Popular Astronomy.

Vol. VI. No. 3. MAY, 1898. Whole No. 53.

WOMEN ASTRONOMERS, (400 A. D.—1750).*

HERMAN S. DAVIS.

FOR POPULAR ASTRONOMY.

Le donne son venute in eccellenza
Di ciascun' arte ove hanno posto cura;
E qualunque all' istorie abbia avvertenza,
Ne sente ancor la fama non oscura.
Ariosto, Canto xx, 2.

Ariosto, in the canto from which the above quatrain was extracted, particularizes Harpalacy and Camilla as famous in warlike deeds and Sappho and Corinne

perche furon dotte,
Splendono illustri e mai non veggon notte.

Though at this day we might add to the former names that of Joan of Arc and to the latter more than one illustrious poetess, yet, reviewing the whole history of the world even to the present day, the comparative fewness of celebrated women in all the realms of art, literature, politics, and science would seem to indicate that it was mediæval chivalry and the poetic purpose which dictated to Ariosto the lines

E di lor opre belle e gloriose
Gran lume in tutto il monde si diffuse

rather than a love for historic truth. It is far from my purpose, however, to subject poetry to the standards of modern historic criticism. Fortunate is it for woman that she has so illustrious an advocate.

It is not in the sphere of independent work that women have been so active, but in their more quiet but effective influence over the men whom they have loved—their greatest work has been in aid to him. As Hamerton has said: "Not by adding to our knowledge but by understanding *us* have women been our greatest helpers," their sympathy and their encouragement urging to greater exertions and renewed endeavors. It is this characteristic which Shakespeare has portrayed in Lady Macbeth; this also

* Biographical Sketches, and a Review of Rebière's "Les Femmes dans la Science." (First Paper).

made the gatherings in the French *salons* of such wide-spread political importance in the past.

In astronomy we see illustrations of this at all times. Perhaps the discovery of the two satellites of Mars in 1877 is due as much to Mrs. ASAPH HALL as to her renowned husband. Wearied by ceaseless watching, discouraged by the lack of success in searching for that which he suspected but could not see, he would be sent back nightly to his task till at last on August 11 his vigils and her confidence were rewarded by a double prize.

Nearly at the same time, on the far-away, roller-bound island of Ascension, Mrs. DAVID GILL was contributing in like manner to the successful issue of her husband's expedition. She tells of the adventure in her charming *Six Months in Ascension*; how, night after night, the sky above Garrison on the north-western shore of the island where her husband had located his heliometer was overcast with clouds caused by trade winds blowing across Green Mountain; and how she, despite friendly advice and earnest entreaties, persisted in a midnight tramp across the 'clinker' to the western shore to prospect for a clearer sky—and found it. The adventure was a far more toilsome one than the bare mention of it would indicate. It required a bold heart and enthusiasm for science to initiate and execute the undertaking, as I can affirm from personal experience in following the same route in daylight twelve years later. The result was a change of location of the temporary Observatory and a continuous series of excellent observations for determination of the solar parallax.

Other women might also be included in this category of those who have thus added (by very great influence none the less valuable by being indirect) contributions to the progress of astronomy.

Independent investigators there have been, indeed, from Hypatia to Mary Somerville; but rarely. Nor is it at all to the discredit of woman as a class that such is the case, for whatever may be said on the subject of 'woman's sphere' in politics, it certainly is true that no one desires her to aid in the advance of science by such independent pedantry as Molière satirizes in his inimitable way in *Les Femmes Savantes*.* But when some individ-

* Butler in his *Hudibras* (II, 3) has also held up to ridicule one feminine pretender to astronomical learning—Sarah Jimmers, whom Lilly calls "Sarah Shelhorn, a great speculatrix."

A copper-plate, with almanacs Engraved upon't, with other knacks,
Of Booker's, Lilly's, *Sarah Jimmers*,
And blank schemes to discover nimmers;
A moon dial, with Napier's bones, And several constellation stones,
Engrav'd in planetary hours, That over mortals had strange powers,
To make'em thrive in law or trade, And stab or poison to evade.

ual woman of well balanced judgment shows a predilection for mathematics or astronomy and innate genius for higher research those characteristics will bear fruit despite discouragement. Of this truth Mary Somerville is perhaps the best example.

Without opening the discussion of higher education for women, which should be most heartily encouraged, I wish merely to pass in review, briefly, the lives of those women who have cultivated astronomy. This will be done in the form of a review of the book recently issued from the press of Nony & Cie, Paris: *Les Femmes dans la Science, notes recueillies, par* A. Rebière.

In this book the author has included 610 names of women who have in one way or another interested themselves in the various sciences. The remarks about these women are arranged in separate articles set in alphabetical order. Thus the volume is really a biographical dictionary. The dictionary proper comprises 285 pages and the remaining 74 pages are devoted to quotations, anecdotes, etc., from all sorts of authors and nearly every variety of literature, even including daily newspapers.

The book is very interesting, though I take issue with the author in his opinion that it would have been less readable had the arrangement of the dictionary been chronological rather than alphabetical. Certainly the most logical order is the chronological, then eight pages more would have sufficed for printing a complete index to facilitate the finding of any individual.

Of the 610 names almost exactly one-sixth belong to women who have been more or less intimately identified with astronomy. Of these many are so little known as to furnish less than a line of material for publication. The number of this kind is so large that it is likely to create the impression in the minds of some readers that the author had made a complete list of all women who have had their names in print as in any way connected with astronomy. Yet it would have been easy to double the number of names had that been the intention. Perhaps it would have been better if twenty per cent. had been omitted. Only the modesty of the title page, "notes recueillies" and recognition in the preface that there might be "inexactitudes et les omissions" justifies the inconsistency. Before the close of this article I shall show that there are a few errors, but of the omissions shall supply only those whose names have fallen in my way, so to speak.

It is proper to remark here, however, that on the whole Rebière has performed his self-appointed task remarkably well. He has collected a vast store of information and has given it to the

world in a sprightly book adorned with many portraits and facsimiles of handwritings. This book should be in every astronomer's library, especially for his wife and daughters to read.

The author has found authority for including among the ancient astronomers and astrologers the females:

AGANICE,	Egypt	ATHYRTA,	Egypt
AGLAONICE,	Thessaly	BERENICE,	Egypt
ARISTOCLE,	Greece	HIPPARCHIE,	
ATHENAIS,	Greece	OCCELO,	

But undoubtedly of all the female astronomers of antiquity the greatest was HYPATIA. Even with a due allowance for the fables which have gathered around her memory she was truly a very remarkable woman. Born in Alexandria, daughter of Theon, the librarian, himself a mathematician and astronomical commentator of no mean merit, judged by the times, she far surpassed him in her keenness of philosophical insight and power of disquisition; so that her fame spread abroad through the then known world. As Hypatia may be known to most readers entirely from the novel of this name by Charles Kingsley, it may be well to emphasize the fact that she is an historial personage. She was born about 370 A. D., and though in Alexandria by that date the mental strength of the Greeks, which gave birth to originality of thought and observation, had indeed passed away, yet Hypatia's learning and ability as a teacher present no unfavorable contrast with that of her masculine contemporaries. She wrote commentaries on the works of the ablest mathematicians who had preceded her; calculated astronomical tables, and publically lectured to throngs of eager students, at Alexandria, upon philosophy and science. But philosophy and science had fallen upon evil days. The population of that once famous seat of learning was now kept in continual turmoil by the bitter disputes and deadly animosities of three classes—the Christians, the Jews and the Pagans. The unscrupulous and fanatical Cyril gained the ascendancy for the Christians; and, probably at his instigation, a mob of vicious monks assailed the beautiful and cultured Hypatia as she was one day returning from her lecture-hall. With circumstances of the most fiendish barbarity they dragged her into a church where she was clubbed to death. Afterwards her corpse was disemmbered and one historian says that the mob actually scraped the flesh from the bones with oyster-shells and cast the remnants into a fire.

This murder of Hypatia in 415 A. D. is usually taken as mark-

ing the almost complete extinction of Greek science until the beginning of the eighth century when it was revived by the Arabs who, after their capture of Alexandria in 640 A. D., extended their dominion over all northern Africa and into Spain, whence emanated Greek scientific influence on Mediæval Europe.

It was not until the beginning of the twelfth century that another woman arose to vie with Hypatia for honors in science. St. Hildegarde (1099–1180), who founded the monastery of Mount St. Rupert near Bingen-on-the-Rhine, wrote a book in which Battandier has pointed out some marvelous statements: (1) that the Sun is in the midst of the firmament, retaining by his force the stars which move around him; (2) that when it is cold in the northern hemisphere it is warm in the southern, that the celestial temperature may thus be in equilibrium; (3) that the stars not only shine with unequal brilliancy but are themselves really unequal in magnitude; (4) that as blood moves in the veins (Harvey was not born until 1578!) and makes them pulsate, so do the stars move and send forth pulsations of light.

If even one-half of these marvelous statements are found in her writings as early as the twelfth century without putting too much of a modern interpretation upon her phraseology, this woman may well be classed with the great forerunners of modern astronomy,—with Copernicus, with Galileo, and with Newton; for she was three centuries earlier than the first of these.

It is greatly to be regretted, however, that Rebière did not give in a foot-note* the exact reading of her text. Perhaps he will do so in a later edition that each reader may form his own judgment on a matter so important.

* Personally I am not inclined to attach a very high value to the astronomical reveries of this Saint Her writings contain a general exposition of the science of the times, but most of it is neither original nor true. I quote three sentences that are, perhaps, the least tainted with pseudo-science.

. . . . Et primus splendore suo splendorem solis illustrat, secundus vero ardore suo ardorem soli administrat; tertius autem cursu suo cursum solis ad rectitudinem retentat. Cum his enim sol circumdatur, dirigitur et retinetur, quatenus firmamento omnique mundo temperamentum calore et spendore suo tribuat.

Pars I, Visio II, *Liber Divinor, oper. simplicis hominis.*

. . . . Sed et luna de aquosa humiditate, ac de nube quae sub ipsa est, et de aera qui super terram est, multo frigidior sole est; et sol multa perureret, si luna illi non resisteret, quoniam ardorem solis luna frigidio humere suo temperat. .

Pars I, Visio II, Ibidem.

Perhaps some one can bring himself to believe that the following reveals her knowledge of universal gravitation:

. . . . Homo quoque per oculos videt, per nasum odorat et per os gustat; sicut etiam per vim solis et lunae a summis stellis, quae ipsis cum ministerio adsunt, quidam radii aliquando in caetera sidera mittuntur, ita ut alterum lumen ab altero excitetur. . . . .

Pars I, Visio IV, Ibidem.

The Duchesse de Ferrare RENEE DE FRANCE (1510-1575) on page 231 and then SOPHIA BRAHE (1556-1643±) sister of Tycho, on page 43 come next in chronological order. Concerning Sophia reference is made to Bertrand's *Founders of Modern Astronomy* though probably the origin of every mention of her is one sentence by Gassendi in his *De Tychonis Brahei Vita*. He says simply: Ea fuit perita Matheseos, et Astronomiam cum diligeret, tum Astrologiam praesertim deperiit: unde et expeditissima in erigendis Thematibus fuit. How many girls in our Seminaries might not have their names enrolled among astronomers as justifiably—if only their brothers should prove themselves to be Tychos!

MARIA CUNITZ was the oldest daughter of Henry Cunitz, a physician of Schweidnitz in Silesia, where she was born about 1610. From girlhood she was inclined to a studious life. After learning history and seven languages she gave special attention to astronomy. She found it continually necessary to defend herself against the general prejudice towards literary women; but both Kästner and Wolf remark with justice that her own life's work was her best vindication. In 1630 she married Elias von Löwen, a physician of Pitschensis. He was also an amateur of astronomy. With some idea of the need for more simple planetary tables he induced her to compose a compendium to the Rudolphine Tables. This she did with his assistance, though not, as sometimes supposed, under his direction. In her preface she gives her husband credit for his services but assumes for herself the responsibility. This is one of the instances where love of science was innate and not acquired from the husband. The magnitude of her labor on these Tables can only be imagined when it is remembered that she did not use logarithms. Unfortunately, while detecting many mistakes in her original sources, she likewise committed many errors herself. Her Tables were a simplification of the Keplerian principally because she neglected small terms in the formulas, such, for example, as the variation of the Sun's distance. Nevertheless, when they were published in 1650 under the title *Urania Propitia* they testified to the genius of a woman who must be admired for her devotion to studies so arduous and to problems so abstruse.

The greater part of this work it must be remembered, too, was prosecuted in the midst of war and in Poland, far away from her home, whence she had fled during the Franco-German war. In 1662 she became a widow, and two years later died, on August 22, while again in flight from the ravages of war.

In the picture on page 57 of Hevelius's very rare book, the *Machinae Celestiae*, may be found represented his own conception of the appearance of his second wife, Madame ELISABETH (or as some authors say, Margarethe) HEVELIUS, née Korpmann. At the time of her marriage she was sixteen years old and famous for her beauty. Indeed it is probably an allusion to her beauty that Westphal makes when he remarks that a comparison of her picture in the first part of the book with that in the last part shows every evidence that they did not both sit up every night to star-gaze. Doubtless, as Hevelius was his own engraver, he did full justice in both pictures to his wife's reputed beauty. Yet Maedler says she is pictured *in effigie* standing in front of the telescope. However that may be, it is true that she rendered her husband the greatest assistance in his observing and without that assistance his life, so fraught with troubles and disappointments, could never have reached the degree of success it otherwise did.

Hevelius was an eminent and wealthy amateur of Danzig. At the same time that Maria Cunitz in Silesia had undertaken a revision of the Rudolphine Tables, Hevelius was likewise conceiving the desire of devoting himself to their revision. Her plan was by a new reduction of old observations: his, by making new observations that should be more accurate. Each was adapting self to circumstances. She was without instruments and without wealth, hence devoted herself to computations which she could do. He was wealthy and in consequence bought instruments and built an Observatory on the roof of his house. After numerous delays which occupied as many as thirteen years he at last, in 1652, began observing for a catalogue of fixed stars. He was assisted by a young man named Kretzmer who had a remarkable taste for astronomy, but whose career was cut short in three years by death. His place was then filled by another assistant who lived only a year. *His* successor in turn died in a few days. Hevelius, thus thoroughly discouraged, then impressed his "printers' devil" into the service of the heavenly science—for besides the usual outfit of astronomical instruments he had also provided himself with a printing outfit that he might the more readily and satisfactorially publish his results to the world. This fellow was probably found to give rather precarious aid for we notice that one household servant after another was tried until finally his wife came to his relief and proved to be the very best of them all.

It is needless to tell how the fruits of their many years of labor

were lost in 1679 by the great fire which destroyed nearly the whole city including his Observatory and records and nearly all the printed copies of the *Machinae Celestae.* Eight years afterwards Hevelius died; some say of a broken heart. After his death his widow published the *Prodromus Astronomicæ* and *Firmamentum Sobieskanum.* The latter she dedicated to John Sobieski, king of Poland; and in it, under the appellation of Scutum Sobieskanum, she* named a constellation in his honor. How long Madame Hevelius survived her husband is not known, nor has she left any further mark of originality in science or literature.

It is of interest to note that this catalogue in whose construction Madame Hevelius so nobly assisted contains the position of 1888 stars. This is the largest number contained in any catalogue from observations with instruments without telescopes, as it is also the last catalogue so constructed. Thus the career of this devoted couple may be taken as marking the close of the Transitional Period between mediæval and modern astronomy.

While Maria Cunitz was prosecuting her work under the gravest difficulties arising from the Franco-German War and even lost her life as an indirect result of that prolonged turmoil, we read the equally sad story on the French side. How JEANNE DUMEE at Paris, in the seventeenth year of her age, not in romanticism but in stern reality, sent her soldier-husband off to the battle field, and thereafter as a solace to her solitude devoted her attention to astronomy,—having previously for some years devoted her leisure to refined studies. History tells not the end of his career. But at any rate the separation lasted long enough for her to write a book on "the opinion of Copernicus concerning the mobility of the earth," wherein with masterful hand she draws forth arguments for and against the Copernican system, and one by one shows how observations of Venus and Jupiter and his rotation and the revolution of his satellites prove the motion of the Earth and the validity of Copernicus' assumptions.

* The accompanying illustration (see frontispiece) is reproduced from the *Firmamentum Sobieskanum.* While it is true that this book was a posthumous publication and that the preface was written by the widow, Madame Elisabeth, the illustration itself (especially when judged in conjunction with the text of the book) leaves little doubt that the happy thought of honoring a patron by this new constellation was a scheme well thought out and really executed by Hevelius himself. It is Hevelius and not the Madame whom the picture represents as humbly offering his two new constellations to the kindly consideration of the greatest astronomers who had preceded him. The angels herald abroad praise and glory. Ptolemy's interest, Hipparchus' thoughtful attention, Timocharis' surprise, Tycho's bewilderment, are all manifest in the countenance or manner of those distinguished personages presided over by the goddess Urania. The original engraving is probably even the handiwork of Hevelius,—it is finished in such elegant detail.

MARIA CLARA MULLER, née Eimmart, was the daughter of George Christophe Eimmart, an engraver and painter of Nuremburg. She was born in 1676. Her father's profession was a lucrative one but he spent all his earnings in the purchase of astronomical instruments. He was a diligent observer and published his results in various memoirs and transactions of societies. At his death many volumes remained unpublished. Among these was *Micrographia stellarum phases lunae ultra 300* for which the illustrations were drawn from telescopic observations by his daughter Maria Clara. Maria's skill as an engraver was also of considerable assistance to her father.

Maria married Johann Heinrich Müller who was her father's assistant engraver. But Müller had been so influenced by the family love for astronomy that he became a diligent amateur and afterwards a professor at Altorf, where he used his manual skill in depicting comets, sun-spots and lunar mountains, aided by his talented wife.

With these in their earlier Nuremburg home were associated the two Rost brothers, novelists and astronomers; also Wurtzelbauer, and Doppelmayer an historian of astronomy. Happy gatherings must these have formed in the workshop and in the Observatory under the watchful eye of father Eimmart and the bewitching smile of daughter Clara. History does not state how many of these students of the heavens were lured to a contemplation of the celestial by their respect and admiration for the graceful and fair Diana of the engravers' bench. Maria Clara died 28 Oct., 1707 (not 1717 as given by Rebière).

MARIE MARGARETHE KIRCH, née Winckelmann was born in upper Lusatia in 1670. Her father was a minister of the Gospel of Panitzch near Leipzig. By nature and also by the training of the peasant astronomer, Christoph Arnold who discovered the comet of 1683, she was such a lover of astronomy that when she became the wife of Gottfried Kirch she was easily able to profit by her husband's further instruction and thus render him considerable assistance both in observing and in computing. Several almanacs and other books were the results of their labors up to her husband's death in 1710.

In 1694 Madame Kirch became the mother of Christfried Kirch who followed the precedent of his parents in profession. As assistant to his mother in preparation of almanacs which she continued to issue after her husband's death, Christfried won sufficient reputation to justify his election to the directorship of

the Observatory of Berlin where he assiduously observed for many years—now in turn assisted by his mother and his eldest sister.

This sister, CHRISTINE KIRCH, had previously been an assistant in the private Observatory of Baron von Krosigk. On the death of the baron she went to live with her brother. Christine died in 1820. Her niece was the wife of Bode, who for so many years published the *Berliner Jahrbuch.*

THERESA and MADELINE MANFREDI, the sisters of Eustachio Manfredi (1674-1739) who was the director of the Observatory of Bologne, Italy, assisted him for many years in the computation of the Ephemerides of Bologne. Maedler mentions (though pehaps incorrectly) a third sister, AGNES, who also rendered assistance in the calculations.

But not alone by patient toil has woman been content to leave her name in astronomical literature. While these sisters in Italy were laboring with the Arabic characters Emilie de Bréteuil, the MARQUISE DU CHATELET, in France was astonishing all Europe by her sparkling originality and brilliant genius. The wife of a marquis but paramour of a philosopher, she is as noted for her depth of scientific intellect as she is notorious for her shallowness of decent morality. She was born at Paris in 1706 and early showed mathematical proclivities. During her short life she published a large number of books and by many writers has been classed with her two renowned teachers and correspondents, Maupertuis and Clairaut. But the work by which she is best known is her translation and popular exposition of Newton's *Principia*, which she was among the very first of continental mathematicians to properly appreciate. Rebière devotes to this remarkable woman eleven pages of his book, inclusive of her portrait and a facsimile of her manuscript and of the title-page of her *Institutions de Physique*, published when she was 34 years of age. She died 10 August, 1749.

COLUMBIA UNIVERSITY, New York City.
March, 1898.

(TO BE CONTINUED.)