

Bibliometric analysis of Russia – EU co-publications

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01 September 2008

Abstract

Bibliometric study of Russia - EU cooperation was initiated within the framework of an EC project “Scenarios for Coordinated Approach to Sustainable S/T Cooperation with the Eastern Neighbours of the EU” (SCOPE-EAST). The objectives of the project were to take sustainable steps towards an enhanced coordination of the R&D cooperation of interested EU-Member States and Associated States with Russia and Ukraine and to achieve coherence between national and EU R&D cooperation strategies. For this purpose a knowledge base on the current status of EU-Russia R&D cooperation was developed. In particular, bibliometric study was designed to identify strategic research areas of mutual interest with potential for future cooperation. The study included the assessment of the current state and dynamics of development of Russia/Ukraine - EU S&T cooperation and the analysis of the joint publications co-authored by Russian/Ukrainian and EU scientists.

Quantitative data on the number joint publications authored by scientists from EU-27 on the whole and each of 27 EU countries and the Russian Federation for 1997-2006 were extracted from the database and analysed. The data on the subjects of co-publications for the period from 2001 to 2006 and the data required to identify top Russian laboratories to the last 3 years (2004-2006) were examined.

A detailed analysis of subject areas made it possible to identify the general trends in co-publishing, scientific specialization, of co-

publications with 27 EU countries, as well as cooperation and co-authorship patterns were analysed and top areas of co-publications were revealed.

1 Introduction

Russia’s contribution to the world science has been examined by V. Markusova, I. Marshakova-Shaikevich, S. Shaposhnik, et al. However, thus far no comprehensive study of Russia-EU cooperation reflected in joint publications has been undertaken, though bibliometric approach might support research policy making, joint priority setting, etc. now when Russia is increasingly involved in the European Research Area and has applied for the status of associated country to the Seventh Framework Programme.

2 Data and Method

Considering the policy implications of bibliometric analysis, the authors used some methods based on the approaches developed by K. Debackere and W. Glaenzel.

The data on joint publications of Russian researchers and their colleagues from EU countries for 1997-2006 were extracted from the online database *Science Citation Index Expanded* (Thomson Corporation Web of Knowledge); publications in social sciences, the humanities and the arts (SSCI and A&HCI) were excluded from consideration. “All document types” without restriction of language were analysed. Absolute measures were used to count (co)-publications: one occurrence of country A

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in a paper was counted as one co-publication for country A, N occurrences of country A in a paper were counted as one co-publication for country A). Each publication was counted once for a country each time this country appeared at least once in a publication regardless of the number of authors from this country in the publication.

The following data series were used for the analysis:

- the total number of publications of the Russian Federation and each of 27 EU countries and joint publications of Russian scientists with EU authors within the 10-year period (1997-2006);
- the number of co-publications of Russian scientists with each of the 27 EU countries for the ten-year period and for each year;
- discipline distribution of joint publications with EU on the whole and each of the 27 EU countries for five years (2001-2006).

3 Results

Over the recent decade the number of publications by Russian scientists recorded in the *Science Citation Index Expanded* varied from 28.8 thousand in 1997 to 25.7 thousand in 2006 (Fig. 1), whereas the share of international publications varied from 28% to 36% (joint publications with EU authors from 17% to 24.4%).

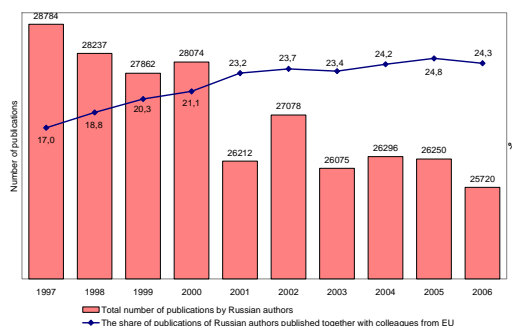


Fig. 1. The pool of publications by Russian authors and the share of joint publications with EU co-authors.

Against the background of decreasing pool of Russian publications one should note a continuous increase in the number of international publications, in particular, joint articles with EU scientists – both in absolute and relative values. Despite the abrupt reduction of the publication activity of Russian authors after 2000 (in particular in 2001 and 2003), the share of articles

published in co-authorship with EU scientists increases permanently, a slight decrease is observed only for 2003 and 2006. The steepest annual increase of the number of joint articles (331) was noticed for 2002.

For example, in 2006 international publications amounted to 36.4% of the pool of publications of Russian authors, of which 46.6% were published by Russian and EU authors, 33.5% - Russian authors in co-authorship with colleagues from other countries than EU, and 19.8% were multinational publications by Russian and EU authors and authors from other countries of the world (Fig. 3).

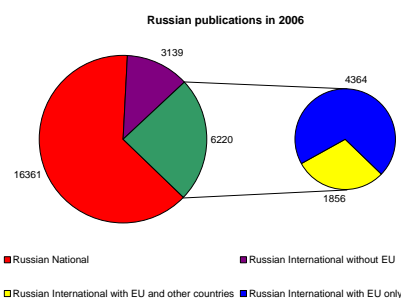


Fig. 2. National and international publications of Russian authors in 2006.

Figure 3 shows the number of the joint publications with Russia for each EU country against the background of the national pools of publications.

Qualitative data for the number of joint publications by European and Russian scientists (by country) made it possible to divide the EU member states into three groups according to their co-publication activity:

- 1) France, Germany, Italy, UK – the minimum and maximum number of co-publications varying from 572 (1997 – Italy) to 2622 (2002 – Germany);
- 2) Austria, Belgium, Czech Republic, Denmark, Finland, Netherlands, Poland, Spain, Sweden – from 133 (1997 – Austria) to 560 (2005 – Poland);
- 3) Bulgaria, Cyprus, Estonia, Greece, Hungary, Latvia, Lithuania, Luxembourg, Malta, Portugal, Romania, Slovakia, Slovenia – from 8 (2006 – Cyprus) to 159 (2006 – Portugal). In certain years, no joint articles were published by Russian researchers together with their colleagues from Malta (1999-2003) and Luxembourg (1997-2001, 2005).

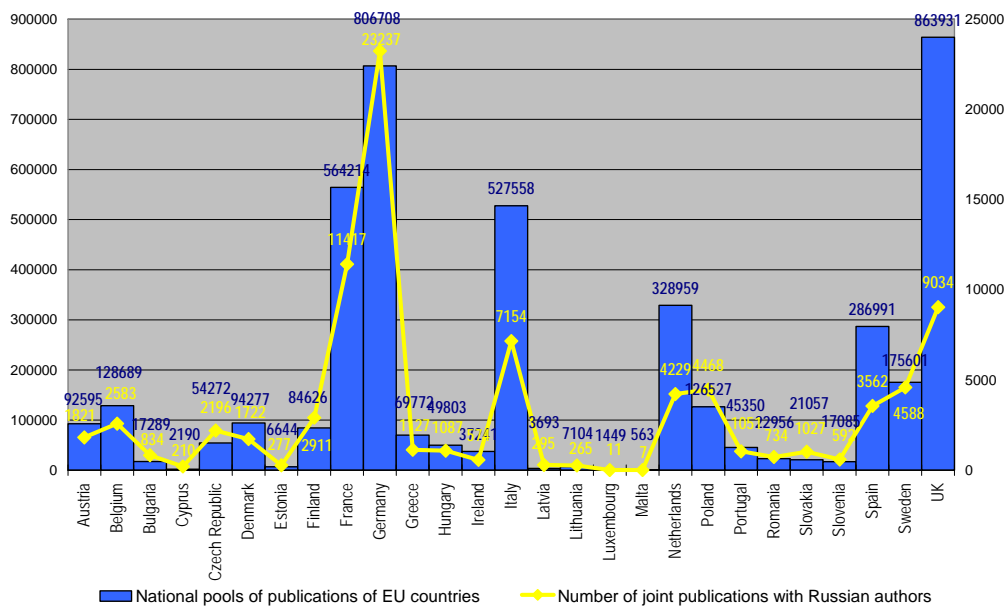
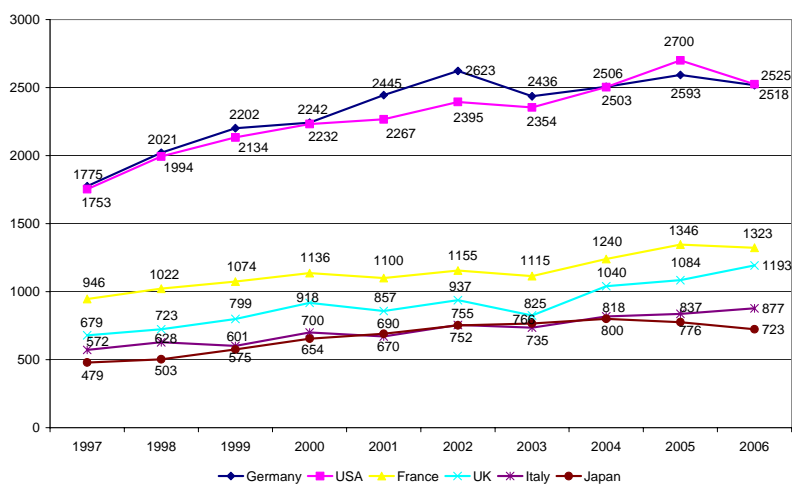


Fig. 3. The number of publications by authors from EU countries and the joint publications with Russian co-authors

Figure 4 illustrates the dynamics of joint publication activity with the countries that belong to the three groups. For comparison, Fig. 4a, which shows the data for the first group of EU countries, also contains the data for USA and Japan. The number of joint publications by German and Russian authors has been steadily increasing: from 1175 in 1997 to 2592 in 2005 with a peak year in 2002 (2622 co-publications). Between 1997 and 2005 the pool of joint Russia-Germany publications increased by a factor of 2.2 and until 2004 Germany was ahead of list; however,

the gap between the number of joint USA-Russia and joint Germany-Russia publications is still small. For France, UK and Italy there is a stable increase, an average annual increase is 49, 51 and 33 publications, respectively. For each of the three countries the decreases in the number of co-publications were observed in 2001 and 2003: -36 and -40 publications for France, -61 and -112 for the UK, and -30 and -20 for Italy, respectively, which corresponds to the decreases in the total pool of Russian publications in the same years.



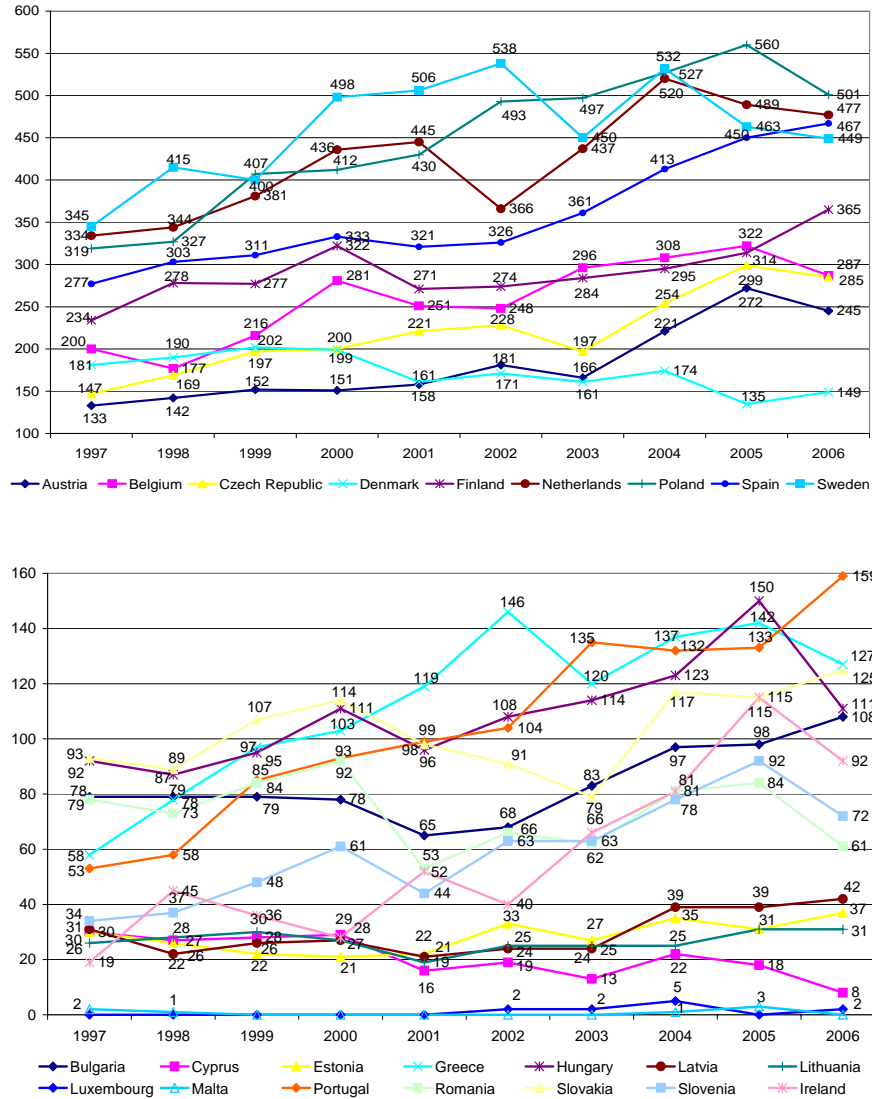


Fig. 4 (a-c). The dynamics of joint publications.

Most of the countries of the second group demonstrate positive dynamics of co-publishing with Russia. If the current rate of increase in the annual number of joint publications is maintained, Poland, Sweden and the Netherlands might soon draw upon Italy and join the first group. Since 2002 the number of joint publications with Spain has been steadily increasing, the annual average increase between 2002 and 2005 was equal to 41 publications, whereas in 2004 it was equal to 52 publications. Sweden demonstrates jump-like dynamics: the abrupt decrease in 2003 (-88) was compensated for by an increase in 2004, then another decline in 2005 (-

69). Only Denmark demonstrates negative dynamics in this group: the maximum of joint publications (202) occurred in 1999 (202) and the minimum – in 2005 (135).

All countries of the third group, except for Cyprus (decrease from 30 publications in 1997 to 13 in 2003) build up scientific cooperation with Russia. The steepest growth is noticed for Ireland (almost five-fold increase between 1997 and 2005), Greece (almost three-fold increase between 1997 and 2002, then a slight deceleration of the increase rate), Portugal and Slovenia (almost by a factor of three between 1997 and 2003 and 1997 and 2005, respectively).

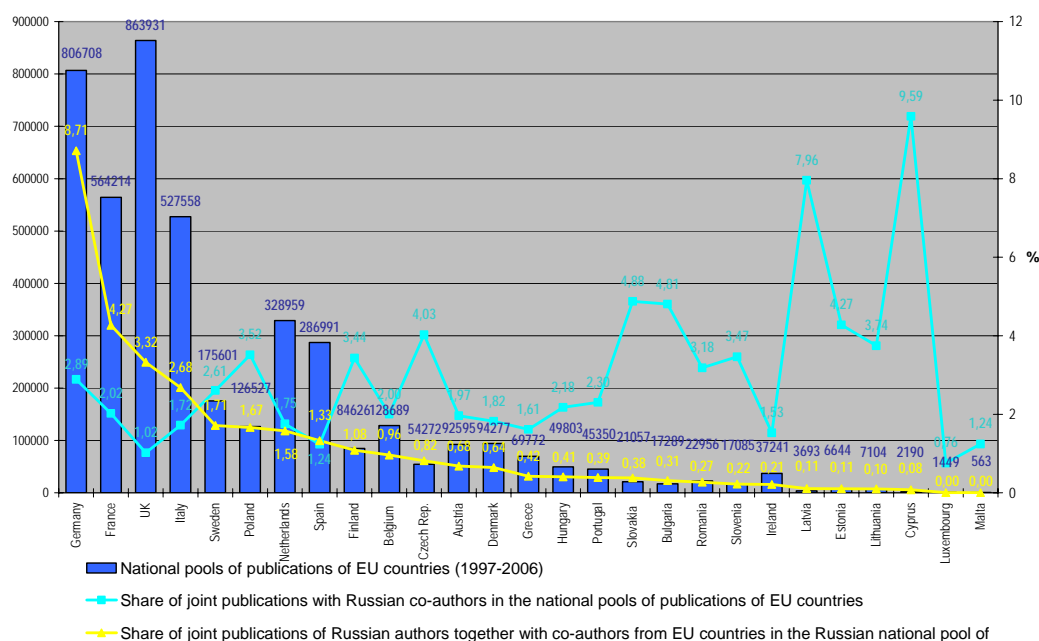


Fig. 5. The shares of joint publications in national pools of publications

To estimate the role of cooperation with Russia among the foreign scientific partners of EU countries, let us compare composite indicators – the share of publications of Russian authors published together with scientists from specific EU countries in the national publication pools of EU countries and Russia (Fig. 5). It should be noted that when analysing these data one should take into account not only the values of the shares, but also the share of international publications in the national pools, as well the general number of co-authoring countries for each country.

Let us consider the approach by the example of Russia and Germany. The Russian and German national pools of publications for the period between 1997 and 2006 amounted to 266.7 and 806.7 thousand, respectively. The number of joint publications by Russian and German authors for the same period is 23.2 thousand, i.e. 8.7% of the Russian pool and 2.9% of the German pool. For example, in 2005 the greatest number of joint articles was published by German authors with USA (12.2 thousand), then followed UK, France, Switzerland, Italy and the Netherlands. Russia was ranked seventh among

the co-authors of German authors (2.6 thousand publications).

At the same time among the co-authors of Russian authors German authors were ranked the second. The chart shows that the share of Russian-German publications in the pool of German publications is lower than the appropriate share in the Russian pool, which evidences a certain asymmetry of collaboration.

Similar co-authorship asymmetry is characteristic of other countries of the first group (France, UK and Italy). Symmetrical relation is noticed for the Netherlands and Spain. For the other EU countries one can observe a reverse asymmetry – the shares of joint publications with Russian co-authors in the pools of publications of these countries exceed the appropriate indicator in the pool of Russian publications. Thus, the preferences of EU countries towards scientific communications with Russia (and respectively, the rank of Russia in the ranking of co-authors of authors from these country) are as follows: among the co-authors of Latvian authors Russia is ranked 4th, for Bulgaria – 5th, Poland – 6th, Czech Republic and Estonia – 7th, Slovakia and Finland – 8th, Cyprus and Slovenia – 10th, Belgium, Greece, Italy and Romania –

11th, Portugal – 12th, the Netherlands and Sweden – 13th, Ireland – 14th, Hungary – 15th, Spain – 16th, Denmark and UK – 17th, Luxembourg – 26th, Malta – 40th. During the recent years Russia has moved several ranks down in the rating of many EU countries.

Priority areas for Russia – EU co-publications

In the recent years (2001-2006) Russian authors published joint articles together with co-authors from EU in the journals that cover more than 170 thematic categories of the database *Science Citation Index Expanded*, which evidences broad thematic scope of cooperation between Russia and EU researchers. However, the degree of integration of Russian scientists in the EU research community noticeably varies in specific disciplines.

Comparison of the 15 top disciplines from the pools of Russian, Russian international and Russian international – with EU + other countries and with EU – shows that main fields of joint publications at national and several levels of international scales coincide to a great extent (Table 1).

Publications in various fields of physics (multidisciplinary physics; physics, particles and fields; physics, condensed matter; nuclear physics; applied physics; physics, atomic, molecular and chemical; nuclear science and technology; mathematical physics) comprise almost a half of joint publications by Russian and EU scientists. For specific countries the share of the articles varies as follows: 78.9% (Romania), 76.9% (Italy), 72.5% (Czech Republic), 67.8% (Spain), 66.8% (Poland and Slovak Republic), 63.1% (Hungary), 61.55% (Germany), 58.7% (France and Ireland), 56.4% (Sweden), 50.5% (Netherlands), 48.5% (Austria), and 42.6% (UK). Various fields of nuclear physics account for almost 14% of publications.

Special comments should be provided for multidisciplinary physics, which is ranked first in the pool of Russian publications, Russian international and Russian international (with EU + other countries) and second – in joint publications EU – Russia. Publications that belong to this thematic category appear in co-authorship with scientists of all EU countries (except for Malta). The high percentage (Slovenia – 37.1, Romania – 25.6, Bulgaria – 25.2, Ireland – 21.7,

Hungary – 20.3, Italy and the Netherlands – 20 each, Poland – 18.8, Czech Republic – 18.7, Greece – 16.6, Austria – 16.5, France – 15.8, UK – 14, Germany – 13.1) is not a surprise because this area includes such journals as “Nature Physics”, “Physics Reports”, “Physics Review Letters”, “Physics Today”, “Physics Letters A & B”, “Reviews of Modern Physics”, “Journal of Physics A: Mathematical and General”, etc. The subjects of the articles in the journals vary from quantum and atom physics, particles physics, physics of condensed matter to mechanics, mathematical physics, astronomy and astrophysics, and interdisciplinary physics research.

EU countries demonstrate high joint publication activity with Russia in other fields of physics: physics, particles and fields; applied physics; nuclear science and technology; physics, condensed matter; nuclear physics; physics, atomic, molecular and chemical; physics, fluids and plasmas; mathematical physics. For most of them the above disciplines take the lead in the number of joint publications. One should note the high share of joint publications with specific EU countries in physics, particles and fields (Slovenia – 30.3%, Greece – 22.8%, Slovakia – 21.6%, Italy – 20.8%, Spain – 20.5%) and physics, condensed matter – Latvia (26.9%). It is noteworthy that in the national pools of publications of these countries these subjects are far from being priorities.

Dominance of physics among the priority fields of co-authorship is logical. Russia is still ranked the fifth (after USA, Japan, Germany and China) in the number of publications in physics worldwide and the sixth – in citation indicators (after USA, Germany, Japan, France and UK). However, the considerable excess of the share of joint articles in various fields of physics over the share of physics articles in the Russian pool of publications appears to be disproportionate even considering the current practice and traditions of publications in physics. This opinion is confirmed by statistical data on the share of publications in physics in the national pools of publications of EU countries.

H. Kretschmer & F. Havemann (Eds.): Proceedings of WIS 2008, Berlin

Fourth International Conference on Webometrics, Informetrics and Scientometrics & Ninth COLLNET Meeting

Humboldt-Universität zu Berlin, Institute for Library and Information Science (IBI)

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Russia	Russia International	Russia + EU + others	Russia + EU
PHYSICS, MULTIDISCIPLINARY	PHYSICS, MULTIDISCIPLINARY	PHYSICS, MULTIDISCIPLINARY	PHYSICS, CONDENSED MATTER
CHEMISTRY, PHYSICAL	PHYSICS, CONDENSED MATTER	PHYSICS, CONDENSED MATTER	PHYSICS, MULTIDISCIPLINARY
PHYSICS, APPLIED	ASTRONOMY & ASTROPHYSICS	ASTRONOMY & ASTROPHYSICS	CHEMISTRY, PHYSICAL
PHYSICS, CONDENSED MATTER	PHYSICS, APPLIED	PHYSICS, PARTICLES & FIELDS	PHYSICS, APPLIED
CHEMISTRY, MULTIDISCIPLINARY	CHEMISTRY, PHYSICAL	CHEMISTRY, PHYSICAL	MATERIALS SCIENCE, MULTIDISCIPLINARY
MATERIALS SCIENCE, MULTIDISCIPLINARY	PHYSICS, PARTICLES & FIELDS	PHYSICS, APPLIED	ASTRONOMY & ASTROPHYSICS
ASTRONOMY & ASTROPHYSICS	MATERIALS SCIENCE, MULTIDISCIPLINARY	MATERIALS SCIENCE, MULTIDISCIPLINARY	PHYSICS, ATOMIC, MOLECULAR & CHEMICAL
BIOCHEMISTRY & MOLECULAR BIOLOGY	PHYSICS, ATOMIC, MOLECULAR & CHEMICAL	PHYSICS, ATOMIC, MOLECULAR & CHEMICAL	PHYSICS, PARTICLES & FIELDS
MATHEMATICS	BIOCHEMISTRY & MOLECULAR BIOLOGY	BIOCHEMISTRY & MOLECULAR BIOLOGY	BIOCHEMISTRY & MOLECULAR BIOLOGY
OPTICS	OPTICS	PHYSICS, NUCLEAR	OPTICS
PHYSICS, PARTICLES & FIELDS	GEOSCIENCES, MULTIDISCIPLINARY	OPTICS	PHYSICS, MATHEMATICAL
GEOSCIENCES, MULTIDISCIPLINARY	PHYSICS, NUCLEAR	GEOSCIENCES, MULTIDISCIPLINARY	PHYSICS, NUCLEAR
CHEMISTRY, ORGANIC	PHYSICS, MATHEMATICAL	PHYSICS, MATHEMATICAL	GEOSCIENCES, MULTIDISCIPLINARY
CHEMISTRY, INORGANIC & NUCLEAR	INSTRUMENTS & INSTRUMENTATION	NUCLEAR SCIENCE & TECHNOLOGY	CHEMISTRY, MULTIDISCIPLINARY
INSTRUMENTS & INSTRUMENTATION	NUCLEAR SCIENCE & TECHNOLOGY	INSTRUMENTS & INSTRUMENTATION	MATHEMATICS

Table 1. Top 15 disciplines in the Russian national pool of publications, among international Russian publications, joint publications Russia + EU + other countries and Russia + EU.

4 Conclusions

The study has proved that S&T cooperation between Russia and EU evolves dynamically. Russian experts are to a great extent integrated into the European research community; however, the intensity of joint publication activity with researchers from different EU countries and in different scientific disciplines is very non-uniform, while the co-authorship pattern “Russia – EU country” can be symmetrical and asymmetrical.

The analysis made it possible to trace the dynamics of co-publishing between Russian scientists and scientists from each of the 27 EU countries for the ten-year period and each year between 1997 and 2006; to examine scientific specialization of cooperation/co-publications and to reveal Russian institutions that are the most active in co-publishing with certain EU countries. Thus, for example the top 10 institu-

tions are the Russian Academy of Sciences, the Institute of High Energy Physics, the Institute for Theoretical & Experimental Physics, Moscow Lomonosov State University, Joint Institute for Nuclear Research, St. Petersburg State University, the Russian Academy of Medical Sciences, Moscow Engineering Physics Institute, St. Petersburg Nuclear Physics Institute and Lebedev Physics Institute.

The macrolevel study completed within the SCOPE-EAST project provided background data for further research and in-depth analysis of the joint publications of Russian and EU researchers considered as a basic output of S&T cooperation between Russia and EU. In particular, the authors intend to continue the study applying the methods of network and context analysis for certain EU countries, going down to the level of cooperating institutes/laboratories and publications.

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Acknowledgement

The authors appreciated fruitful exchange with Didier Journo (CNRS) who was dealing with methodology and bibliometric data for Ukraine within SCOPE-EAST.

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