2]
- Journal of Physical Chemistry C
- Physica B
- Physica Status Solidi (B)

7. Electronics & devices

- Applied Physics Letters [4]
- IEEE Electron Device Letters [2]
- Electronics Letters
- Europhysics Letters
- IEEE Journal Selected Topics in Quantum Electronics
- IEEE Transactions on Electron Devices
- Journal of Applied Physics

- Journal of Lightwave Technology
- Nature Nanotechnology

8. Education & communication

- American Journal of Physics [3]
- European Journal of Physics [2]
- Journal of the Public Understanding of Science
- Physics Education

9. Environmental & earth science

- Advances in Water Resources
- Agricultural and Forest Meteorology
- Annals of Glaciology
- Atmospheric Research
- Boundary Layer Meteorology
- Climate Dynamics
- International Journal of Heat and Mass Transfer
- Journal of Aerosol Science
- Journal of Applied Meteorology
- Journal of Atmospheric and Solar-Terrestrial Physics
- Journal of Biometeorology
- Journal of Climate
- Journal of Glaciology
- Journal of Physical Oceanography
- Monthly Weather Review
- Water Resources Research

10. Fluid dynamics

- Physical Review E [2]
- Journal of Fluid Mechanics
- Physica D
- Physics of Fluids
- Proceedings of the Royal Society A

11. Gravitation & cosmology

- Classical and Quantum Gravity [4]
- Astrophysical Journal [3]
- Journal of Cosmology and Astroparticle Physics [3]
- Physical Review D [3]
- Astronomy and Astrophysics [2]
- Monthly Notices of the Royal Astronomical Society [2]
- Physics Letters B [2]
- Astronomical Journal
- General Relativity and Gravitation
- Living Reviews in Relativity

12. Instrumentation & measurement

- Review of Scientific Instruments [4]
- Measurement Science and Technology [2]
- Nuclear Instruments and Methods in Physics Research [2]
- Optics Letters [2]
- Infrared Physics and Technology
- Journal of Instrumentation
- Journal of the Optical Society of America A
- Metrologia
- Nature Methods
- Optics Express
- Publications of the Astronomical Society of the Pacific

13. Condensed matter: electrical, magnetic & optical

- Physical Review B [12]
- Nature Materials [9]
- Applied Physics Letters [7]
- Journal of Physics: Condensed Matter [6]
- Journal of Applied Physics [3]
- Europhysics Letters [2]
- Journal of Chemical Physics [2]
- Nature Physics [2]
- Advanced Materials
- Europhysics Journal E
- Journal of Alloys and Compounds
- Journal of Magnetism and Magnetic Materials
- Journal of the Optical Society of America
- Journal of the Physics and Chemistry of Solids
- Journal of Physics C: Solid State Physics
- Optics Express
- Optics Letters
- Physical Review E

14. Condensed matter: structural, mechanical & thermal

- Nature Materials [5]
- Physical Review B [5]
- Journal of Physics: Condensed Matter [3]
- Applied Physics Letters [2]
- Journal of Chemical Physics [2]
- Physica B [2]
- Physical Review E [2]
- Acta Metallica Materiala
- Advanced Materials
- Carbon
- Journal of Alloys and Compounds
- Journal of Applied Physics
- Journal of Low Temperature Physics
- Materials Science and Engineering

15. Mathematical physics

- Communications in Mathematical Physics [3]
- Journal of Physics A [3]
- Physical Review A [3]
- Journal of Mathematical Physics [2]
- Journal of Statistical Physics [2]
- Physical Review E [2]
- Journal of Geometry and Physics
- Letters in Mathematical Physics
- Physica A
- Reviews in Mathematical Physics

16. Medical physics

- IEEE Transactions on Medical Imaging [2]
- Magnetic Resonance in Medicine [2]
- Medical Physics [2]
- Physics in Medicine and Biology [2]
- Annals of Biomedical Engineering
- European Journal of Nuclear Medicine and Molecular Imaging
- IEEE Transactions on Biomedical Engineering
- Imaging
- Journal of Nuclear Medicine
- Medical Image Analysis
- Physiological Measurement
- Radiology

17. Nanoscale science & low-D systems

- Nano Letters [7]
- Applied Physics Letters [6]
- Nature Materials [6]
- Nature Nanotechnology [5]
- Advanced Materials [4]
- Nanotechnology [3]
- Small [3]
- Langmuir [2]
- Carbon
- Journal of Applied Physics
- Journal of Physics: Condensed Matter

18. Nuclear physics

- Nuclear Physics A [5]
- Physical Review C [5]
- European Physical Journal A [4]
- Journal of Physics G: Nuclear and Particle Physics [4]
- Physics Letters B [4]
- Nuclear Instruments and Methods in Physics Research [2]

19. Optics, quantum optics & lasers

- Optics Letters [8]
- Journal of the Optical Society of America A and B [6]
- Optics Express [6]
- Nature Photonics [5]
- Physical Review A and B [5]
- Journal of Modern Optics [3]
- Journal of Optics A: Pure and Applied Optics [3]
- Applied Optics [2]
- Applied Physics B [2]
- Applied Physics Letters [2]
- Optics Communications [2]
- IEEE Journal Selected Topics in Quantum Electronics
- IEEE Photonics Technology Letters
- Journal of Physics A: Mathematical and Theoretical
- Nature Physics
- New Journal of Physics
- Physical Review E

20. Particle physics & field theory

- Physical Review D [7]
- Journal of High Energy Physics [5]
- Nuclear Physics B [5]
- Physics Letters B [5]
- European Physical Journal C [4]
- Nuclear Instruments and Methods in Physics Research [2]
- Journal of Physics G: Nuclear and Particle Physics

21. Plasma physics

- Plasma Physics and Controlled Fusion [3]
- Physics of Plasmas [2]
- Physical Review E [2]
- Plasma Sources Science and Technology [2]
- Applied Physics Letters
- IEEE Transactions on Plasma Science
- Journal of Applied Physics
- Journal of Nuclear Materials
- Journal of Vacuum Science and Technology

22. Quantum information & quantum mechanics

- Physical Review A [3]
- Applied Physics Letters [2]
- Physical Review B [2]
- Foundations of Physics
- Journal of Applied Physics
- Journal of Physics A: Mathematical and Theoretical
- Journal of Physics: Condensed Matter
- Journal of Statistical Physics

- Nature Materials
- Nature Physics
- Quantum Information Computing

23. Semiconductors

- Applied Physics Letters [5]
- Physical Review B [5]
- Nature Materials [3]
- IEEE Journal Selected Topics in Quantum Electronics [2]
- Journal of Applied Physics [2]
- Semiconductor Science and Technology [2]
- Advanced Materials
- Electronics Letters
- Journal of Physics: Condensed Matter
- Nature Physics
- New Journal of Physics
- Optics Letters
- Physical Review A

24. Soft matter, liquids & polymers

- European Physical Journal E - Soft Matter [3]
- Macromolecules [3]
- Physical Review E [3]
- Soft Matter [3]
- Advanced Materials [2]
- Langmuir [2]
- Europhysics Letters
- Journal of Applied Polymer Science
- Journal of Chemical Physics
- Journal of Fluid Mechanics
- Journal of Materials Chemistry
- Journal of Polymer Science, Polymer Physics Edition
- Journal of Rheology
- Nature Materials
- Physics of Fluids
- Polymer

25. Statistical physics & nonlinear systems

- Physical Review E [3]
- Journal of Physics A: Mathematical and Theoretical [2]
- Journal of Statistical Physics [2]
- Nonlinearity [2]
- Physica A [2]
- Fluctuation and Noise Letters
- International Journal of Bifurcation and Chaos
- Journal of Statistical Mechanics: Theory and Experiment
- Physica D

- Physical Review B
- Physics Letters A

26. Superconductivity

- Physical Review B [3]
- Applied Physics Letters [2]
- Journal of Applied Physics
- Journal of Low Temperature Physics
- Nature Materials
- Nature Physics
- Physica B
- Superconductor Science and Technology

27. Surfaces, interfaces & thin films

- Physical Review B [6]
- Langmuir [4]
- Surface Science [4]
- Journal of Chemical Physics [3]
- Applied Physics Letters [2]
- Applied Surface Science [2]
- Journal of Physical Chemistry (B and C) [2]
- Nano Letters [2]
- Thin Solid Films [2]
- Advanced Materials
- Journal of Applied Physics
- Journal of Physics: Condensed Matter
- Journal of Physics D: Applied Physics
- Nature Materials
- Nature Nanotechnology
- Physical Review E

3.2 Delineation of physics according to WoS-defined Journal Subject Categories

The producer of the *Web of Science* (Wos) database, *Thomson Scientific*, applies a journal-based classification system to delineate fields of science within this database. These *Journal Subject Categories* are (large) sets of journals with a common subject scope.

The following journal subject categories were selected by CWTS, after close consultation with the ESRC and RC UK, to represent physics research worldwide.

PHYSICS, APPLIED
PHYSICS, ATOMIC, MOLECULAR & CHEMICAL
PHYSICS, CONDENSED MATTER
PHYSICS, FLUIDS & PLASMAS
PHYSICS, MATHEMATICAL
PHYSICS, MULTIDISCIPLINARY
PHYSICS, NUCLEAR
PHYSICS, PARTICLES & FIELDS

NANOSCIENCE & NANOTECHNOLOGY

OPTICS

3.3 Delineation of comparator fields (Chemistry, Biology and Geology)

The list of *Thomson Scientific* Journal Subject Categories (see 3.2) that delineate the broad fields of *Biology*, *Chemistry*, and *Geology* are:

BIOLOGY
- BEHAVIORAL SCIENCES
- BIOLOGY
- ENTOMOLOGY
- EVOLUTIONARY BIOLOGY
- FISHERIES
- HORTICULTURE
- MARINE & FRESHWATER BIOLOGY
- MATHEMATICAL & COMPUTATIONAL BIOLOGY
- MYCOLOGY
- ORNITHOLOGY
- PLANT SCIENCES
- ZOOLOGY

CHEMISTRY
- CHEMISTRY, ANALYTICAL
- CHEMISTRY, APPLIED
- CHEMISTRY, INORGANIC & NUCLEAR
- CHEMISTRY, MULTIDISCIPLINARY
- CHEMISTRY, ORGANIC
- CHEMISTRY, PHYSICAL
- ELECTROCHEMISTRY
- ENGINEERING, CHEMICAL
- MATERIALS SCIENCE, PAPER & WOOD
- MATERIALS SCIENCE, TEXTILES
- POLYMER SCIENCE
- SPECTROSCOPY

GEOLOGY
- ENGINEERING, GEOLOGICAL
- ENGINEERING, MARINE
- ENGINEERING, OCEAN
- GEOCHEMISTRY & GEOPHYSICS
- GEOGRAPHY, PHYSICAL
- GEOLOGY
- GEOSCIENCES, MULTIDISCIPLINARY
- IMAGING SCIENCE & PHOTOGRAPHIC TECHNOLOGY
- METEOROLOGY & ATMOSPHERIC SCIENCES
- MINERALOGY
- OCEANOGRAPHY
- PALEONTOLOGY
- REMOTE SENSING

Additional analysis by RCUK

The following analysis was undertaken by RCUK using data Thomson Scientific data from the report by CWTS, University of Leiden.

(A) Output Volumes Normalised by Population

The following analysis normalises physics output frequency (in table 2 below) and normalises it by population (table 1 below). It therefore gives a figure for physics research output volume relative to the population size in each country.

Table 1: Population (million)

Population (million)	**2008**
USA	304
Japan	127
Germany	82
France	64
United Kingdom	61
Canada	33
The Netherlands	17

Table 2: Physics Publication Output Frequencies

Source: Thomson Scientific/Analysis: CWTS Leiden University (from table 2.1 of the above report)

	1997	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**
USA	34897	34920	36035	35020	36761	36742	39705	38715	44832	43711
Japan	15303	15736	16809	16340	17663	17316	20047	17482	18804	17844
Germany	14306	15662	15453	15118	15417	15403	16602	15078	17686	16890
France	10013	9873	10376	10341	10782	10401	11236	10357	12133	11671
UK	9396	9957	10073	10006	10117	10130	10487	10398	11788	11533
Canada	3887	3759	3645	3779	3724	4026	4448	4418	5485	5620
The Netherlands	2653	2692	2720	2755	2925	2927	3082	3162	3513	3314

Table 3: Physics Output Volumes Normalised by Population (physics outputs volume per million of total population)

	1997	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**Average 97-06**
USA	114.79	114.87	118.54	115.20	120.92	120.86	130.61	127.35	147.47	143.79	125.44
Japan	120.50	123.91	132.35	128.66	139.08	136.35	157.85	137.65	148.06	140.50	136.49
Germany	174.46	191.00	188.45	184.37	188.01	187.84	202.46	183.88	215.68	205.98	192.21
France	156.45	154.27	162.13	161.58	168.47	162.52	175.56	161.83	189.58	182.36	167.47
UK	154.03	163.23	165.13	164.03	165.85	166.07	171.92	170.46	193.25	189.07	170.30
Canada	117.79	113.91	110.45	114.52	112.85	122.00	134.79	133.88	166.21	170.30	129.67
The Netherlands	156.06	158.35	160.00	162.06	172.06	172.18	181.29	186.00	206.65	194.94	174.96

(B) Physics Output Share Normalised to UK output

Source: Thomson Scientific/Analysis: CWTS Leiden University (from data in table 2.6 in the report above)

The following table takes physics research output share by sub-discipline (as a percentage of the world total) and then normalises the data in relation to the UK output. UK output is 1.00 and other countries' output is therefore shown in relation to this.

	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
01. Accelerators. beams & electromagnetism										
Canada	0.53	0.55	0.46	0.32	0.46	0.36	0.39	0.64	0.57	0.74
France	0.92	1.29	0.68	0.80	1.10	0.85	0.66	1.06	0.94	0.95
Germany	1.29	1.78	1.05	1.15	1.63	1.35	1.19	1.66	1.41	1.42
Japan	1.73	1.93	1.41	1.27	2.14	1.44	1.51	2.32	1.63	1.58
The Netherlands	0.26	0.33	0.31	0.27	0.31	0.29	0.34	0.32	0.24	0.37
UK	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
USA	5.14	6.64	4.35	3.86	5.39	4.64	5.17	6.47	5.52	5.31
02. Astrophysics & astroparticles										
Canada	0.34	0.31	0.37	0.36	0.34	0.37	0.40	0.36	0.41	0.41
France	0.82	0.67	0.62	0.61	0.64	0.63	0.65	0.65	0.66	0.64
Germany	1.46	1.26	1.08	1.23	1.20	1.05	1.21	1.01	1.16	1.15
Japan	0.81	0.98	1.07	1.06	1.13	0.92	1.22	1.07	0.88	1.04
The Netherlands	0.28	0.23	0.21	0.21	0.23	0.21	0.22	0.20	0.20	0.23
UK	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
USA	4.23	4.03	4.54	4.24	4.34	4.31	4.63	4.26	4.17	4.26
03. Atomic & molecular physics										
Canada	0.43	0.43	0.37	0.35	0.37	0.38	0.38	0.39	0.47	0.46
France	0.88	0.83	0.86	0.84	0.92	0.84	0.85	0.83	0.91	0.91
Germany	1.37	1.37	1.30	1.18	1.29	1.22	1.32	1.22	1.38	1.24
Japan	1.37	1.37	1.30	1.18	1.29	1.22	1.32	1.22	1.38	1.24
The Netherlands	0.29	0.30	0.25	0.24	0.25	0.27	0.26	0.29	0.29	0.26
UK	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
USA	4.41	4.26	4.06	3.76	4.12	4.00	4.27	4.38	4.66	4.59
04. Biological physics										
Canada	0.63	0.61	0.48	0.46	0.47	0.48	0.52	0.52	0.50	0.52
France	0.95	1.08	0.97	0.93	1.01	0.94	1.00	0.88	0.97	0.89
Germany	1.54	1.97	1.85	1.71	1.65	1.69	1.76	1.53	1.64	1.60
Japan	1.59	1.61	1.46	1.41	1.38	1.46	1.52	1.39	1.33	1.23
The Netherlands	0.39	0.34	0.35	0.32	0.32	0.33	0.38	0.35	0.34	0.32
UK	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
USA	6.83	6.34	5.63	5.17	5.13	5.16	5.46	5.24	5.20	5.08
05. Chemical physics & physical chemistry										
Canada	0.41	0.42	0.37	0.38	0.35	0.37	0.40	0.40	0.49	0.49
France	0.91	0.91	0.88	0.85	0.92	0.85	0.88	0.85	0.97	0.93
Germany	1.27	1.46	1.35	1.25	1.34	1.33	1.36	1.32	1.43	1.38
Japan	1.20	1.42	1.26	1.20	1.37	1.30	1.49	1.45	1.42	1.35
The Netherlands	0.30	0.30	0.26	0.27	0.27	0.26	0.28	0.29	0.30	0.28
UK	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
USA	3.89	3.94	3.62	3.68	3.82	3.70	4.01	3.97	4.46	4.36
06. Computational physics										
Canada	0.38	0.38	0.37	0.35	0.35	0.38	0.41	0.40	0.50	0.51
France	0.96	0.94	0.91	0.89	0.97	0.92	0.89	0.93	1.00	0.97
Germany	1.39	1.45	1.34	1.30	1.41	1.32	1.37	1.33	1.49	1.45
Japan	1.25	1.42	1.42	1.38	1.48	1.36	1.51	1.51	1.40	1.45
The Netherlands	0.27	0.29	0.25	0.26	0.27	0.26	0.27	0.29	0.29	0.28
UK	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

USA	3.86	3.92	3.77	3.54	3.91	3.88	4.16	4.13	4.41	4.36
07. Electronics & devices										
Canada	0.42	0.38	0.38	0.36	0.37	0.40	0.42	0.44	0.49	0.48
France	1.01	0.93	0.92	0.91	1.00	0.96	0.93	0.94	0.98	0.94
Germany	1.46	1.47	1.41	1.37	1.47	1.43	1.48	1.41	1.49	1.44
Japan	1.43	1.46	1.47	1.45	1.56	1.53	1.60	1.59	1.46	1.44
The Netherlands	0.29	0.26	0.26	0.25	0.27	0.27	0.28	0.29	0.29	0.28
UK	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
USA	4.46	4.22	4.28	4.03	4.40	4.43	4.63	4.71	4.74	4.63
08. Education & communication										
Canada	0.45	0.33	0.71	0.77	0.53	0.31	0.31	1.00	0.57	0.46
France	0.22	0.33	0.62	0.32	0.53	0.56	0.50	0.45	1.00	0.80
Germany	0.61	0.54	0.62	0.61	0.24	1.03	0.35	1.17	1.09	0.93
Japan	0.00	0.20	0.18	0.00	0.16	0.44	0.44	0.83	0.68	0.67
The Netherlands	0.14	0.20	0.44	0.16	0.11	0.16	0.12	0.05	0.16	0.22
UK	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
USA	11.73	8.14	14.76	9.61	7.69	7.39	5.58	12.31	9.61	9.96
09. Environmental & earth science										
Canada	0.70	0.98	0.77	0.65	0.64	0.94	0.70	0.85	0.74	0.81
France	0.62	0.97	0.66	0.58	0.75	0.76	0.65	0.77	0.93	0.64
Germany	0.70	0.85	0.71	0.69	0.60	0.92	0.77	0.80	0.85	0.88
Japan	0.45	0.68	0.47	0.53	0.53	0.73	0.64	0.77	0.67	0.71
The Netherlands	0.24	0.37	0.36	0.31	0.23	0.27	0.28	0.28	0.31	0.22
UK	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
USA	6.17	7.61	6.64	6.19	5.56	7.37	6.72	7.37	5.94	6.01
10. Fluid dynamics										
Canada	0.43	0.38	0.33	0.34	0.30	0.35	0.38	0.40	0.41	0.41
France	1.01	1.14	0.99	1.01	1.06	0.97	1.08	0.94	0.96	0.93
Germany	1.40	2.15	1.79	1.81	1.62	1.72	1.83	1.57	1.59	1.52
Japan	1.24	1.18	1.08	1.08	1.01	1.22	1.17	1.13	1.10	1.03
The Netherlands	0.24	0.14	0.16	0.17	0.16	0.12	0.14	0.12	0.13	0.15
UK	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
USA	5.54	5.03	4.10	4.17	3.89	4.07	4.08	4.19	4.20	4.11
11. Gravitation & cosmology										
Canada	0.35	0.25	0.34	0.32	0.28	0.31	0.32	0.29	0.35	0.40
France	0.65	0.34	0.37	0.37	0.35	0.36	0.35	0.38	0.41	0.41
Germany	1.15	0.78	0.78	0.74	0.78	0.68	0.74	0.66	0.74	0.73
Japan	0.54	0.53	0.64	0.66	0.67	0.56	0.67	0.63	0.63	0.60
The Netherlands	0.24	0.14	0.16	0.17	0.16	0.12	0.14	0.12	0.13	0.15
UK	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
USA	3.89	3.38	4.29	3.88	4.03	3.76	3.86	3.80	3.93	3.93
12. Instrumentation & measurement										
Canada	0.28	0.27	0.38	0.28	0.24	0.29	0.30	0.30	0.52	0.39
France	0.85	1.14	0.90	0.87	0.92	0.89	0.72	0.86	0.98	0.86
Germany	1.16	1.44	1.32	1.18	1.40	1.28	1.06	1.27	1.30	1.22
Japan	1.10	1.37	1.54	1.49	1.56	1.45	1.23	1.52	1.38	1.26
The Netherlands	0.37	0.27	0.27	0.26	0.31	0.30	0.30	0.31	0.29	0.29
UK	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
USA	3.99	4.56	5.19	3.55	4.43	4.14	3.95	4.08	4.56	3.93
13. Condensed matter: electrical, magnetic & optical										
Canada	0.44	0.38	0.36	0.34	0.39	0.43	0.44	0.47	0.47	0.50
France	1.27	1.04	1.03	1.01	1.19	1.18	1.08	1.10	1.08	1.10
Germany	1.78	1.49	1.50	1.42	1.69	1.69	1.61	1.61	1.60	1.57
Japan	1.83	1.68	1.63	1.63	1.85	1.89	1.84	1.85	1.60	1.62
The Netherlands	0.37	0.27	0.27	0.26	0.31	0.30	0.30	0.31	0.29	0.29
UK	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
USA	4.79	4.13	4.36	3.95	4.74	4.85	4.87	5.10	4.82	4.93
14. Condensed matter: structural, mechanical & thermal										
Canada	0.43	0.39	0.37	0.36	0.37	0.41	0.42	0.44	0.46	0.48
France	0.99	0.91	0.89	0.91	0.95	0.94	0.91	0.90	0.96	0.91
Germany	1.49	1.43	1.39	1.39	1.44	1.44	1.46	1.40	1.48	1.40
Japan	1.49	1.47	1.43	1.48	1.49	1.54	1.59	1.57	1.45	1.37

The Netherlands	0.29	0.25	0.25	0.25	0.26	0.27	0.28	0.28	0.27	0.27
UK	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
USA	4.56	4.17	4.28	4.06	4.33	4.44	4.57	4.66	4.67	4.54
15. Mathematical physics										
Canada	0.55	0.46	0.38	0.38	0.35	0.40	0.40	0.43	0.48	0.45
France	1.17	1.20	1.06	1.08	1.14	0.99	1.12	1.00	1.08	1.00
Germany	1.79	2.47	2.03	1.93	1.78	1.83	1.93	1.69	1.84	1.72
Japan	1.34	1.27	1.14	1.13	1.08	1.26	1.22	1.18	1.22	1.14
The Netherlands	0.41	0.32	0.28	0.24	0.28	0.29	0.32	0.29	0.29	0.31
UK	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
USA	5.72	5.20	4.20	4.25	4.07	4.19	4.18	4.31	4.63	4.38
16. Medical physics										
Canada	1.06	0.92	0.81	0.93	0.65	0.68	0.77	0.74	1.10	0.82
France	0.59	0.45	0.56	0.50	0.46	0.47	0.58	0.50	0.68	0.49
Germany	1.08	0.95	0.97	0.97	0.88	1.00	1.22	1.21	1.49	1.14
Japan	1.27	0.97	0.74	0.75	0.62	0.71	0.70	0.67	0.68	0.54
The Netherlands	0.78	0.59	0.49	0.59	0.50	0.66	0.70	0.80	0.92	0.68
UK	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
USA	10.67	7.62	7.08	7.49	5.92	5.75	6.54	6.85	7.66	5.75
17. Nanoscale science & low-D systems										
Canada	0.40	0.33	0.37	0.36	0.35	0.40	0.43	0.50	0.45	0.48
France	1.06	0.92	0.90	0.86	0.95	0.97	0.92	0.93	0.88	0.87
Germany	1.36	1.12	1.20	1.12	1.22	1.24	1.25	1.29	1.20	1.25
Japan	1.70	1.54	1.70	1.63	1.85	2.02	1.89	1.91	1.64	1.68
The Netherlands	0.31	0.22	0.26	0.25	0.26	0.26	0.26	0.28	0.25	0.27
UK	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
USA	4.61	3.94	4.80	4.44	4.97	5.13	5.30	5.64	4.97	4.90
18. Nuclear physics										
Canada	0.37	0.40	0.39	0.32	0.38	0.43	0.41	0.38	0.53	0.52
France	1.03	1.11	0.94	0.92	1.18	1.10	1.00	1.25	1.21	1.11
Germany	1.60	1.97	1.46	1.51	1.93	1.71	1.80	1.86	1.81	1.96
Japan	1.40	1.73	1.65	1.47	2.05	1.71	2.00	2.16	1.69	2.13
The Netherlands	0.27	0.32	0.27	0.24	0.32	0.30	0.34	0.36	0.34	0.37
UK	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
USA	4.53	5.00	4.37	3.95	4.85	4.84	5.07	5.34	5.17	5.31
19. Optics. quantum optics & lasers										
Canada	0.46	0.37	0.40	0.37	0.42	0.47	0.47	0.47	0.54	0.50
France	1.15	0.91	0.96	0.92	1.06	1.07	0.98	0.98	1.03	1.00
Germany	1.79	1.49	1.57	1.46	1.63	1.67	1.62	1.53	1.58	1.48
Japan	1.64	1.44	1.49	1.41	1.68	1.75	1.67	1.64	1.53	1.42
The Netherlands	0.34	0.24	0.25	0.24	0.29	0.28	0.27	0.29	0.27	0.27
UK	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
USA	5.57	4.73	5.16	4.68	5.34	5.48	5.43	5.63	5.36	5.12
20. Particle physics & field theory										
Canada	0.36	0.34	0.38	0.32	0.34	0.38	0.41	0.39	0.51	0.50
France	0.88	0.93	0.81	0.77	0.86	0.88	0.81	0.94	0.94	0.86
Germany	1.42	1.55	1.29	1.27	1.42	1.36	1.44	1.42	1.51	1.45
Japan	1.20	1.37	1.35	1.21	1.49	1.28	1.54	1.58	1.32	1.59
The Netherlands	0.24	0.27	0.23	0.22	0.25	0.27	0.31	0.27	0.31	0.30
UK	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
USA	4.31	4.34	3.99	3.60	4.01	4.05	4.38	4.48	4.49	4.42
21. Plasma physics										
Canada	0.52	0.46	0.38	0.35	0.33	0.38	0.40	0.47	0.45	0.46
France	1.13	1.25	1.07	1.02	1.11	1.03	1.12	1.00	1.05	1.02
Germany	1.81	2.27	1.92	1.80	1.79	1.80	1.96	1.71	1.79	1.64
Japan	2.56	2.21	1.87	1.69	1.79	1.84	1.98	1.86	1.71	1.64
The Netherlands	0.37	0.29	0.28	0.25	0.27	0.28	0.33	0.29	0.29	0.30
UK	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
USA	6.56	6.31	5.23	4.97	4.78	4.93	5.14	5.26	5.24	5.04
22. Quantum information & quantum mechanics										
Canada	0.40	0.36	0.40	0.34	0.38	0.43	0.44	0.43	0.52	0.51

France	1.09	0.92	0.96	0.90	1.05	1.02	0.97	1.02	1.03	0.98
Germany	1.57	1.44	1.43	1.37	1.54	1.48	1.51	1.48	1.52	1.47
Japan	1.57	1.48	1.66	1.63	1.83	1.76	1.79	1.78	1.63	1.64
The Netherlands	0.37	0.29	0.28	0.25	0.27	0.28	0.33	0.29	0.29	0.30
UK	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
USA	4.65	4.26	4.75	4.16	4.95	5.02	5.18	5.30	5.20	4.98
23. Semiconductors										
Canada	0.41	0.37	0.38	0.35	0.38	0.40	0.43	0.44	0.48	0.50
France	1.01	0.92	0.91	0.88	0.99	0.94	0.90	0.94	0.95	0.94
Germany	1.45	1.39	1.32	1.27	1.41	1.34	1.37	1.35	1.41	1.38
Japan	1.44	1.48	1.51	1.48	1.65	1.57	1.67	1.67	1.48	1.50
The Netherlands	0.29	0.27	0.26	0.26	0.28	0.27	0.27	0.29	0.29	0.28
UK	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
USA	4.36	4.15	4.31	3.96	4.49	4.49	4.70	4.76	4.73	4.66
24. Soft matter, liquids & polymers										
Canada	0.50	0.52	0.43	0.42	0.39	0.43	0.49	0.48	0.52	0.52
France	1.10	1.34	1.09	1.04	1.14	1.07	1.13	1.03	1.11	1.02
Germany	1.34	1.92	1.68	1.57	1.56	1.63	1.73	1.55	1.61	1.59
Japan	1.49	1.62	1.46	1.33	1.34	1.46	1.48	1.42	1.39	1.38
The Netherlands	0.37	0.34	0.33	0.32	0.30	0.32	0.38	0.36	0.35	0.33
UK	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
USA	4.78	5.00	4.38	4.17	4.20	4.24	4.57	4.55	4.74	4.62
25. Statistical physics & nonlinear systems										
Canada	0.43	0.42	0.38	0.37	0.37	0.41	0.43	0.41	0.48	0.46
France	0.97	0.93	0.90	0.96	0.99	0.91	0.97	0.89	1.01	0.94
Germany	1.60	1.76	1.61	1.65	1.58	1.61	1.69	1.48	1.64	1.54
Japan	1.26	1.29	1.21	1.29	1.22	1.28	1.43	1.32	1.30	1.14
The Netherlands	0.30	0.28	0.25	0.25	0.28	0.27	0.30	0.29	0.30	0.29
UK	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
USA	4.87	4.57	4.19	4.24	4.13	4.30	4.47	4.32	4.64	4.41
26. Superconductivity										
Canada	0.41	0.34	0.37	0.34	0.38	0.42	0.44	0.45	0.48	0.51
France	1.12	0.95	0.96	0.92	1.05	1.05	0.95	1.03	1.02	1.02
Germany	1.57	1.42	1.39	1.34	1.53	1.47	1.48	1.48	1.50	1.47
Japan	1.65	1.62	1.69	1.62	1.91	1.80	1.84	1.90	1.63	1.66
The Netherlands	0.29	0.25	0.26	0.24	0.28	0.28	0.27	0.30	0.29	0.29
UK	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
USA	4.49	4.11	4.44	4.00	4.70	4.77	4.92	5.10	4.87	4.86
27. Surfaces, interfaces & thin films										
Canada	0.42	0.38	0.38	0.36	0.38	0.41	0.42	0.45	0.48	0.49
France	1.01	0.93	0.93	0.92	1.00	0.96	0.92	0.95	0.98	0.95
Germany	1.46	1.47	1.41	1.37	1.48	1.43	1.47	1.43	1.49	1.46
Japan	1.43	1.46	1.49	1.48	1.59	1.55	1.64	1.63	1.48	1.48
The Netherlands	0.29	0.27	0.26	0.25	0.28	0.28	0.29	0.29	0.29	0.29
UK	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
USA	4.46	4.22	4.38	4.11	4.51	4.55	4.74	4.82	4.77	4.71