Part 9. Some miscellaneous topics in astronomical history

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The IAU and French women astronomers

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Abstract. The research about women in astronomy began in 1988 following a request received from Wilfried Schröder, now deceased but, at that time, in charge of the *Interdivision Commisssion on History*, which was included in the *International Association of Geomagnetism and Aeronomy* (IAGA) attached to the IUGG *International Union of Geodesy and Geophysics*. The results obtained concerning "*Astronomy, Geophysics and Women*", presented at the symposium "The history of geomagnetism and aeronomy", were published (Débarbat 1989) in *Advances in Geosciences* in the form of a short paper. The IAU began to publish, in 1992, membership statistics in its *Information Bulletin* IB 68, including percentages of women and men, and several papers were published on the subject up to the last one *Statistics on Women in IAU Membership* (Débarbat 2004). Recent results are given including examples from the past.

Keywords. Women astronomers, French astronomy, history of the IAU

1. Introduction

The research about women in astronomy began in 1988 following a request received from Wilfried Schröder, now deceased but, at that time, in charge of the *Interdivision Commisssion on History*, which was included in the *International Association of Geomagnetism and Aeronomy* (IAGA) attached to the IUGG *International Union of Geodesy and Geophysics*. The results obtained concerning "*Astronomy, Geophysics and Women*", presented at the symposium "The history of geomagnetism and aeronomy", were published (Débarbat 1989) in *Advances in Geosciences* in the form of a short paper.

Another request from Wilfried Schröder at the IUGG/IAGA meeting in Vienna (Austria) in 1991, led to *L'Astronomie, les femmes et la géophysique. Quelques exemples en France* (Débarbat 1992). A third opportunity occurred after the IAU published, in its *Information Bulletin* IB 68, membership statistics by countries including numbers of men and women: *Un échantillon de 765 femmes engagées dans la recherche internationale – Le cas de l'UAI* (Débarbat 1993). After IB 68, the International Astronomical Union (IAU) pursued the publication of statistical membership data in its *Information Bulletin* and results became regularly published under the same form or through mailings. Especially useful were data in IB 82 (June 1998) and IB 89 (June 2001) and several papers were published. The paper *Statistics on Women in the IAU Membership* was published in *Organisations and Strategies in Astronomy 5* under the title *Statistics on Women in IAU Membership* (Débarbat 2004).

2. A statistical examination over twenty-four years

The evolution of the place of women astronomers has been examined on several occasions and from several points of view. In the present paper some of the 2004 results are analysed, recalling a discussion based on Table 1 and corresponding to a comparison based on an examination over twenty years. The paper had also given a picture showing

Table 1. Total membership and percentage of women for the years 1992, 1998, 2001 and 2016 for countries with more than 100 IAU members in 2001.

Rank	Countries	Membership	1992	1998	2001	2016
1	US	2807	8.6	8.9	9.7	14
2	France	849	26.2	26.8	26.3	25
3	Japan	726	1.4	2.5	3.2	7
4	UK	712	6.6	9.2	10.0	13
5	Italy	669	17.4	17.8	19.9	26
6	China, Nanjing	666	9.3	10.6	9.2	13
7	Germany	647	3.7	5.7	5.7	12
8	Russian Fed.	465	19.3	18.6	18.3	18
9	Spain	378	14.3	16.2	17.0	20
10	Australia	328	5.2	7.9	8.2	15
11	Canada	303	6.3	6.0	6.5	14
12	India	281	2.9	4.0	5.1	9
13	Netherlands	226	7.4	6.0	9.9	11
14	Brazil	204	13.8	16.5	17.6	23
15	Korea, Rep. of	159				13
16	Poland	156	12.8	12.8	10.7	16
17	Ukraine	149	17.9	16.8	17.9	29
18	Mexico	148				18
19	Argentina	147	30.8	33.3	35.6	38
20	Belgium	145	12.4	12.5	11.9	18
21	Sweden	137	4.8	4.2	12.2	14
22	Switzerland	136				11
23	Czech Republic	128				14
24	South Africa	124				24
25	Greece	118				16
26	Chile	115				14

two ladies, one from France, one from Finland for a Finland–ESO Agreement which was signed on 2004, February 9.

In the paper *Statistics on women in the IAU Membership*, countries with more than 100 IAU members in 2001 – about ten years after 1998 – 19 countries had more than 100 IAU members; they were compared for the percentage of women members (in the years 1992, 1998, 2001). By 2016 they were 26 countries with at least 100 members, and Table 1 shows their representation of women at four epochs, namely 1992, 1998, 2001 and 2016. For each country, is given the total number of IAU members in order of decreasing values in 2016, and also the percentage of women is given. Considering all adhering countries, that is to say a total of 12 348 members, there were 10 284 male members and 2 064 females, or in total 83.28 % male and 16.72 % female. For these statistics I have eliminated National members belonging to countries whose membership is Terminated (six), Suspended (six) or Interim (eight), that is to say Algeria, Republic of Azerbaijan, Bolivia, Costa Rica, Cuba, Georgia, Honduras, Iran (Islamic Republic of), Jordan, Korea (Democratic People Republic of), Lebanon, Macedonia (Former Republic of), Mongolia, Morocco, Panama, Peru, South Arabia, Urugay, Uzbekistan and Viet Nam.

Instead of just 13 countries having more than (IB 68) one hundred total members, they where three more countries by 1998 (listed in IB 82) and then three more (in IB 89) with the total being nineteen countries in 2001. This figure represents the evolution of the women percentage with time. France is more or less stable. Argentina having now (2001) 101 members, was number one for the percentage of women even when under the hundred. By 2001 it has become the leader of the over-100 countries with 35.6 % of women among its 101 members. The abnormal number of IAU members in France, according to its population and level of life, is also recalled.

Table 1 was divided into Table 2, concerning the seven countries having more than 500 members, and Table 3, concerning the 14 countries having more than 100 members. Table 2 gives data for 1992 and Table 3 for 2001 showing countries having more than 1%

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Table 2. The seven countries having more than 500 members in 1992.

Order	Country	Membership	%
1	Italy	669	26
2	France	849	25
3	USA	2807	14
4/5	UK	712	13
4/5	China, Nanjing	666	13
6	Germany	647	12
7	Japan	726	7

Table 3. The 14 countries having more than 200 members in 2001.

Order	Country	Membership	%
1	Italy	669	26
2	France	849	25
3	Brazil	204	23
4	Spain	378	20
5	Russian Fed.	465	18
6	Australia	328	16
7	USA	2807	14
8	Canada	303	14
9	UK	712	13
10	China	666	13
11	Germany	647	12
12	Netherlands	226	11
13	India	281	9
14	Japan	726	7

Table 4. The 2016 order of decreasing percentage of women in the corresponding year.

Order	%	Country	Order	%	Country
1	38	Argentina	14	14	USA
2	29	Ukraine	15	14	Canada
3	26	Italy	16	14	Sweden
4	25	France	17	14	Czech Republic
5	24	South Africa	18	14	Chile
6	23	Brazil	19	13	Japan
7	20	Spain	20	13	China, Nanjing
8	18	Russian Fed.	21	13	Korea, Rep. of
9	18	Mexico	22	12	Germany
10	18	Belgium	23	11	Netherlands
11	16	Poland	24	11	Switzerland
12	16	Greece	25	9	India
13	15	Australia	26	7	Japan

of women IAU members against the total number of women. In the IAU, it is already noticed, that countries remaining under the influence of the Latin culture have more women astronomers than others. A second group appears to be those countries with an Anglo-Saxon influence, but for other countries it is not so easy to identify any similar influences. As noticed in the 1993 paper, Sweden appears to be a singular case, with an increase from 0.5% women astronomers in 1992 to 8.05% in 2001.

Table 4 gives the data 2016 in order of the decreasing percentage of women for that year. Among the first ranks, are countries under influence of Latin culture, together with Ukraine at 29% and the Russian Federation at 18%.

3. The French case for Women in Astronomy over three centuries

Together, Simone Dumont and Suzanne Débarbat have presented a talk at the *Comité des Travaux Historiques et Scientifiques* (134th congress, *Savants et inventeurs entre la gloire et l'oubli*, Bordeaux 2009), in the colloquium *Célèbres ou obscurs: Hommes*

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dans leurs territoires et leur histoire, concerning *Les femmes en astronomie à l'époque moderne*. At the end of the presentation was given, under the title *Place des femmes astronomes dans les institutions Nationales (en France) et Internationales*, data about the IAU over the last ten or more years. A part of Débarbat's contribution became a paper given in September 2010 in *Cultural Astronomy*, a meeting organized by the Università degli Studi del Molise. The title was *Women in Astronomy in France and a few Specific Cases*.

This paper recalled some well known names of French women astronomers during the 18th century (S. Dumont's article), mostly based on Fontenelle's famous book *Entretiens sur la pluralité des mondes*. After the first edition (1686) and the second one (1787, one more chapter), several editions appeared up to the present time, and were translated into many languages. The success of this book is perhaps related to Fontenelle talking, in the evening, in a garden, with a lady... Another well known name is the Marquise du Châtelet, with her translation of the *Principia* from Isaac Newton, in 1759.Most of these women were generally known through their father, brother, husband or lover.

Regarding ladies one century after Fontenelle, Lalande published in 1786, *Astronomie des dames*; he also wrote:

> "*Je crois qu'il ne manque aux femmes que des occasions de s'instruire et de prendre de l'émulation, on en voit assez qui se distinguent, malgré les obstacles de l'éducation et du préjugé, pour croire qu'elles ont autant d'esprit que la plupart des hommes qui acquièrent la célébrité dans les sciences.*"

The 19th century is not so open for science to women, and none of them were found in the field of astronomy. The first female astronomer, found at the *Observatoire de Paris*, created in 1667, a few months after the *Académie des Sciences*, is a young lady who came as a student to submit a thesis on the rings of Saturn (1893). Curiously she was chosen by the director, then Ernest Mouchez (Fig. 1), to be the Chef of the group of five or six ladies in charge of measuring the positions of stars for the *Carte du Ciel* enterprise; she also made observations of planets, comets, went in balloon in 1901 to observe the Leonids... After having married a rich British amateur astronomer, she came back to live in France, after his death.

During the 20th century, among women who made a career as an astronomer, was Edmée Chandon (born 1885) who passed a thesis in 1930, working mostly in the time service (Fig. 2). Also there is Raymonde Chevallier-Dubois (born 1902) who also worked in the time service, participating in the 1933 international longitude operation; she became a member of the IAU (Commission 18, longitude by radio telegraphy). In the Meudon Observatory near Paris, we find Marguerite Roumens (born 1898), who married the astronomer Lucien d'Azambuja. She was recruited in 1925, and became one of the observatory's astronomers in 1932. Of course nothing occurred during World War II, except that men were engaged in the war. The only instruments in service were those of the time service, and the Bureau International de l'Heure (BIH) was still kept in operation.

From 1945, the director – then André Danjon – made an awful job to reactivate and to reorganize not only the *Observatoire de Paris*, but also to take care of other French observatories. The *Centre National de la Recherche Scientifique* (CNRS), created by the mid-thirties, had also to be reactivated and developed, and similarly this was also the case for the observatory in Meudon. In this observatory, attached from 1925/26 to the *Observatoire de Paris*, was Renée Herman-Montagne (born 1908) with a thesis in 1946 Figs 3, 4. In 1956 she became the first woman, Chef de service at the *Observatoire de Paris* and, most probably, the first woman to get to the upper level in the category of astronomers. Nicole Heidman-Schaerb (born 1927), was in 1965 in the service of radio-astronomy; she sumittted her thesis in 1969 and later moved to the

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Figure 1. Ernest Mouchez.

Figure 2. Three women and two men in the Service de l'heure of the Observatoire de Paris: Lagarde, Edmée Chandon, Rose Bonnet, Lambert (chef du Service, killed in Germany in 1943), Raymonde Chevallier. © Bibliothèque Observatoire Paris.

Institut d'Astrophysique in Paris (IAP, CNRS). The last to be mentionned in the paper was Françoise Praderie (born 1938), who was recruited in 1960. She submitted a thesis in 1967 and assumed leadership functions at national, European and international levels.

For the year 1991, the case of the *Observatoire de Paris* was examined by Débarbat (1993). This paper concerned the total number of researchers over three categories who were candidates for elections, among 727 persons in total. Nowadays the list of persons having the right to vote in elections at the level of the Observatoire de Paris is of the same order – that is to say 768. Women represent 28%, all categories of functions being

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Figure 3. Renée Herman. © Bibliothèque Observatoire Paris.

considered. To consiser another result for women, the choice among their total was made for scientists, in two specific domains for which ambiguities in the category could be avoided. Out of a total of 104 (the lower limit chosen for consideration for significant results at the IAU level), were found, 50 in the upper level and 54 in the lower one. In the upper level, men numbered 38 and women 12, while in the lower one there were 40 men and 14 women. The result gives respectively 76% and 74% men. Mixing the two levels, the mean is 75% men and 25% women. The percentage of women appears to be lower now than it was in 1991/1992.

4. The French Women Astronomer in National Organizations and in the IAU

In this section I consider the French national organization, the *Académie Royale des Sciences*, which had its first official meeting on 1666 December 22 under Louis XIV. But despite the 1789 *Révolution française*, the first woman elected to this Académie appeared only in 1962. She was Marguerite Perey (1909–1975), who was elected in the *Section de physique* as a correspondant; at this epoch, there were both correspondants and members. This situation ended in 2002 when it was decided to abolish the former category of correspondant. Marguerite Perey never got to the second category of member. The first woman who was a correspondant in 1979 in the Section des sciences mécaniques, and who became member in 1979 was Yvonne Choquet-Bruhat (born in 1923) and she was the first one in this category.

In the *Section des sciences de l'Univers* the first woman to be elected as a *correspondant*, in 1994, was Anny Cazenave (born 1944) in the field of climatology at the *Centre national des études spatiales* (CNES); she became a *membre* in 2004. A few years later, Nicole Capitaine (born in 1948) entered the same section as correspondant in 1997 and she had a position as an astronomer at the *Observatoire de Paris*. As already mentioned, after 2002 there were were only members. For that reason, Françoise Combes (born in 1952) was, in 2004, a member of the Section *Sciences de l'Univers*. And in 2007 Catherine Cesarsky became a member in the same section, for Astronomy.

There are other positions where women are found at the *Académie des sciences*. For example, the function as *secrétaire perpétuel*. Catherine Bréchignac (born 1946), became a correspondant from 1977 and a member of the *Section de physique* in 2005, and then became *secrétaire perpétuel* of the *Division des sciences mathématiques et physiques, sciences de l'univers et leurs applications* in 2011.

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Figure 4. This photograph is dated Paris 1947 taken at a meeting organized in Paris (1946 October 22–24) by the Comité national français d'astronomie to which many foreign astronomers were invited to attend. An exposition was organized about Le Verrier and the discovery of Neptune, one century earlier, in 1846. Among the participants, 11 women are seen representing 15% of the total. Can be seen Marguerite d'Azambuja, Renée Herman, Marie Bloch (1902–1979), Raymonde Dubois, and a forgotten Paris woman-astronomer, Renée Canavaggia (1902–1996). © Bibliothèque Observatoire Paris.

A few years later another woman replaced Jean-François Bach (born 1940) in 2016. Pascale Cossart (born 1948), correspondant in 1999, member in 2002, was the second woman to be *secrétaire perpétuel* for the *Division des sciences chimiques, biologiques et médicales, et leurs applications*. The first had been Nicole Le Douarin (born 1930), correspondant en 1980, membre en 1982 and secrétaire perpétuel from 2001 to 2005.

The *Académie des siences* makes known, on its web-site, that women number 28 among 263 members in total, but as seen, at the present time, there are women serving as *secrétaire perpétuel* in its two divisions. At the same time, there are four women being part of the *Sciences de l'univers*, and it is easy to take note of the fact that these four also have positions, at a high level, in more specific groups of scientists, related to their activity, both at national and international levels.

5. Conclusion

The short study in this paper, issued from several articles published between 1989 and the present time, highlights some increasing presence of women in astronomy, as well as differences between countries, such as those having Latin languages. A new study is underway for the year 2021, thirty years after the one published in 1991.

6. Discussion

Cesarsky: This is more a comment. In addition to translating Newton's *Principia*, Emilie du Châtelet wrote more personal texts – e.g., in 1738 she replied to a question of the *Académie des Sciences* (on the origin and propagation of fire), and a book related to Leibniz's ideas, called *Institutions de Physique*, which leeds her to have heavy scientific discussions with Academy members.

Alves-Brito: A comment. Even though we have in Brazil a relatively good number of women working in Astronomy in 2018 ($\sim 40\%$) when comparing, for instance, with Physics ($\sim 5\%$), it is important to highlight that only 14% of the Brazilian Academy of Science members are women. At the French Academy of Science it is $\sim 10\%$. This reality

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suggests we have to think further: not only about the number of women in Astronomy but also the reasons for which they are absent ("Caesar effect") from the system.

Débarbat: The women considered are members of the IAU; consult the *IAU Information Bulletin*.

Durruty Jésus de Alba Martínez: A quick question: Madame du Châtelet could be considered astronomer as translator of Newton's works?

Débarbat: In those days the scientists were not considered with a specification of their scientific discipline. It seems to me that for translating the *Principia*, knowledge of astronomy was required; mastering Latin only was not sufficient.

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