

TRENDS OF PAPERS PUBLISHED FROM 2006 TO 2010 IN JOURNALS *NATURE AND SCIENCE*

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ABSTRACT

We present an analysis of the papers published in the journals *Nature* and *Science* in the years from 2006 to 2010. During this period, 7788 papers in total were published in the two journals. This includes 544 astronomy papers that correspond to 7.0% of the papers in ‘all’ research fields and 18.9% of those in the field of ‘physical sciences’. The sub-fields of research of the astronomy papers are distributed, in a descending order of the number of papers, in Solar System, stellar astronomy, galaxies and the universe, the Milky Way Galaxy, and exoplanets. The observational facilities used for the studies are mainly ground-based telescopes (31.1%), spacecrafts (27.0%), and space telescopes (22.8%), while 16.0% of papers did not use any noticeable facilities and 1.7% used other facilities. Korean scientists have published 86 papers (33 in *Nature* and 53 in *Science*), which is 1.10% of all the papers ($N = 7788$) in the two journals. The share of papers by Korean astronomers among the scientific papers by Koreans is 8.14%, slightly higher than the contribution of astronomy papers (7.0%) in both journals.

Key words: history and philosophy of astronomy; sociology of astronomy; astronomical data bases; miscellaneous

1. INTRODUCTION

While all scientific and astronomical research papers report new findings on nature and the Universe, some of them contribute greatly to the development of science and human knowledge. These achievements that have a high impact on science and mankind are often acknowledged by press releases to the public and/or prestigious prizes such as the Nobel Prize. Some representative ways to assess papers and determine which are high impact papers could be investigating highly cited papers or considering papers published in highly cited journals (Davoust & Schmadel, 1987; Leverington, 1996; Schulman et al., 1997; Abt, 1998, 2000; Pearce, 2004;

Trimble & Ceja, 2008; Stanek, 2008; Crabtree, 2008; Trimble, 2009; Frogel, 2010; Kim, 2011).

There have been many studies to measure the productivity and/or effectiveness of (1) facilities (e.g. telescopes) (Trimble, 1995, 1996; Benn & Sánchez, 2001a, 2001b; Ringwald et al., 2003; Meylan, Madrid, & Macchetto, 2004; Trimble, Zaich, & Bosler, 2005; Grothkopf et al., 2005; Trimble & Ceja, 2007, 2008; Trimble, 2009; Apai et al., 2010), (2) organizations (Crabtree & Bryson, 2003), (3) countries (Sánchez & Benn, 2004; Abt, 2010; Kamphuis & van der Kruit, 2010), (4) scholars (Dietrich, 2008; Stanek, 2009; Kamphuis & van der Kruit, 2010; Pimblet, 2011), and so

on. Ahn et al. (2008) suggested that the number of papers produced by ground-based large ($D \sim 3.6 - 10$ m) optical telescopes are roughly proportional to the diameters of the primary mirrors (see also Leverington (1997)). Recently, Kim (2011) presented results of an investigation on the paper productivities of ground-based large ($D > 8$ m) optical telescopes from an analysis of papers published from 2000 to 2009.

Considering that the astronomical papers with the highest number of citations and those published in the journals *Nature* and *Science* are the outputs with the greatest impact on science and on mankind (Benn & Sánchez, 2001b), we have investigated the papers published in the journals *Nature* and *Science* from 2006 to 2010 in this study. Specifically, we have tried to answer the following questions which people often ask: (1) how many papers are published in the journals *Nature* and *Science*, (2) what is the percentage of astronomy papers among these papers, (3) what are the distributions and portions of sub-research fields of astronomy, (4) what facilities were used for those astronomy papers and what were the percentages of their uses, and (5) how many Korean scientists and Korean astronomers contributed to those papers. Because in some countries including Korea there is insufficient capability in the society to assess the scientific competence of personnel or the qualities of research output, it is common to consider publications in highly cited journals/magazines like *Nature* and *Science* as the proxy of scientific expertise. It will be, therefore, meaningful to investigate the statistics and distribution of papers in the two representative journals. This paper is organized as follows: Section 2 describes the data utilized in this work. Section 3 presents the analysis results of the number of papers, research fields in astronomy, astronomical facilities used, and papers by Koreans. Finally, Section 4 provides summary and discussion of the results.

2. DATA

The academic papers investigated in this study are those contained in the two weekly journals *Nature*¹ and *Science*² for five years from 2006 to 2010. Among the contents of the two journals, we only counted ‘articles’ and ‘letters’ in *Nature* and ‘research articles’ and ‘reports’ in *Science* in order to take into account original

studies (cf. Isaac Newton Group webpage³).

In this paper, we have used the term ‘astronomy’ to include both astronomy and astrophysics.

3. RESULTS

3.1. Number of Papers

Table 1 shows the basic statistics of the papers in the journals *Nature* and *Science* from 2006 to 2010. During this period, 4004 papers were published in *Nature*, while 3784 papers were published in *Science*, with yearly mean numbers of 800 and 757, and weekly (i.e., per issue) mean numbers of 15.6 and 14.8, respectively.

For the journal *Nature*, we have used the webpage of the Japanese table of contents, which shows a detailed field classification for each article. Using these classifications, we distributed each research field into two areas of life sciences and physical sciences, of which items are shown in the footnotes of Table 1. The second column of Table 1 shows the yearly number of papers in each of these two main categories for the journal *Nature*.

The subject index of the journal *Science*’s webpage gives three main classifications; life sciences, physical sciences, and other subjects. Astronomy is included in the physical sciences; ‘other subjects’ include education, economics, sociology, policy/research ethics, etc. The numbers of papers in each of these categories for each year are shown in the fourth column of Table 1.

For the period of 2006 to 2010, there were 319 and 225 astronomy papers published in the journals *Nature* and *Science*, with yearly mean values of 64 and 45, respectively. The astronomy papers in *Nature* accounted for 8.0% and 24.1% of ‘all’ and ‘physical sciences’ papers, while those of *Science* accounted for 5.9% and 14.4%, respectively. These 544 (= 319 + 225) papers in astronomy for the journals *Nature* and *Science* comprise a total of 7.0% of the papers for ‘all’ research fields ($N = 7788 = 4004 + 3784$) and 18.9% of the papers for the fields of ‘physical sciences’ ($N = 2885 = 1321 + 1564$).

If we simply compare the fraction of astronomy papers among all science papers with the fraction of funds given to astronomy field among all research fields, the portion of astronomy papers among all science papers is greater than that of the fund given to astronomy among all the research related budgets. For example, in the

¹<http://www.nature.com>.

²<http://www.sciencemag.org>.

³<http://www.ing.iac.es/PR/natsci.html>.

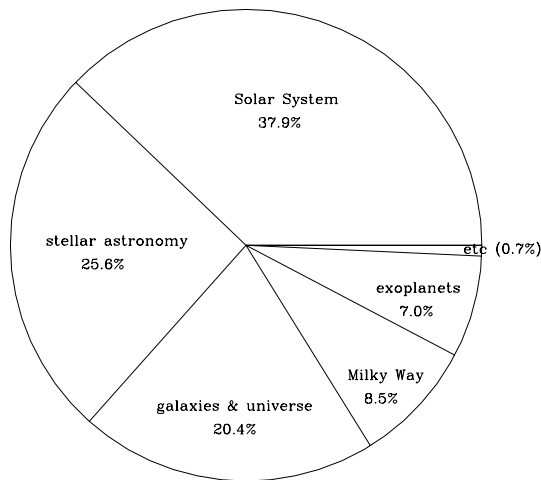


Fig. 1.— The distribution of subjects for papers published in the journals *Nature* and *Science*. ‘stellar astronomy’ includes stars, supernovae, novae, star formation, and the Sun; ‘galaxies & universe’ includes external galaxies, active galactic nuclei, gamma-ray bursts, galaxy clusters, large scale structure, and cosmology; ‘Milky Way’ includes our Galaxy, star clusters, and interstellar matter; ‘etc.’ includes cosmic rays and instrumentation. This shows only the general trend and the exact order could change, depending on the classification criteria of each item.

case of the United States (we take the U.S. case as an example because it is not easy to get funding information for other countries), funds approved and disbursed by the National Science Foundation for the field of astronomy in 2011 were only 4.3% (236.6 million USD) of the research and related activities (R&RA) fund of 5.56 billion USD⁴. All the more interesting is to note that astronomy papers make up almost one fifth of the physical science papers, which include all the natural sciences and engineering fields. This implies that astronomy has a greater impact on science and mankind and generates great interest from the general public.

3.2. Sub-fields in Astronomy

Table 2 shows the distribution of papers in the sub-fields of astronomy for the journals *Nature* and *Science*.

⁴<http://www.nsf.gov>.

The classification criterion has been set up by the authors and modified by comparing the results from the two journals. Figure 1 shows the general distribution of the sub-fields. The data in this Figure shows that the order, sorted by number of papers, is Solar System, stellar astronomy, galaxies and the universe, the Milky Way Galaxy, and exoplanets.

‘Solar System’ is the most studied sub-field in the two journals, with a percentage of 37.9%, followed by ‘Stars’ (11.4%), ‘External Galaxies’ (10.5%), ‘Supernovae and Novae’ (7.2%), ‘Exoplanets’ (7.0%), and so on (Table 2). ‘Solar System’ and ‘Stars’ comprise half of astronomy papers (see the sixth column of Table 2), while the five fields (Solar System, Stars, External Galaxies, Supernovae and Novae, and Exoplanets) make up three quarters.

Reasons why the field of ‘Solar System’ takes the largest portion of astronomy papers could be the following. The first reason could be the launches of several spacecrafts/satellites, which bring us much closer and more detailed views/information on Solar System objects. This is shown in the following subsection, in Table 3 and in Figure 2. As can be seen in Figure 2 (a), the papers that used spacecrafts comprised 27.0% (147/544) of all the astronomy papers; and spacecrafts were used in 32.2% (147/457) of astronomy papers (excluding papers of ‘no facility used’). Another reason might be the great interest of both scientists and the public in the neighborhood of our home planet, which extends from the Earth and Moon to Mercury, Venus, and Mars, and on to the far side of the Solar System, as well as to asteroids and comets.

3.3. Facilities for Astronomy Papers

Table 3 and Figure 2 show the statistics of the observational facilities used in the astronomy papers under consideration. When multiple facilities are used in a certain paper, we either (1) focused on the main facility which is presumed to have provided the most critical data for the research (e.g., taking the Very Large Telescope instead of the Keck Telescope in Gal-Yam et al. (2009)’s paper), or (2) took the larger (more expensive) facility over the smaller (cheaper) ones when they were used with similar importance (e.g., taking the 8.2 m Subaru telescope instead of the 2.2 m/3.5 m telescopes at the Calar Alto Astronomical Observatory, in Krause et al. (2008)). Although these selections can leave some ambiguities in certain cases, we assume that

Table 1: Number of Papers for Research Fields Published in the *Nature* and *Science* Journals

Year	<i>Nature</i> N(all) ^a	N(astronomy) ^b	<i>Science</i> N(all) ^c	N(astronomy) ^b
(1)	(2)	(3)	(4)	(5)
2006	822 (= 535 + 287)	82 (10.0%, 28.6%)	758 (= 434 + 313 + 11)	41 (5.4%, 13.1%)
2007	762 (= 512 + 250)	50 (6.6%, 20.0%)	743 (= 431 + 303 + 9)	34 (4.6%, 11.2%)
2008	823 (= 555 + 268)	65 (7.9%, 24.3%)	748 (= 432 + 308 + 8)	46 (6.1%, 14.9%)
2009	783 (= 515 + 268)	62 (7.9%, 23.1%)	774 (= 443 + 323 + 8)	48 (6.2%, 14.9%)
2010	814 (= 566 + 248)	60 (7.4%, 24.2%)	761 (= 437 + 317 + 7)	56 (7.4%, 17.7%)
Sum	4004 (= 2683 + 1321) 100 (= 67.0 + 33.0)%	319 (8.0%, 24.1%)	3784 (= 2177 + 1564 + 43) 100 (= 57.5 + 41.3 + 1.1)%	225 (5.9%, 14.4%)

^a Number of papers for all research fields (= life sciences + physical sciences), where astronomy is included in the latter. **Life sciences** mean archaeology, structural biology, agronomy, nano-technology, brain, immunology, microbiology, virus, ontogeny, pathology, taxonomy, physiology, biophysics, ecology, biochemistry, cytology, sense, plant, neurology, psychology, cancer, pharmacology, linguistics, epidemiology, genetics, cognizance, medicine, tumor, evolution, and cooperative action and **physical sciences** mean engineering, nano-technology [different from that in the life science], mathematics, universe, meteorology, physics, physical chemistry, optics, quantum, materials, earth, statistics, microscopy, ocean, visualization, chemistry, chemical engineering, and environment.

^b Number of papers in astronomy. Values in parentheses are percentage among ‘all’ papers (for the former) and percentage among ‘physical sciences’ papers (for the latter).

^c Number of papers for all research fields (= life sciences + physical sciences + Etc.), where ‘Etc.’ includes, e.g., education, economics, sociology, and policy/research ethics (astronomy is included in the ‘physical sciences’).

they do not significantly affect the distribution shown in Figure 2.

While 16.0% of papers did not use any noticeable facilities for their studies (e.g., theory, simulation), large ($D > 8$ m) optical telescopes were dominantly used for the studies of 10.5% papers (combining *Nature* and *Science*). They are currently the largest facilities in optical wavebands. Table 3 shows that the next most heavily-used facilities were spacecrafts to Saturn and Mars (14.9%) and space telescopes in the gamma-ray, optical, and infrared wavebands (15.8%). Figure 2 (a) shows that the percentages of papers that used ground-based telescopes, spacecrafts, and space telescopes were 31.1%, 27.0%, and 22.8%, respectively, for all astronomy papers. Optical and radio & sub-mm telescopes make up 69.2% and 23.7%, respectively, of all the ground-based telescopes (Figure 2 (b)). Figure 2 (c) shows that space telescopes of gamma-ray, optical, infrared, X-ray, and ultraviolet wavebands take 24.2%, 23.4%, 21.8%, 16.1%, and 3.2%, respectively.

Among the 105 papers that used ground-based optical telescopes, as shown in Figure 2 (d), the largest

telescopes of $D > 8$ m comprise 54.3% ($N = 57$), while those of $3.0 \leq D \leq 4.2$ m take 21.0% ($N = 22$), those of $D < 3.0$ m take 19.0% ($N = 20$) and those of $5.0 \leq D \leq 6.5$ m take 5.7% ($N = 6$). The possible reason why ground-based optical telescopes of diameters between 5.0 m and 6.5 m take a lesser percentage of papers (1.1% among all the facilities in Table 3) than those of diameters between 3.0 m and 4.2 m (4.0%) or even those of diameters smaller than 3.0 m (3.7%) (Figure 2 (d)) could be the lower ($\lesssim 1/3$) number of telescopes for ground-based optical telescopes of diameters between 5.0 m and 6.5 m. As can be seen in Table 3, among the ground-based optical telescopes, it is remarkable that the Sloan Digital Sky Survey (SDSS) project, operated with only one 2.5 m telescope, stands out with 2.2% of papers. This might result from a large survey program covering a quarter of the sky and the creation of 3-dimensional maps containing more than 930,000 galaxies and more than 120,000 quasars via both photometry and spectroscopy (Abazajian et al., 2009). Although the large fraction of ground-based optical telescopes of $D > 8$ m (Figure 2 (d)) could be somewhat biased, if at all, by the second criterion ex-

Table 2: Sub-field Distribution of Astronomical Papers in the *Nature* and *Science* Journals from 2006 to 2010^a

Field	N(<i>Nature</i>)	N(<i>Science</i>)	N(Sum)	Percentage [%]	Accumulated Percentage [%]
(1)	(2)	(3)	(4)	(5)	(6)
Solar System	107	99	206	37.9	37.9
Stars	32	30	62	11.4	49.3
External Galaxies	45	12	57	10.5	59.7
Supernovae and Novae	23	16	39	7.2	66.9
Exoplanets	28	10	38	7.0	73.9
Formation of Stars and the Solar System	13	14	27	5.0	78.9
Interstellar Matter (including Supernova Remnants)	11	12	23	4.2	83.1
Gamma Ray Bursts	17	5	22	4.0	87.1
Cosmology	10	4	14	2.6	89.7
Milky Way Galaxy	8	4	12	2.2	91.9
Star Clusters	7	4	11	2.0	93.9
Sun	6	5	11	2.0	96.0
Active Galactic Nuclei	7	3	10	1.8	97.8
Galaxy Clusters and Large Scale Structure	3	5	8	1.5	99.3
Cosmic Ray	1	2	3	0.6	99.9
Instrumentation	1	0	1	0.2	100
Sum	319	225	544	100	–

^a On the order of percentage.

plained in the first paragraph of this subsection, it is still valuable to note that state-of-the-art facilities and big science (e.g. space telescopes, ground-based optical telescopes of $D > 8$ m) and dedicated facilities (e.g. SDSS, Cassini, Voyager, CoRoT) might be one of the critical factors to create high impact papers.

3.4. Papers by Koreans

For the papers published in *Nature* and *Science* from 2006 to 2010, we have probed the papers with Korean scientists in the author lists and show the results in Table 4. We extracted papers with authors of Korean names and Korean affiliations.

Table 4 shows that 86 papers (33 for *Nature* and 53 for *Science*) have Koreans as the authors, and among them seven papers (two for *Nature* and five for *Science*) are astronomy papers written by Korean astronomers. In total, Korean authors contributed 1.10% of the total 7788 papers published in the two journals. Astronomy papers by Korean authors ($N = 7$) make up 8.14% of the 86 papers by Korean scientists. While astronomy papers comprise 7.0% of the papers of ‘all’ research

fields in the two journals *Nature* and *Science*, as can be seen in Section 3.1, this contribution of Korean astronomers to the Korean sciences (at least in the statistics of the two journals for the given period) shows a slightly higher percentage than the world normal. If we take only the first author and corresponding author papers, the rate even increases to 11.1% (5/45).

Table 5 shows the number distribution of papers written by Korean scientists in the fields of physics, chemistry (including biochemistry), biology & life science, earth sciences & astronomy, and engineering (including materials science). Although biology & life science is the field of most abundance and earth sciences & astronomy is the field with least number of papers, the fraction of papers in biology & life science in Korea (29.1%) is much lower than the fraction of this field in the world (Table 1; $4860/7788 = 62.4\%$). It is also worthwhile to note that astronomy papers make up two thirds (7/11) of the papers in the field of earth sciences & astronomy.

Table 6 provides a detailed bibliography of the seven *Nature* and *Science* papers written by Korean

Table 3: Facilities Used in the Papers of *Nature* and *Science* Journals from 2006 to 2010

Facility	<i>Nature</i>	<i>Science</i>	Sum (%)	Accumulated Percentage [%] ^a
(1)	(2)	(3)	(4)	(5)
no facility used	58	29	87 (16.0)	–
ground-based telescope, optical ($D > 8$ m)	39	18	57 (10.5)	10.5
spacecraft - Cassini	28	18	46 (8.5)	18.9
spacecrafts to Mars	12	23	35 (6.4)	25.4
space telescope, gamma-ray	15	15	30 (5.5)	30.9
space telescope, optical	24	5	29 (5.3)	36.2
space telescope, infrared	18	9	27 (5.0)	41.2
radio telescope	13	11	24 (4.4)	45.6
ground-based telescope, optical ($3.0 \leq D \leq 4.2$ m)	19	3	22 (4.0)	49.6
spacecrafts to Moon	2	20	22 (4.0)	54.0
ground-based telescope, optical ($D < 3.0$ m)	16	4	20 (3.7)	57.3
space telescope, X-ray	13	7	20 (3.7)	61.0
SDSS	8	4	12 (2.2)	63.2
VLA, VLBA, VLBI	5	7	12 (2.2)	65.4
spacecraft - Others	4	8	12 (2.2)	67.6
spacecraft - Voyager	8	2	10 (1.8)	69.5
ground-based telescope, gamma-ray	3	5	8 (1.5)	70.9
supercomputer	5	3	8 (1.5)	72.4
spacecrafts to Mercury	0	7	7 (1.3)	73.7
spacecrafts to Earth	1	6	7 (1.3)	75.0
ground-based telescope, optical ($5.0 \leq D \leq 6.5$ m)	5	1	6 (1.1)	76.1
CoRoT satellite	4	2	6 (1.1)	77.2
Lunar sample/meteorite	5	1	6 (1.1)	78.3
submm telescope	2	2	4 (0.7)	79.0
space telescope, ultraviolet	3	1	4 (0.7)	79.8
space telescope, Sun observing	1	2	3 (0.6)	80.3
balloon	2	0	2 (0.4)	80.7
ground-based telescope, Sun observing	0	2	2 (0.4)	81.1
ground-based telescope, cosmic ray	0	2	2 (0.4)	81.4
space telescope - Kepler	0	2	2 (0.4)	81.8
spacecrafts to Venus	1	1	2 (0.4)	82.2
space telescope - WMAP	0	1	1 (0.2)	82.3
etc. ^b	5	4	9 (1.7)	84.0
Total	319	225	544 (100)	–

^a Excludes the first row of ‘no facility used’ (16.0%). Accumulation starts from the second item (optical telescope, $D > 8$ m) and the final sum becomes 84.0%.

^b Includes virtual observatory, Center for High Angular Resolution Astronomy (CHARA interferometer), Navy Prototype Optical Interferometer (NPOI), dark matter search detector array, Laser Interferometer Gravitational-wave Observatory (LIGO), composition analyzer, velocimeter, and magnetometer.

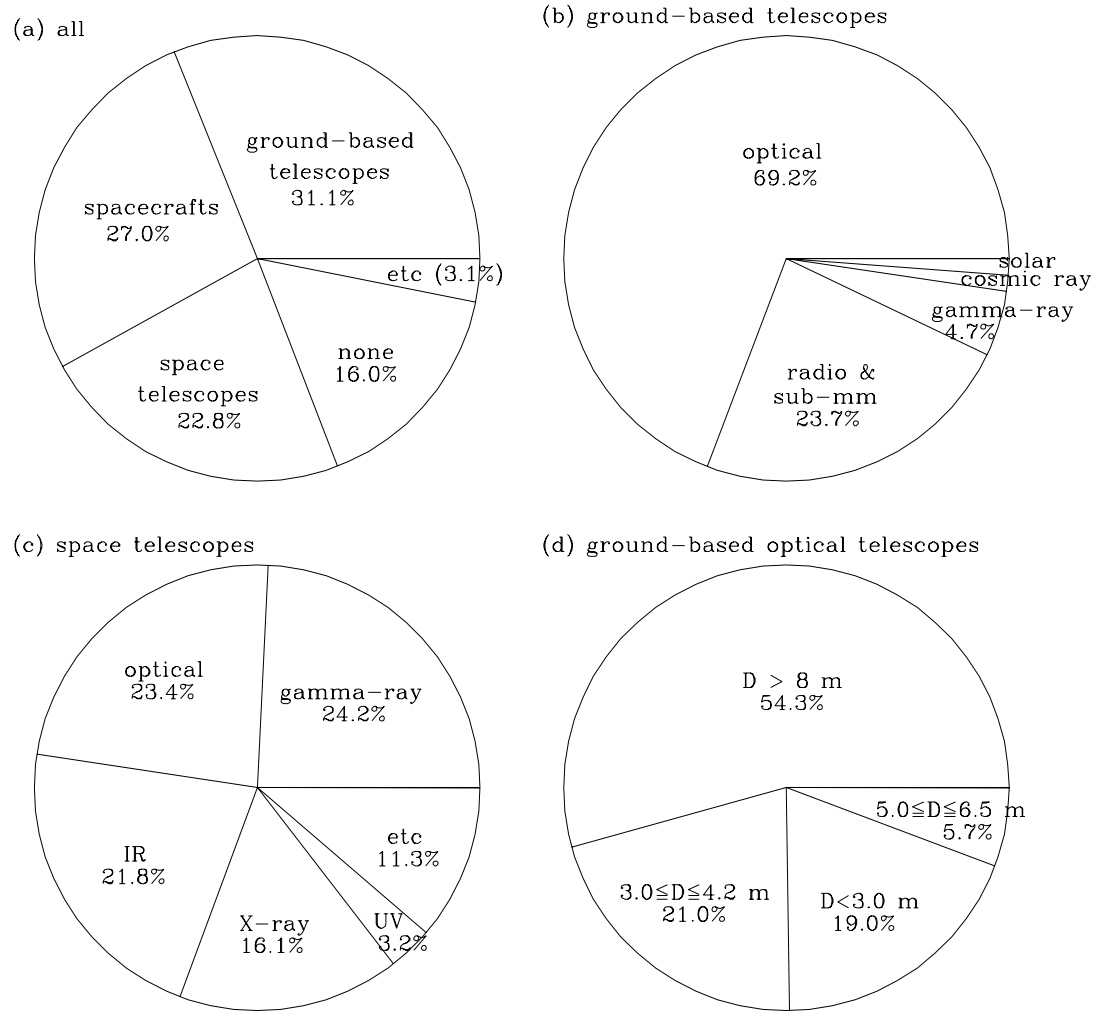


Fig. 2.— Pie charts for the facilities used in astronomy papers published in the journals *Nature* or *Science* from 2006 to 2010. (a) Facilities for all 544 astronomy papers. Spacecrafts include Lunar sample/meteorite; space telescopes include balloon and CoRoT satellites; ‘etc.’ includes supercomputer and the last item in Table 3. (b) Sub-distribution of ground-based telescopes for all wavelength ranges. ‘Optical’ includes the SDSS telescope, and ‘radio & sub-mm’ includes VLA, VBLA, and VLBI telescopes. (c) Sub-distribution of space telescopes, where ‘etc.’ contains solar telescopes, Kepler, WMAP, balloons, and the CoRoT satellite. (d) Sub-distribution of ground-based optical telescopes.

astronomers from 2006 and 2010, of which five papers are with first/corresponding authors and the remaining two are with co-authors. Among the seven papers, two (Yoon, Yi, & Lee, 2006; Ryu et al., 2008) used no observational facilities; two papers that used GALEX⁵ as the main facility (Schawinski et al., 2006, 2008) actually used multiple facilities; one paper (Lee, Park, & Hwang, 2010) used the SDSS data; and the remaining two papers (Lee et al., 2009; Gaudi et al., 2008) used small optical telescopes of 1 m class. This status of facilities used by Korean astronomers reflects well the current situation of facilities for the Korean astronomical community, and shows (1) participation in one space project (GALEX), (2) use of small ground-based optical telescopes (CTIO 1.0 m and Mt. Lemmon 1.0 m telescopes), (3) use of public archive data (SDSS), and (4) studies without any noticeable facilities. Since the tools that we use to look at the Universe are essential in astronomical studies, as can be seen in the Table 3, construction of or participation in more facilities/projects will bring a greater number of *Nature* and *Science* papers in the future.

While the sub-fields of the seven *Nature* and *Science* papers published by Korean astronomers are diverse, it is interesting that three (43%) out of seven papers are on ‘star clusters’. It is true, in general, that scientists with more and better facilities produce more and better papers. Nevertheless, considering the fact that these three papers did not use any of the current largest (or most expensive) facilities, this statistic shows that excellence in scholarship is another indispensable element in its own way.

4. SUMMARY AND DISCUSSION

We have examined the distribution and statistics of ‘articles’ and ‘letters’ in the journal *Nature* and ‘research articles’ and ‘reports’ in the journal *Science* published from 2006 to 2010. The 4004 *Nature* papers are composed of 2683 life science papers and 1321 physical science papers, among which the latter group contains 319 (8.0% among 4004) astronomy papers. The 3784 *Science* papers are made up of 2177 life science papers, 1564 physical science papers, and 43 papers in other fields, where 225 (5.9% among 3784) astronomy papers are included in the physical science papers. In total, astronomy papers comprise 7.0% of the papers for ‘all’ research fields and 18.9% of the papers for the fields of

‘physical sciences’ in the two journals.

The sub-fields of study for these astronomy papers are as follows: ‘Solar System’ (37.9%) and ‘Stars’ (11.4%) comprise half of the astronomy papers, while the five fields of Solar System, Stars, External Galaxies, Supernovae and Novae, and Exoplanets make up three quarters.

While 16% of the astronomy papers did not use any noticeable facilities for their research, spacecrafts, space telescopes, and ground-based telescopes were used for 27.0%, 22.8%, and 31.1%, respectively. Such spacecrafts, which explore in detail objects in the Solar System, might have been an important factor in increasing the large number of the research papers in this field. Space telescopes are mainly those in the gamma-ray (24.2%), optical (23.4%), infrared (21.8%), and X-ray (16.1%) wavebands; ground-based telescopes are largely optical (69.2%) and radio (23.7%) telescopes. The largest ($D > 8$ m) ground-based optical telescopes produced the greatest number of *Nature* and *Science* papers (57/105, 54.3%) among all ground-based telescopes. While this value could be affected somewhat, if not much, by one of the facility-selection criteria in Section 3.3 (taking the larger facility as the primary facility for the paper when one large and one small facilities are used in equal amounts), it seems that the order of importance among the ground-based optical telescopes would not change.

From the 4004 *Nature* and 3784 *Science* papers, we have extracted 86 papers by Korean authors with Korean affiliations. Among these 86 papers, seven astronomy papers (two in *Nature* and five in *Science*) are included, making up 8.14% of the 86 Korean papers. While ‘astronomy’ papers comprise 7.0% of the papers for ‘all’ the research fields of the journals *Nature* and *Science*, Korean astronomers appear to contribute slightly more (8.14%) to all Korean papers in these two journals.

We anticipate that these results might be used, at least, for establishing criteria to assess leading research groups (especially for astronomy fields), and estimating future production of *Nature* and *Science* papers.

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⁵Galaxy Evolution Explorer satellite.

Table 4: Papers Written by Korean Scientists^a from 2006 to 2010

Journal	All Fields ^b			Astronomy		
	N	(= First Author ^c + Others)		N	(= First Author ^c + Others)	
<i>Nature</i>	33 0.82% ^d	(= 17 + 0.42% ^d +	16) 0.40% ^d)	2 6.06% ^e	(= 2 +	0)
<i>Science</i>	53 1.40% ^f	(= 28 + 0.74% ^f +	25) 0.66% ^f)	5 9.43% ^g	(= 3 +	2)
Sum	86 1.10% ^h	(= 45 + 0.58% ^h +	41) 0.53% ^h)	7 8.14% ⁱ	(= 5 +	2)

^a Korean names and Korean affiliations.

^b Including astronomy.

^c Including corresponding author.

^d Percentage among the 4004 *Nature* papers from 2006 to 2010.

^e Percentage among the 33 *Nature* papers by Korean scientists from 2006 to 2010.

^f Percentage among the 3784 *Science* papers from 2006 to 2010.

^g Percentage among the 53 *Science* papers by Korean scientists from 2006 to 2010.

^h Percentage among the 7788 *Nature* and *Science* papers from 2006 to 2010.

ⁱ Percentage among the 86 papers by Korean scientists from 2006 to 2010.

Table 5: Number of Papers Written by Koreans^a in Each Field

Field	<i>Nature</i>		<i>Science</i>		Sum(%)
	First Author ^b	Others	First Author ^b	Others	
Physics	6	6	3	7	22 (25.6%)
Chemistry	4	1	4	5	14 (16.3%)
Biology & Life Science	1	7	12	5	25 (29.1%)
Earth Science & Astronomy	3(2) ^c	0	4(3) ^c	4(2) ^c	11 (12.8%)
Engineering	3	2	5	4	14 (16.3%)
Sum	17	16	28	25	86 (100%)

^a Korean names and Korean affiliations.

^b Including corresponding author.

^c The number in parentheses is that for astronomy.

Table 6: Bibliography of Papers Written by Korean Astronomers from 2006 to 2010^a

1 ^b	Authors	Schawinski, Kevin; Khochfar, Sadegh; Kaviraj, Sugata; Yi, Suhyoung K.; 15 coauthors ; Lee, Young-Wook; and 4 coauthors
	Journal	2006, Nature, 442, 888
	Title	Suppression of star formation in early-type galaxies by feedback from supermassive black holes
	Facilities	GALEX, SDSS
	Subject	External Galaxies
2 ^c	Authors	Lee, Jae-Woo; Kang, Young-Woon; Lee, Jina; Lee, Young-Wook
	Journal	2009, Nature, 462, 480
	Title	Enrichment by supernovae in globular clusters with multiple populations
	Facilities	CTIO 1.0 m
	Subject	Star Clusters
3 ^c	Authors	Yoon, Suk-Jin; Yi, Suhyoung Ken; Lee, Young-Wook
	Journal	2006, Science, 311, 1129
	Title	Explaining the Color Distributions of Globular Cluster Systems in Elliptical Galaxies
	Facilities	Models
	Subject	Star Clusters
4 ^c	Authors	Ryu, Dongsu; Kang, Hyesung; Cho, Jungyeon; Das, Santabrata
	Journal	2008, Science, 320, 909
	Title	Turbulence and Magnetic Fields in the Large-Scale Structure of the Universe
	Facilities	Simulations
	Subject	Large-Scale structure
5 ^c	Authors	Lee, Myung Gyoon; Park, Hong Soo; Hwang, Ho Seong
	Journal	2010, Science, 328, 334
	Title	Detection of a Large-Scale Structure of Intracluster Globular Clusters in the Virgo Cluster
	Facilities	SDSS
	Subject	Star Clusters
6 ^d	Authors	Gaudi, B. S.; 19 coauthors ; Han, C.; Kaspi, S.; Lee, C.-U.; 3 coauthors ; Park, B.-G.; and 47 coauthors
	Journal	2008, Science, 319, 927
	Title	Discovery of a Jupiter/Saturn Analog with Gravitational Microlensing
	Facilities	LOAO and many telescopes
	Subject	Exoplanets
7 ^d	Authors	Schawinski, Kevin; 22 coauthors; Yi, Suhyoung K.
	Journal	2008, Science, 321, 223
	Title	Supernova Shock Breakout from a Red Supergiant
	Facilities	GALEX, CFHT, VLT, Gemini, HST
	Subject	Supernovae

^a Names of non-Korean authors in the middle of author list are substituted with number of coauthors.^b Paper with Korean corresponding author (Yi, Suhyoung K.).^c First author papers.^d Coauthor papers.

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