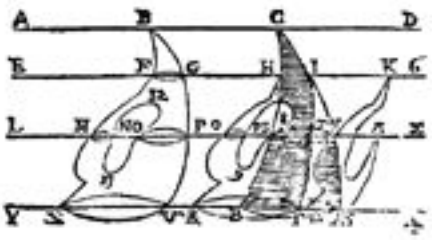
BULLETIN

CSHPM SCHPM



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WHAT'S INSIDE

Canadian Society for History and Philosophy of Mathematics

Société canadienne d'histoire et de philosophie des mathématiques

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ABOUT THE SOCIETY

Founded in 1974, the Canadian Society for History and Philosophy of Mathematics/Société canadienne d'histoire et philosophie des mathématiques (CSHPM/SCHPM) promotes research and teaching in the history and philosophy of mathematics. Officers of the Society are:

President: **Craig Fraser**, University of Toronto, Toronto, ON M5S 1K7, CAN, craig.fraser@utoronto.ca
Vice-President: **Nicolas Fillion**, Simon Fraser University, Burnaby, BC CV5A 1S6, CAN nfillion@sfu.ca
Secretary: **Patricia Allaire**, 14818 60th Ave., Flushing, NY 11355, USA, PatAllaire@gmail.com
Treasurer: **David Orenstein**, 26 Wolfrey Ave., Toronto ON, M4K 1K8, CAN, david.orenstein@alumni.utoronto.ca
Past President: **Maria Zack**, Point Loma Nazarene University, San Diego, CA 92106, USA, MariaZack@pointloma.edu

Members of Council

Duncan Melville, St Lawrence University, Canton, NY 13617, USA, dmelville@stlawu.edu
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Amy Shell-Gellash, Eastern Michigan University, Ypsilanti, MI 48197, USA, ashellge@emich.edu
Richard Zach, University of Calgary, Calgary, AB T2N 1N4, CAN, rzach@ucalgary.ca

Volunteer Positions

The Society's Web Page (www.cshpm.org) is maintained by **Michael Molinsky**, University of Maine at Farmington, Farmington, ME 04938, USA, michael.molinsky@maine.edu. The Proceedings of the Annual Meeting are edited by **Maria Zack** and **Dirk Schlimm**. The Society's Archives are managed by **Eisso Atzema**, University of Maine, Orono, ME 04469, USA, eisso.atzema@maine.edu. **Hardy Grant**, hardygrant@yahoo.com, and **Amy Ackerberg-Hastings**, aackerbe@verizon.net, edit the CSHPM Notes column for *Notes* of the Canadian Mathematical Society. **Maritza Branker**, Niagara University, Lewiston, NY 14109, USA, mbranker@niagara.edu, serves as CMS Liaison.

New Members are most cordially welcome; please contact the Secretary.

President's Message

During the past academic year, Nic Fillion has organized and presided over a series of some twenty online talks on the history and philosophy of mathematics. Nic and Maritza Branker organized sessions on the history and philosophy of mathematics for the winter meeting in December of the Canadian Mathematical Society. Maria Zack is actively engaged in reviewing and preparing for publication papers arising from the 2021 annual meeting held with the BSHM last July. Amy Ackerberg-Hastings and Hardy Grant have continued to manage and edit the CSHPM column on the history and philosophy of mathematics for the *CMS Notes*. Sylvia Nickerson edited and brought to publication the fall 2021 edition of the *CSHPM/SCHPM Bulletin*, with many interesting articles and news from the society and the profession. David Orenstein has taken over from Greg Lavers as Treasurer of the CSHPM and has also assisted in the organization of the annual meeting. Michael Molinsky has continued in his very able capacity as webmaster for the CSHPM/SCHPM home page. Finally, thanks goes out to Christopher Baltus, Tom Drucker and Glen Van Brummelen for their service on the nominating committee for 2022-2024 CSHPM officers.

This year's annual conference of the CSHPM/SCHPM will be held virtually from 13–16 May. Program chairs Andrew Perry and Amy Ackerberg-Hastings have put together a full complement of talks over three days. The special theme this year is original sources in the history of mathematics and their significance for the history, philosophy and pedagogy of mathematics.

Digitization and scanning have made a wide range of original sources available that in the past were accessible only with difficulty. Original texts may be investigated with various digital bibliographic tools. Translation applications allow penetration of original-language sources that often required extensive linguistic training for scholars of previous generations. These changes mark entry into a new era of scholarship. Digital Humanities is very relevant to the history and philosophy of mathematics.

The keynote speaker for the special session is Emmylou Haffner from Ecole Normale Supérieure de Paris.

Dr. Haffner is an early career researcher with a doctorate from the Université Paris Diderot and postdoctoral experience at the Arbeitsgruppe Didaktik und Geschichte der Mathematik at the University of Wuppertal. She analyzes the manuscripts and publications of major mathematicians of the nineteenth century, tracing the genesis and development of their original ideas from notebooks and draft writings to finished published works. She has done such a study for the German mathematician Richard Dedekind, a leading foundational figure of the period in highly novel areas of pure mathematics.

The CSHPM/SCHPM is a member society of the Canadian Federation of Humanities and Social Science/Fédération des sciences humaines du Canada. The annual congresses are held under the auspices of the FHSS. In 2021 the FHSS ratified its Charter on Equity, Diversity, Inclusion, and Decolonization in the Social Sciences and Humanities. The FHSS has requested that affiliated societies draw the Charter to the attention of their members. Members can consult the Charter at `fhss.swoogo.com/edid-charter?lang=en` or `fhss.swoogo.com/edid-charter?lang=fr` (in English and French, respectively).

The International Mathematical Congress was scheduled to take place in St. Petersburg in June. Following the invasion of Ukraine both the Canadian and American mathematical societies announced they would not participate in the St. Petersburg Congress. The International Mathematical Union itself shifted plans for the congress to a virtual format. It will now be held over 6-14 July while the IMU will hold its General Assembly in person on 3-4 July in Helsinki. The CSHPM/SCHPM has limited involvement with Russia or Ukraine, but supports fraternal Canadian and American societies in their statements of opposition to the military actions taken by Russia.

Looking to the academic year 2022-2023, there is optimism that the pandemic will continue to subside and a return to in-person meetings can be planned with an ongoing online dimension. The 2023 Congress for the Humanities and Social Sciences will take place from 27 May to 2 June at the lovely campus of York University in north Toronto.

Craig Fraser

Announcements

Karine Chemla (SPHERE (CNRS & Université de Paris)) was named the winner of the 2021 Hirst Prize and Lectureship awarded jointly by the London Mathematical Society and the British Society for the History of Mathematics (BSHM). Congratulations!

Sara Schechner (Harvard University) was awarded the Sawyer Dialing Prize from the North American Sundial Society "for her career in education and conservation of our dialing heritage, and in particular for her authorship of *Time of Our Lives: Sundials of the Adler Planetarium.*" The prize is considered the "Oscar" of the sundial world because the awardee receives a personalized sundial.

The biennial Neumann Prize for 2021 has been awarded by the BSHM to Tony Royle, for his book *The Flying Mathematicians of World War I.* See `https://www.bshm.ac.uk/neumann-prize`.

HOM SIGMAA News: The First Wednesday Lecture Series, organized by Jemma Lorenat, has featured the following presentations in 2022. On 12 January, Adrian Rice (Randolph-Macon College) gave a presentation on the topic, "Beyond the strength of a woman's physical power: Mathematics, Machines, and the Mind of Ada Lovelace." On 2 February, Clemency Montelle (University of Canterbury), Kim Plofker (Union College), and Glen Van Brummelen (Trinity Western University) presented the talk, "The sine of one degree and its history." On 2 March, Edray Herber Goins (Pomona College) spoke about "MADDER: Mathematicians of the African Diaspora Database's Ensemble of Researchers." On 4 May, Richard (Abe) Edwards (Michigan State University) will give a presentation; title not available yet.

HOM SIGMAA members elected Ximena Catepillán (Millersville University) as Chair and Antonia Cardwell (Millersville University) as Electronic Resources Coordinator. Both assumed their duties in January 2022. HOM SIGMAA is grateful to Amy Shell-Gellasch, Danny Otero, and Andrew Perry for their years of service as Chair, Past Chair, and Electronic Resources Coordinator.

Program Coordinator for HOM SIGMAA Virtual Series Lectures, Jemma Lorenat, is taking suggestions for speakers. Electronic Resources Coordinator, Antonia Cardwell, is soliciting History of Mathematics Course Outlines and library resources for the HOM SIGMAA webpage. Connect with HOM SIGMAA at

https://homsigmaa.net

The CSHPM/SCHPM series of occasional Online Colloquia continues in 2022. For regular updates on the program, follow the CSHPM page on Facebook. A list of past online colloquia can be found at http://www.cshpm.org/archives/onlinecolloquium.php.

The Pohle Colloquium series continues with Prof. Walter Meyer of Adelphi University speaking on 6 April on "The History of *College Algebra*, Part 1: 1894-1909, The Smooth and the Rough." As part of the greater work of the Cajori Two Group, this talk reports on analysis performed on the change of content in most College Algebra books from the period 1894-1909. Prof. Daniel Curtin of Northern Kentucky University on 4 May will deliver a talk on "'A minus times a minus is minus,' says Cardano. Why?" Talks are held in Science 322 at 4:00 p.m. preceded by coffee at 3:45 p.m., followed by dinner in a local restaurant.

A symposium on Reappraising the 'Art of Counting': Celebrating 500 years of Cuthbert Tunstall's *De arte supputandi libri quatuor* will take place 9-10 September 2022. Organized by the British Society for the History of Mathematics and the Department of Mathematical Sciences at Durham University, this symposium will bring together intellectual historians and historians of mathematics to illuminate the context of the life and work of Turnstall, the Yorkshire-born humanist. Tunstall's *De arte supputandi libri quattuor* was a tract on arithmetic widely received across Europe in its day. It holds the honour of being the first work devoted exclusively to mathematics to have been printed in England. For more information https://www.bshm.ac.uk/events/

The BSHM plans a meeting on the History of Analysis on 14 May 2022 at Birkbeck College, London. Registration is now open for this meeting https://www.bshm.ac.uk/events/history-analysis.

The BSHM event History of Mathematics and Flight will take place 2 July 2022, at Concorde Centre, Manchester Airport, https://www.bshm.ac.uk/events/history-mathematics-and-flight.

A one-day BSHM meeting to commemorate 400 years of the Sedleian Professorship in Natural Philosophy will take place 18 June 2022 at Weston Library, Oxford. See https://www.bshm.ac.uk/events/sedleian-professors. For other upcoming BSHM events and meetings, consult the BSHM website for the latest updates, https://www.bshm.ac.uk/.

Francine F. Abeles was an invited guest discussant (along with Ursula Martin, University of Edinburgh, and Elena Ficari, University of Konstanz) at a colloquium held in Germany on World Logic Day, 14 January 2022. Its theme was Female Logicians: Their Impact on Modern Logic.

We remember Dr. John Selden, who died this past January at the age of 87. John is remembered for his passion for mathematics and for mentoring math students at a variety of universities in the United States and abroad. Together with his wife Annie Selden he received the Inaugural Mentoring Award for the help and advice provided to young researchers. This award was given by the Mathematical Association of America's Special Interest Group for Research in Undergraduate Mathematics Education. John and Annie established the Selden Prize for Research in Undergraduate Mathematics Education through the Mathematical Association of America (MAA) to elevate the field and encourage young researchers. Anyone wishing to donate in memory of John Seldon to increase the underlying fund can do so on the MAA website. Alternatively checks may be made out to the Mathematical Association of America with a note indicating a donation to Selden Prize Fund in memory of John Selden and mailed to The Mathematical Association of America, Washington, DC.

Michael Hoskin, the highly distinguished historian of astronomy and biographer of the Herschel family, died in December 2021. Hoskin completed a doctorate in algebraic geometry at Peterhouse, Cambridge in 1956, after which he noticed an advertisement for a newly established lectureship in the history of science at the University of Leicester. He took up this position, and a similar lectureship at Cambridge two years later, beginning his career of more than fifty years as a historian of mathematics and astronomy. With D. T. (Tom) Whiteside he would eventually edit *The Mathematical Papers of Isaac Newton*, a monumental enterprise encompassing eight volumes published by Cambridge University Press. Hoskin was the world's leading authority on the Herschel family of astronomers, about whose lives and works he wrote eight books and three dozen papers. His corpus elegantly documents the extraordinary devotion and commitment of William and his sister Caroline to observing the universe. His biography *Discoverers of the Universe:*

William and Caroline Herschel was published in 2011. Hoskin also had a hand in launching the *Journal for the History of Astronomy* which he edited and contributed to for forty-five years. His many contributions to the field of history of science and astronomy were extraordinary. He will be missed.

We mourn the loss of Paolo Brenni, a great champion of scientific instruments. President of the Scientific Instrument Society since 2005, his sudden loss has been commemorated with a memorial book for those who wish to celebrate Brenni's life, `http://www.scientificinstrumentsociety.org/blog/2021/12/4/paolo-brenni-1954-2021`.

The Canadian Federation for the Humanities and Social Sciences is seeking experienced scholars from a variety of fields to join the Awards to Scholarly Publications Committee which evaluates grant applications for scholarly works, and issues funding recommendations continuously throughout the year. Please reach out to `aspp-paes@federationhss.ca` to find out more.

The Council of the History of Science Society has appointed Fa-ti Fan, Professor of History at Binghamton University, as Vice President of the Society. The society is deeply grateful to Fa-ti for accepting this appointment and agreeing to serve.

The Forum for the History of the Mathematical Sciences (FoHoMS) has a new chair. After twelve years Karen Hunger Parshall has stepped down and Brit Shields has taken her place. Members of FoHoMS (a subgroup of the History of Science Society) will now be hearing from Shields regarding news and updates.

At the 2021 AGM of the British Society for the History of Mathematics Simon Gardiner joined Council as Treasurer, while Klaas Sijbrandij stepped down as Treasurer after five years of service. The full list of Council Members for 2022 can be seen on the BSHM website, `https://www.bshm.ac.uk/people`.

The Mathematical Association of America is proud to relaunch the Distinguished Lecture Series (funded by the Paul R. and Virginia P. Halmos Endowment Fund) in a virtual format. These lectures feature the foremost experts within the field of mathematics known for their ability to make current mathematical ideas accessible to non-specialists. They are crafted for both professionals and students, as well as anyone interested in learning more about current trends in mathematics. Abstracts and speaker biographies will be posted as lectures are scheduled at `maa.org/programs/maa-distinguished-lecture-series`.

2022 CSHPM/SCHPM Meeting Program

The following draft schedule outlines speakers and titles for live virtual sessions planned for this year's annual meeting. Times are given in Eastern Daylight Time (EDT). Go to `federationhss.ca/en/congress/congress-2022/register` to register for the meeting.

Friday, May 13
SPECIAL SESSION 1
10:00 AM Welcome by Craig Fraser, President of CSHPM/SCHPM
10:15 AM Annual Kenneth O. May Lecture delivered by Emmylou Haffner, École Normale Supérieure, Université Paris Sciences et Lettres, "Going to the source(s) of sources in mathematicians' drafts"
11:30 AM BREAK
SPECIAL SESSION 2 (Presiding: Amy Ackerberg-Hastings)
12:00 PM Mario Bacelar Valente, Pablo de Olavide University, "Ancient Greek mathematical proofs and metareasoning"
12:30 PM Craig Fraser, University of Toronto, "Original Sources in Research Mathematics: The Case of Hamilton-Jacobi Theory circa 1900"
1:00 PM Julia Tomasson, Columbia University, "Reading Uqlidis in New York: The Making and Unmaking of "The Arabic Euclid" in Columbia University's Rare Book and Manuscript Library"
1:30 PM BREAK
SPECIAL SESSION 3 (Presiding: Andrew Perry)
2:30 PM Emily Hamilton, University of Massachusetts, Amherst, "It's 6am. Do You Know Where Your Calculus Teacher Is?"
3:00 PM Valérie Lynn Therrien, McGill University, "The Evolution of Cantor's Proofs of the Non-Denumerability of $\mathbb{R}$"
3:30 PM Cynthia Huffman, Pittsburg State University, "Mathematical and Philosophical Imagery in Original Sources Related to Émilie du Châtelet"
4:00 PM Glen Van Brummelen, Trinity Western University, "Hidden in the Manuscripts: How Bianchini's Texts were Read and Used"
4:30 PM BREAK
SESSION 4 (Presiding: David Orenstein)

5:00-6:00 PM Informal Discussion Time and Social Hour

Saturday, May 14

SESSION 5 PANEL ON HISTORY OF & IN MATHEMATICS EDUCATION (Presiding: David Bellhouse)

10:00 AM Jorge Nuno Silva, University of Lisbon, "Who was able to perform multiplication and division of large numbers by the year 1 CE? And by the year 1000 CE?"

10:30 AM David Dunning, Oxford University, "Constructing the 'Home-side' of a Scientific Legacy: Mary Everest Boole, Pedagogy, and Domesticity"

11:00 AM David Orenstein, Danforth CTI, Emeritus, "The 1992 Quebec City International Congress on Mathematical Education (ICME) / Le Congrès international sur l'enseignement des mathématiques (CIEM) de 1992 à Québec"

11:30 AM Panel Discussion with Jorge Nuno Silva, David Dunning and David Orenstein, followed by General Discussion and Questions

12:00 AM BREAK

GENERAL SESSION 6 (Presiding: Maria Zack)

12:30 PM Jean-Charles Pelland, Bergen University, "Recipes for talking about mathematical progress"

1:00 PM José Antonio Pérez Escobar, École Normale Supérieure Paris, Université Paris Sciences et Lettres, "Showing mathematical flies the way out of foundational bottles: the later Wittgenstein as a forerunner of Lakatos and the philosophy of mathematical practice"

1:30 PM Nicolas Fillion, Simon Fraser University, "Pedagogy and curriculum in intermediate logic courses"

2:00 PM Patricia Marino, University of Waterloo, "On the Use of Mathematics in Economics: Formalism, Fit, and Physics"

2:30 PM BREAK

GENERAL SESSION 7 (Presiding: Nicolas Fillion)

3:00 PM G. Arthur Mihram and Danielle Mihram, University of Southern California, "Limited Roles for Mathematics in Science and in Academic Curricula"

3:30 PM Chanwoo Lee, University of California, Davis, "Foundation as Scaffolding"

4:00 PM Iman Ferestade, Simon Fraser University, "Do engineers really know what they are doing?"

4:30 PM BREAK

SESSION 8 (Presiding: Robert Bradley)

5:00 PM Informal Discussion Time and Social Hour

Sunday, May 15

GENERAL SESSION 9 (Presiding: Craig Fraser)

10:00 AM Maria Zack, Point Loma Nazarene University, "Blaise Pascal, Amos Dettonville, and the Roulette"

10:30 AM Hassan Amini, University of Tehran, "Codex Paris 772 as a source for History of Mathematics"

11:00 AM Gregg De Young, American University in Cairo, "Changing perspectives on the medieval transmission of Euclid's Elements"

11:30 PM BREAK

GENERAL SESSION 10 (Presiding: David Orenstein)

12:00 PM Amy Ackerberg-Hastings, *MAA Convergence*, "Comparing the Histories of Professional Societies for Women in STEM"

12:30 PM David Bellhouse, University of Western Ontario, "The Evolution of the Field of Statistics: A Case Study from Twentieth-century Manitoba"

1:00 PM Dirk Schlimm and David Waszek, McGill University and CNRS, Archives Henri Poincaré–Nancy, France, "John Venn's pluralism regarding logical forms"

1:30 PM BREAK

GENERAL SESSION 11 (Presiding: Patricia Allaire)

2:00 PM J.J. Tattersall and S.L. McMurran, Providence College and California State University, San Bernardino, "Cambridge Women's Research Club"

2:30 PM Ruigang (Paul) Xu, McGill University, "Hugh MacColl and Counterpossibles"

3:00 PM Christopher Baltus, SUNY Oswego, "Was Jacob Steiner a cofounder of projective geometry?"

3:30 PM BREAK

SESSION 12 (Presiding: Craig Fraser)

4:00 PM Annual General Meeting

Help Wanted

The Society is looking for an ongoing volunteer: Webmaster.

The responsibilities of the webmaster include hosting and maintaining the CSHPM website (`www.cshpm.org`), updating the online membership form each year, moderating the Council and Announcement list-servs, creating the online ballot for biennial elections, and supervising the CSHPM Facebook and Twitter accounts. For more information or to volunteer, contact

Mike Molinsky, *michael.molinsky@maine.edu.*

2021 Financial Statements

The following financial statement covers the period 1/1/2021 through 31/12/2021.

TD Canada Trust CAN Funds	
Income	$CAN
Dues by Cheque	557.49
Transferred from PayPal	9000.00
Total	9,557.49
Expenses	$CAN
Transfer out to US account	2,000.00
Cheques Issues/Wire Out	5,891.95
Fees	0.00
Total	7,891.95
Balance	1,665.54

TD Canada Trust US Funds	
Income	$US
Dues by Cheque	1,008.47
Transfer in from Canadian Account	1,537.40
Total	2,545.87
Expenses	$US
Cheques Issued	3,121.50
Fees	4.95
Total	3,126.45
Balance	-580.58

Paypal	
Income	$CAN
Membership	10,842.50
Total	10,842.50
Expenses	$CAN
PayPal Service Charges	425.79
Transfer to Canadian Account	9,000.00
Student Bursary	0.00
Total	9,427.79
Balance	1,414.71

Assets in Canadian Funds	
Cash, TD Canada Trust Account	$CAN
Balance (12/31/2020)	19,370.16
Income - Expenditure 2021	+1,665.09
Total (Balance as of 12/31/2021)	21,035.25
Cash, PayPal Account	$CAN
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Balance (12/31/2020)	5,734.50
Income - Expenditure 2021	+1,414.78
Total (Balance as of 12/31/2021)	7,149.28
Investments	
TD GIC (1.80%, matures Sep. 16)	4,601.43
TD GIC (1.35%, matures April 10)	4,682.40
Total Investments	9,283.83
Total Assets (Canadian)	37,468.36

Assets in US Funds	
Cash	$US
Balance (12/31/2020)	11,750.98
Income - Expenditure 2021	-586.58
Total (Balance as of 12/31/2021)	11,164.40
Total Assets (USD Funds)	11,164.57
=$CAN	14,087.57

Grand Total Assets ($CAN)	51,555.93

Comments: The Society has three accounts. A TD Canada Trust account for Canadian funds (CDN), a TD Canada Trust account for American funds (USD), and a PayPal account (CDN). The two bank accounts are used to deposit income or pay expenses in the appropriate currency. For example, journal subscriptions are paid in US dollars. Memberships paid by cheque can be in CDN or USD. The PayPal account is used to collect membership dues and journal subscriptions via the Internet; the PayPal account is kept in Canadian dollars.

David Orenstein

In Memoriam Gregory H. Moore

The recent death of Gregory H. Moore is a reminder that some legendary names from the early days of the Society are passing from the scene. Greg was an important historian of mathematical logic for a number of decades after receiving his doctorate from the University of Toronto in 1979. While not active in the affairs of the Society for the last couple of decades, Moore contributed much effort as the society was first getting underway.

The published work for which Moore was best known was his book, *Zermelo's Axiom of Choice*, published by Springer in 1982. A revised version of his dissertation, Moore sought to put Zermelo's work in historical perspective, contextualizing it against logical work being done in other countries. With excellent French Moore's translations of letters between Hadamard,

Baire, Lebesgue, and Borel in the book remain useful resources for those interested in the acceptance or rejection of the axiom of choice. Review of *Zermelo's Axiom of Choice* in *Historia Mathematica* was enthusiastic. Dover republished the volume in 2013 with a new preface by the author describing the continuing influence of the axiom and including some new pages of bibliography.

A standard explanation for the creation of the axiom was in response to the plethora of paradoxes emergent in the late nineteenth and early twentieth centuries. Moore explains what it was that drove Zermelo to formulate the axiom and put it to use. Recent scholarship has drawn on this account, particularly Ebbinghaus' volume on Zermelo from 2007. His confidence in Moore's historical judgments is evident throughout. Moore's review of Ebbinghaus in the *Notices* of the American Mathematical Society enabled him to continue his narrative about Zermelo's influence.

Moore was a graduate student of Kenneth O. May. He was an admirer of May's approach to history. He spoke nostalgically of May when the CSHPM paid tribute to his memory. After May's death, Moore worked with Frank Tall in the Department of Mathematics at the University of Toronto where he held an NSERC Fellowship to research the history of forcing. In 1986 Moore obtained a position in the Department of Mathematics and Statistics at McMaster University. He remained there for the rest of his academic career and became involved with the translation of materials held in the Bertrand Russell Archives at McMaster. Moore worked on the history of the Continuum Hypothesis. His paper on this this topic appeared in the *Bulletin of Symbolic Logic* in 2011.

Moore's articles appeared in a variety of journals and books. Their thoughtful review of the historical record provided a basis for the work of philosophers as well as historians. His work on the evolution of first-order logic, for example, the article 'Beyond First-Order Logic' from *History and Philosophy of Logic* (1980) is helpful to philosophers who consider whether logic is sufficient to do mathematics. Moore edited the first two volumes of the collected papers of Gödel published by Oxford University Press. He edited volumes three and five of *The Collected Papers of Bertrand Russell* (1993 and 2014). History of logic owes a great deal to Moore's labours as an author and editor. Moore was difficult to get to know personally and did not have many graduate students. His technical expertise and historical insights were a rare combination and his legacy of scholarship will long benefit those interested in the history of logic.

The author would like to acknowledge the assistance of Frank Tall in the preparation of this memorial.

Tom Drucker

New Classroom Materials from *MAA Convergence*

MAA Convergence is both an online journal on the history of mathematics and its use in teaching, and an ever-expanding collection of online resources to help its readers teach mathematics using its history. In addition to mini-Primary Source Projects for secondary school students and undergraduates, a variety of potential classroom applications may be found in our recent articles and features.

Figure 1: David L. Roberts and R. Bruce Lindsay.

In "Building a Book: HathiTrust, Ancestry.com, Serendipity, and Lifetime Interests," David Lindsay Roberts reveals how personal knowledge, changes in historical research methods, and unexpected discoveries came together in the preparation of a book on the history of American mathematics, providing inspiration for students and instructors pursuing their own historical projects. Toke Knudsen explains the distinctive pedagogical approach of "E. G. Ziegen-

balg's Danish Translation of Euclid's *Elements*" and describes how this 1744 work came to exist and how the copy he owns was passed through the generations.

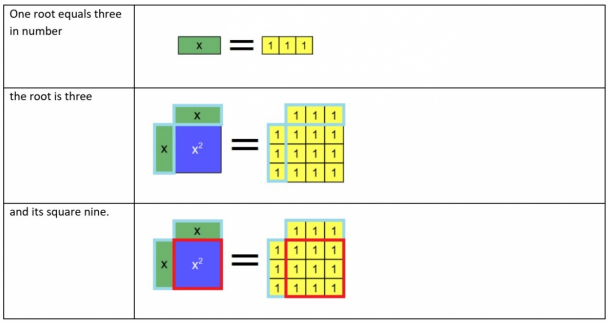

Figure 2: Algebra tiles equations.

"Reflections on Chinese Numeration," by Frank J. Swetz, recommends ancient Chinese rod numerals to the instructors of preservice elementary teachers as an alternative place-value numeration system for helping students understand the structures and operations of arithmetic. Instructors of preservice teachers may also wish to join Günhan Caglayan in using algebra tile manipulatives in a series of activities for visualizing al-Khwārizmī's algebraic solution methods. To assist readers looking for quick historical classroom exercises, Mike Molinsky has organized *Convergence*'s popular "Problems from Another Time" feature into chronological, geographical, and subject indexes, accessible from the journal's homepage, `maa.org/press/periodicals/convergence`.

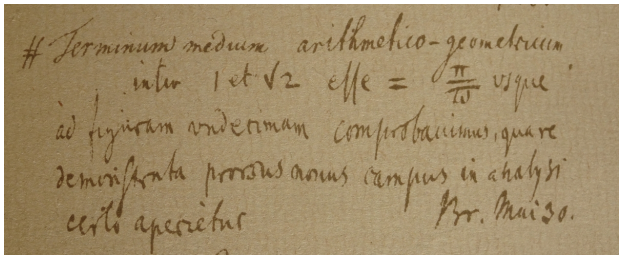

Figure 3: Gauss's diary.

Danny Otero has completed his series of six curricular units based on primary source texts for use in teaching and learning trigonometry with the episodes, "al-Bīrūnī Does Trigonometry in the Shadows" and "Regiomontanus and the Beginnings of Modern Trigonometry." In the ongoing "Series of Mini-projects from **TR**ansforming **I**nstruction in **U**ndergraduate **M**athematics via **P**rimary **H**istorical **S**ources," the TRIUMPHS team has added two more mini-Primary Source Projects (mini-PSPs):

- "Gaussian Guesswork: Three Mini-Primary Source Projects for Calculus 2 Students," by Janet Heine Barnett;
- "Fourier's Heat Equation and the Birth of Modern Climate Science: A Mini-Primary Source Project for Differential Equations and Multivariable Calculus Students," by Kenneth M. Monks.

Convergence publishes expository articles on the history of topics in the grades 8–16 mathematics curriculum; translations of primary sources; classroom activities, projects, or modules for using history to teach mathematics; and classroom testimonials after applications of such activities, projects, or modules. Interested in contributing? We'd love to hear from you at `convergence@maa.org`! Guidelines for Authors may be found on the journal's website, linked above.

Janet Heine Barnett & Amy Ackerberg-Hastings

Off the Shelf: Review of George Hosmer's *Practical Astronomy*

After reviewing Glen van Brummelen's second volume of his *History of Trigonometry: The Doctrine of Triangles* (in the November 2021 *Bulletin*), my interest in this area continued to be fulfilled inside George L. Hosmer's *Practical Astronomy* (1925, third edition).

Professor of Geodesy at the Massachusetts Institute of Technology (MIT), George Leonard Hosmer (1874-1935) was the author of several other works: *Azimuth, Geodesy, Navigation,* and the two-volume, *The Principles and Practice of Surveying* (all with publisher John Wiley & Sons). Hosmer was on staff of their civil engineering department for thirty-seven years and was founding director of Camp Technology, MIT's summer camp for civil engineering students. He joined a total solar eclipse expedition to Sumatra in 1901 and came to Labrador in 1905 on a similar (Carnagie Institute) expedition to observe the effect of a solar eclipse on the declination. During his long career Hosmer worked in the areas of sanitation, water supply and power development, boundary surveys, and grade crossing elimination and he was once on the United States Coast and Geodetic Survey and was a member of the American Association for the Advancement of Science, the American Society of Civil Engineers, the local Boston Society of Civil Engineers, the American

Geographical Society, and the Society for the Promotion of Engineering Education (Anonymous, 1935).

My own copy of *Practical Astronomy* originates from the bookshelves of the math department where I taught at Danforth Collegiate and Technical Institute in Toronto, where I obtained this and other precious items including a three volume English translation of *Euclid's Elements*, Clifton Fadiman's *Fantasia Mathematica* (1958), and Kenneth O. May's *Elements of Modern Mathematics* (1959).

Handwritten inside the front cover are the price, $2.75, and name of a past owner, A. E. Brown. A pocket for a library sign out card obscures notes written on the back endpapers (no borrowers listed). This duodecimo volume is hardbound in black leather with an embossed circle with the publisher's initials. Embossed on the spine in gold writing are the title, author, edition, and publisher.

Nine preparatory chapters provide the astronomical background of coordinate systems, instruments and observational astronomy. The core text consists of five chapters (ten through fourteen) over roughly one hundred and ten pages. These chapters cover observations for latitude, determining time, measuring longitude and azimuth, and nautical astronomy. The volume is rounded out by the provision of tables and appendices.

Hosmer offers us "the more common methods of determining latitude, time, longitude and azimuth with small instruments. Those printed in large type may be used for a short course... [The other] methods..., although less simple, are very useful to the engineer [but] a knowledge of other data must [be] obtain[ed] by observation..." (p. 115). As an example of a simpler method Hosmer describes how to obtain latitude using circumpolar stars at culmination with two examples using Polaris (Alpha Ursae Minoris) and the star Cephei 51. The second of these calculations is so simple it only uses three numerical values: observed altitude at lower culmination ($39°33'30''$), declination ($39°33'30''$) and a refraction correction ($1'09''$). This calculation is simply a pair of subtractions of angle measurements (all in degrees, minutes and seconds of arc), with no trigonometry in sight, yielding a latitude of $42°20'56''$ North.

By contrast, there's the method presented for calculating latitude by the altitude of Polaris when the time is known. This method employs trigonometry such that the latitude is computed by the formula (Equation 78)

$$\varphi = h - p\cos(t) + \frac{1}{2}p^2\sin^2(t)\tan(h)\sin(1'').$$

Examples are then given using this formula. The first of these examples has quite a bit of handmade annotations, presumably by the book's prior owner, A. E. Brown. The example begins with the observed altitude of Polaris being 9 January 1907. There are two columns of observations given, one of the observed time and the other of the observed Altitude. The column starts with such a pair of observations being 6h 49m 26s and $43°28'30''$ along with three more such pairs. These columns yield means of 6h 53m 02s and $43°28'15''$ respectively. In handwriting Brown makes various comments as to whether such examples are or are "not on exam," or whether "These are *important*."

Hosmer then lists in two columns the logarithms to five decimal places of every multiplicative factor in Equation 78 (quoted above). For example, since $p = 1°11'09'' = 4269''$ then $\log p = 3.63033$. In handwriting Brown added a calculation:

$$\text{rad} = 206,264.8''$$

$$1'' = \sin(1\,\text{rad}/206,264.8)$$

$$= 1/206,264.8.$$

After the appropriate sequence of logarithm addition and conversion into and out of anti-logarithms, Hosmer gets us to a latitude of $42°17'12''$ N.

Hosmer's *Practical Astronomy* was well received in its time. An astronomy journal reviewer of a posthumous later edition stated, "the new Hosmer is even clearer and simpler than the old; it is up to date; it will extend the useful life of this celebrated book for many years" (1948, fourth edition) noting that in updating the book, James Robbins had confined most of his changes to minor revisions, the elimination of obsolete methods (e.g. conforming to the change from astronomical time to civil time in the American Ephemeris and Nautical Almanac), and the introduction of new co-ordinates that had become more recently in use. The book was praised for its merging of subjects time and longitude (although criticized for the unnecessary expansion of content into matters of "purely historical interest"!). Overall, its judicious introduction of subjects appropriate to the precise observations required

of the professional astronomer or geodesist was seen as praiseworthy and useful (Wylie, 1948).

David Orenstein

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Bulletin Co-Editor Sought

A collaborator to work with the current content editor of the CSHPM *Bulletin* is sought. The current content editor seeks a collaborator to help assemble announcements and compile articles for each issue. Particularly due to the coincidence of this voluntary role with end of term grading deadlines in April of each year, someone willing to help prepare the May issue would be particularly helpful. Interested members are asked to contact Sylvia Nickerson at `s.nickerson@utoronto.ca`. A co-editor who can solicit news and articles from US-based history of math networks and American members of our Society would be most useful and particularly welcome.

Quotations in Context

"There are things which seem incredible to most men who have not studied mathematics."

Although the king of Syracuse, Hiero II (c. 306–215 BCE), outlived his eldest son Gelon (c. 266–216 BCE), Hiero apparently respected his son so much that he allowed Gelon to share the title of "king" during his reign. Certainly this was the title Archimedes (287–212 BCE) used in *The Sand-Reckoner*, which was written in the form of a short letter addressed to Gelon. At the beginning of this work, Archimedes set out the topic he planned to explore:

> There are some, king Gelon, who think that the number of the sand is infinite in multitude; and I mean by the sand not only that which exists about Syracuse and the rest of Sicily but also that which is found in every region whether inhabited or uninhabited. Again there are some who, without regarding it as infinite, yet think that no number has been named which is great enough to exceed its multitude. And it is clear that they who hold this view, if they imagined a mass made up of sand in other respects as large as the mass of the earth, including in it all the seas and the hollows of the earth filled up to a height equal to that of the highest of mountains, would be many times further still from recognizing that any number could be expressed which exceeded the multitude of the sand so taken [Heath, p. 221].

Archimedes claimed that not only could he enumerate such a planet-sized collection of sand, but that he could do the same if the sand were to fill the entire universe. He then proceeded to describe Greek models of the universe, proving properties of that universe geometrically based on the astronomical assumptions. Archimedes also reviewed his system for writing the required large numbers, which had been first described in an earlier letter to the Greek mathematician Zeuxippus at Alexandria, a document which is unfortunately lost to time.

Starting with a relatively small sphere, Archimedes found an upper bound for the number of grains of sand that could fit in the sphere and then increased the sphere until it was larger than the estimated size of the universe, which allowed him to show that the possible number of grains of sand in that universe would be smaller than a number he could clearly define with his notation. The conclusion to the work is the source of the quotation of this column:

> I conceive that these things, king Gelon,

> will appear incredible to the great majority of people who have not studied mathematics, but that to those conversant therewith and have given thought to the question of the distances and sizes of the earth, the sun and moon, and the whole universe, the proof will carry conviction. And it was for this reason that I thought the subject would be not inappropriate for your consideration [Heath, p. 232].

While some modern publications do contain the full quotation shown above, the majority only present the simplified version from the top of this column, which is usually stated without any explanation of what the "things which seem incredible" might specifically be. Hopefully you will agree that the additional context provided by this column is "not inappropriate for your consideration."

Anyone interested in viewing *The Sand-Reckoner* in the original Greek can find it on pages 169-200 of Heiberg's work listed in the references below.

Mike Molinsky

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Heath, Thomas Little *The Works of Archimedes*, Cambridge University Press, 1897.
Heiberg, Johan Ludvig *Quaestiones Archimedeae*, Hauniae, 1879.

BSHM Christmas Meeting and AGM

In Toronto, Canada, the 4:55 a.m. EST welcome message from British Society for the History of Mathematics (BSHM) President Sarah Hart (at 9:55 a.m. GMT) began before sunrise. Fortunately, this attendee lives with two cats insistent on a 5:00 a.m. EST start to their day. I was therefore awake early enough to attend most of the talks that had been organized for the BSHM's Christmas Meeting. As a CSHPM reciprocal member, I spoke and voted at the AGM. Both events were held on 11 December 2021.

At 10:00 a.m. GMT Philip Bealey (Oxford University) delivered a talk on "'Harriot's Rule': Some false questions of priority in 17th Century mathematics" after which Tony Crilly (Middlesex University, Emeritus) commemorated "Arthur Cayley's bi-centennial 2021."

Every other year the BSHM awards the Neumann Prize for a book in English about the history of mathematics aimed at a non-specialist readership. In 2021 the Neumann Prize was awarded to Tony Royle for *The Flying Mathematicians of World War I* (McGill-Queen's University Press). In 2013 this award was granted to Jacqueline Stedall's *The history of mathematics: A very short introduction*. I recall reviewing this book in the May 2014 issue of the CSHPM *Bulletin*. Sydney Padua's graphic novel about a fantastical pre-history of modern computing, *The Thrilling Adventures of Lovelace and Babbage*, won the prize in 2015. Comic artists continue to cross over into the history of mathematics realm, as Christos Papadimitriou (Columbia University) gave a presentation about his graphic novel about the philosophical foundations of mathematics, *Logicomix*.

Aoife Kearins (Cambridge University) delivered a talk about how the penny post revolutionized mathematical collaboration. Prepaid throughout the United Kingdom from 1840 onwards, the penny post facilitated the spread of mathematical ideas by speeding communications and connecting many disparate areas of British society. David Dunning (Oxford University) examined an episode from the early history of computer science with his talk about Christopher Strachey's Programing Research Group at Oxford. Other talks were given by Alex Aylward (Oxford University) and Deborah Kent (University of St Andrews).

After several hours of focused high-level scholarship, a much-needed tea break consisted of light-hearted comparisons of the designs on our tea mugs, many of which featured cats.

At the Annual General Meeting I delivered the CSHPM Liaison Report in which our Society's events, publications and programs were highlighted. The day concluded with a celebration of the semi-centenarian of the BSHM. By 6:00 p.m. GMT (1:00 p.m. EST), it was all over.

David Orenstein

In Memoriam Eri Yagi (1931-2021)

Eri Yagi, emeritus professor at Toyo University, died suddenly on 4 March 2021. Yagi continued working on her current subject until the day before her death. Born in Tokyo, Yagi finished her undergraduate education at Ochanomizu Women's University. She began to study history of physics in the graduate course in physics at the University of Tokyo in 1955. Strongly attracted to Derek Price's idea of Scientometrics, she

visited Yale University's Department of History of Science and Medicine where she stayed from 1960-1963.

After producing significant results with Price, she came back to Japan and obtained a Ph.D. from the University of Tokyo in 1965. Her next project was to write a biography of Hantaro Nagaoka, the most prominent physicist during the Meiji and Taisho eras, using his unpublished materials. After publishing this biography in 1973 with her colleagues, Yagi devoted considerable energy to history of thermodynamics developed by Clausius. Since 1976 she often visited Archives Deutsches Museum in Munich to gather Clausius' manuscripts. She published several papers on this subject, exchanging ideas with John N. Heilbron and Martin J. Klein.

Her contribution "Heat and Thermodynamics" to *Encyclopedia of History and Philosophy of Mathematical Science* edited by Ivor Grattan-Guiness gave her the occasion to join the British and Canadian societies of history of mathematics. In 2009, she was invited to the opening conference of Clausius Tower in Koszalin University of Technology in Poland. After leaving Toyo University in 2002, she organized her colleagues at the Institute for History of Science to continue translating selected Clausius' papers in Japanese. These were published in 2012.

Japanese women obtained equal rights after World War II. Although their situation has been gradually changed even today they experience invisible discrimination. Looking back at her life in this context, we praise Yagi as a female pioneer in the realm of history of science in Japan.

Michiyo Nakane

Off the Shelf: Review of James Peebles' *Cosmology's Century*

James Peebles is a Manitoba-born Canadian-American astrophysicist and cosmologist. In 2019 he was awarded the Nobel Prize in Physics for "theoretical discoveries in cosmology." In his career at Princeton University, Peebles was involved in the 1965 discovery of cosmic microwave background radiation. He has made fundamental contributions to theories on nucleosynthesis, dark matter, and galaxy and structure formation. Through an analysis of influential papers, personal correspondence, and recollection, *Cosmology's Century* traces the development of "empirical cosmology" (physical cosmology) along six lines of relatively independent research, culminating in what Peebles identifies as the unification of and revolution in cosmology in 1998–2003.

Peebles' analysis of the first line of research, the establishment of the cosmological principle, the theory that the universe is, on a large scale, homogeneous and isotropic, is presented in Chapter 2. It begins with Einstein's general theory of relativity and related considerations in the early twentieth century, and then traces further developments from the 1920s to the 1970s. Chapter 3 discusses the discovery of the expansion of the universe and the two major cosmological theories that attempted to account for this, the big bang and steady-state theories. The third line of research Peebles identifies is the discovery of the fossil remnant from the big bang: cosmic microwave background radiation. As a member of the group in the early 1960s that predicted the existence of background radiation, Peebles provides a particularly rich exploration of his recollections of this discovery in Chapter 4. Chapter 5 explores the puzzle of the homogeneity of background radiation versus the clumpy distribution of matter and galaxies we view in the sky. An important piece required to solve this puzzle was an adequate theory of how galaxies and galaxy clusters evolved, several of which were proposed in the mid-twentieth century. A noteworthy empirical aspect of this research was the use of sophisticated statistical methods such as two-point correlation to analyze the distribution of galaxies, with another significant contributor here being renowned mathematical statistician Jerzy Neyman. The final research programs Peebles discusses are the detections of anomalies in galaxy motion, which pointed to the existence of subliminal (dark) mass, and the subsequent identification of this missing mass with non-baryonic matter identified by particle physicists. The penultimate chapter concludes with an assessment of the events of 1998–2003 in which these individual lines of research converged into the current preferred cosmological model.

Bookending these historical chapters are brief discussions of philosophical and sociological aspects of twentieth-century cosmology. Peebles believes the passive nature of cosmology implies that inquiry is restricted to observations: "we can look, but never touch" (p. 2). This partially explains the ubiquity of both empirical and non-empirical considerations in theory assessment throughout the twentieth century, which Peebles seems to consider inevitable but not

undesirable. The concluding chapter leaves the reader with food for thought on the role of technology in cosmology, social constructions of science, and counterfactual "What if?" questions about paths not taken.

True to its subtitle, *An Inside History*, this book provides insight into a practitioner's reflections. Peebles highlights the motivations that drove or deterred different lines of research, as well as physicists' underlying assumptions about what satisfactory cosmological theories needed to address. The selection of citations to original papers, equations, and figures illustrate what this scientist considered key to the development of cosmology. Readers familiar with Peebles' previous writings on cosmology will find it rewarding to compare this selection with those in his earlier books.

From the 1930s to the 1990s, the Einstein-de Sitter model was the preferred vision of the universe. At the end of the 1990s, teams of astronomers at Harvard and Berkeley used supernovae as distance indicators for far-flung galaxies. To their astonishment, they found that the expansion of the universe had begun to accelerate about five billion years ago. This remarkable finding led to the adoption of a new cosmological model characterized by the essential role of the cosmological constant lambda. This model is known as the lambda-cold-dark-matter, or ΛCDM model. It may be viewed as a descendant of the Friedmann-Lemaître universe that was discussed in the early years of relativistic cosmology, but which fell out of favour after the 1930s.

Peebles' key thesis is that the 1998-2003 developments constitute a *revolution* in cosmology. The culmination of the above research programs into the acceptance of the ΛCDM model as the "simplest" theory marked the period after which cosmological research was unified and a Kuhnian paradigm achieved. The implication of this view is, of course, that cosmology before 1998 was not quite unified. This seems a peculiar thing for a physicist highly active on the cosmological scene in the years leading up to 1998 to assert, particularly given Peebles' claim in the 1993 edition of *Physical Cosmology* on page 197:

> Those who would seek a revolution in cosmology must bear in mind that the days are gone when it was easy to think of viable alternatives. Now any serious attempt at a revision of the main elements of the standard world picture would involve a survey of a considerable (though certainly limited) store of observational and laboratory constraints.

The disparity between Peebles' 1993 view and that which he expresses in *Cosmology's Century* indicates the unexpected nature of developments in 1998–2003, demonstrating that even scientists intimately involved in their fields cannot predict the occurrence of revolutions. It could also be seen to illustrate a pervasive preoccupation with the *idea* of revolutions in science and elsewhere. Readers may rightly question where the line between revolution and major innovation should be drawn.

Semantics aside, *Cosmology's Century* provides a thorough and technical account of key developments in twentieth-century cosmology. Although clearly not a historian's history, it will be of interest to historians engaged with the mathematical and technical aspects of modern cosmology, historiographers studying practitioners' histories, and cosmologists curious about the historical development of their field.

Nichole Levesley and Craig Fraser

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CMS Winter Meeting

Originally planned to take place in Vancouver, BC, the History and Philosophy of Mathematics Session organized by Maritza Branker and Nic Fillion on behalf of the CSHPM/SCHPM took place virtually on 5–6 December 2021.

A successful session took place with twelve talks spanning two days. Topics were equally balanced between history and philosophy of mathematics. The online format allowed speakers to attend from international locations including South America, Australia and the U.K. as well as the usual North American participants. The organizers also prepared a panel for the general meeting on the theme of Women in Mathematics that was well received.

Speakers and talks included Amy Ackerberg-Hastings (Independent Scholar) on the "Historian of Mathematic's Toolbox: Historiography and Methodology for Mathematicians," Tom Archibald (SFU) on "Hermite and Concrete Analysis," Maritza M. Branker (Niagara University) on "Black American Women Math-

ematicians: Past and Present," Rob Corless (Independent Scholar) on "Émile Mathieu and antisecularity in perturbation," David E. Dunning (Oxford) on "Constructing the 'Home-side' of a Scientific Legacy: Mary Everest Boole, Pedagogy, and Domesticity," James Franklin (University of South Wales) on "Aristotelian Realist Philosophy of Mathematics," Conor Mayo-Wilson (University of Washington, Seattle) on "Expectation and Fairness in Huygens' "Value of All Chances,"" Dora Musielak (University of Texas at Arlington) on "The Marquise, the Philosopher, and the Mathematician: Debate over Newtonian Mechanics in the 18th Century," David Orenstein on "The Mathematical Sciences at the December 1921 Toronto Meeting of the American Association for the Advancement of Science," Margaret Stawiska-Friedland (Math Reviews) on "Women mathematicians with PhDs in interwar Poland," Mario Bacelar Valente (Pablo de Olavide University) on "Geometric cognition: A hub-and-spoke model of geometric concepts" and Maryam Vulis (St John's University/Norwalk CC) on "The Role of William Friedman in American Cryptology."

Q&A with Dr. Sarah Symons

Dr. Sarah Symons is a professor in the Integrated Science program and an associate member of the departments of History and Physics & Astronomy at McMaster University in Hamilton, Ontario, Canada. Until recently she was also director of the William J. McCallion Planetarium. Dr. Symons obtained a PhD in the history of astronomy from the department of mathematics and computer science at the University of Leicester. Dr. Symons is a specialist on ancient Egyptian astronomy, in particular, what are known as Egyptian Star Maps.[1]

I had the good fortune of interviewing Dr. Symons about her research in the course MAT 390 History of Mathematics up to 1700\HPS 390 The Story of Number: Mathematics from the Babylonians to the Scientific Revolution (IHPST, University of Toronto) in fall 2021. This transcript has been edited and condensed for brevity.

SN: Let's start from the very beginning. What inspired you to become interested in the history of ancient Egypt and in ancient Egyptian astronomy in particular?

SS: *As a child I loved codes. When I discovered hieroglyphs it just looked like the best code in the world and I thought I have got to learn to read that. I learned the hieroglyphic alphabet and wrote my diary in hieroglyphs. I remained interested in ancient Egypt throughout my younger years, watching all the documentaries on TV that that I could. When I was studying mathematics and astronomy at the undergraduate level I did a course on the history of mathematics. We had a project on Egyptian mathematics. I went to the instructor and said I think you've probably read this project about ancient Egyptian mathematics many, many times and he said yes. I proposed to do a project on Egyptian astronomy instead which he accepted. When he read my project he commented that there might be a PhD in this area because not that much had been done at that time on ancient Egyptian astronomy.*

SN: Did that course project contain anything related to star maps?

SS: *It was an undergraduate project, so I just described what everybody else was saying. I noticed that there were some gaps in our understanding of star maps. Nothing much had been done since the 1960s. Yes, star maps were one of the topics I looked at.*

SN: What is a star map?

SS: *Astronomical documents from ancient Egypt and some astronomical instruments survive. For instance when the ancient Egyptians built a tomb or temple they would often paint a miniature universe on the ceiling or inside the lid of a tomb or coffin or sarcophagus. This painting represented the sky in that universe. Originally this painting was decorative – an overall star pattern repeating – and not really informational. But every so often, some temple or tomb ceiling or coffin lid actually represented the sky. So there were two different branches of the ways in which ancient Egyptians represented the sky. These different astronomical representations (or ARs) from the ancient period are a type of astronomical diagram of lots of different things in the sky, or a static picture of one instant of how phenomena appeared in the sky. ARs are the closest thing to star maps we have from this time period. They differ from our view of a star map today chiefly in that they do not use a coordinate system to indicate position. Another important*

[1] Sarah Symons and Elizabeth Tasker, "Archeoastronomy: Stars of the Dead, Mysterious tables of astronomical information have been found in 4,000-year old coffins. What in the world was their purpose?" *Scientific American*, October 2015, pp.70-75.

type of astronomical text is a diagonal star table (or DST). This document is more akin to a modern planetarium in that it shows certain stars in a subsection of the sky and their motions. This is a table representing the movements of stars in the sky.

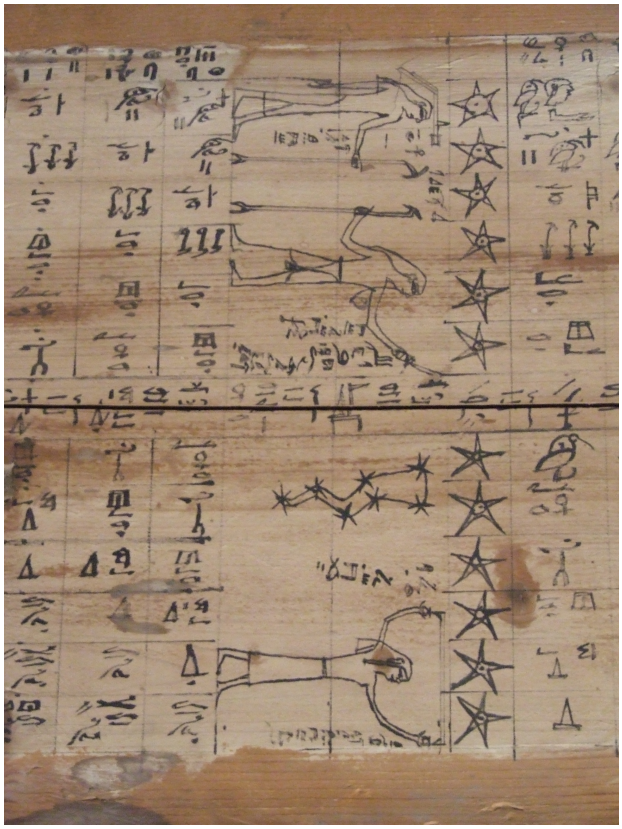

Figure 4: A coffin lid in the Nubian Museum, Aswan, dating to about 2000 BCE. This text shows (top to bottom) Sirius, Sahu (approx. Orion), Meskhetiu (The Big Dipper), and the sky goddess Nut. The surrounding text is a diagonal star table. (Photo credit: Sarah Symons)

ARs and DSTs (or what we might colloquially refer to as Egyptian star maps) were decorative but also functional. The belief was once you were dead and properly buried in the tomb, one part of your existence in the afterlife was living inside your tomb. So one would require things for you to live your afterlife there. There was a religious belief that if you painted something on the tomb, or if you made a model of an object or living thing and placed this inside the tomb, in the afterlife this model would become real. So there was this belief that representations of the sky would become your real sky in the afterlife.

SN: So some star maps were like snapshots of the sky whereas others describe the sky in motion and record the relative position of stars as well as at what times they appear. If these charts plotted star positions versus time, how did the Egyptians tell the time?

SS: *If we go down to the to the realm of a second we might imagine the human heartbeat would be a reasonable guess for a timekeeper for that short length of time in the ancient period. But in fact, in ancient Egypt and nearby civilizations we find no evidence of heartbeat as a measure used for short time intervals. In ancient Egypt we find two methods for timekeeping that don't involve astronomical bodies. Water clocks existed from about 1500 BC through to the end of the Greco-Roman time in Egypt. This type of device was used during the night to divide the night into twelve portions. During the day sundials were used to tell time. The Egyptians also divided the day into twelve portions. Although it is often claimed ancient Egypt was the birthplace of the 24-hour day it's not at all clear that this was a continuous equally divided twenty-four hours. But time was definitely measured into groups of twelve daylight hours and twelve nighttime hours. These hours were personified as gods and goddesses in two distinct groups.*

SN: Was timekeeping important in Egyptian society?

SS: *It's difficult to say how important timekeeping was with everyday people. Keeping track of time in terms of hours, minutes and seconds was important for a functioning military so people would be on guard for a quarter of the night or a third of the night. We don't get shorter time keeping units being used by everyday people during pharaonic civilization at all (or at least, there is no evidence for this). We find things like the depiction of water clocks in tombs and in places used by Egyptian royalty. Temples frequently had water clocks inlaid with precious stones. These were expensive objects people would not have had in their houses. Timekeeping was important in a religious context where rituals were performed according to the calendar.*

Egyptian religion stipulated that the movement of the sun was very important, particularly its movement during the nighttime when the sun was seen to be in danger of passing through the netherworld. It is possible that the impetus for keeping time at night came from a desire to help the sun along its nighttime journey when it was experiencing all these different threats.

SN: The Egyptian calendar was divided into ten day weeks, where each month had three weeks, and there were twelve months in one year plus a five day period to make up 365 days in one solar year. Egyptian star maps have a column for recording star positions for each week of the year, plus that little five-day half week? And the groupings of stars that were recorded according to those periods of time became known as decans after the Greek word deca meaning ten?

SS: *The decans were in place as a concept by about 2100 BCE and continued throughout the rest of ancient Egyptian history up to the Greco Roman period. These star groupings are so old that they're actually called astronomy rather than astrology because astrology hadn't really been invented yet. In these static astronomical maps we see the decans as a list of stars. Beyond just tracking the decans these star maps expanded to include foreign elements such as signs of the zodiac coming in from a Mesopotamian influence. The decans and Zodiac mixed together to produce a new kind of astronomical ceiling. The most famous one being the circular Dendera zodiac.*

Eventually the list of decans crystallized into thirty-six groupings assigned to the zodiac signs so each zodiac sign would contain three decans. In some astrological traditions that have survived to the present, the division of zodiac signs into three decans each still exists. But the very early Egyptian activities were not astrological because ancient Egyptian culture did not seem to demand that astronomy predict things in the human world and people's everyday lives. It wasn't until the Greco Roman period that the idea of the zodiac influencing people became an idea.

SN: Do we know which stars the Egyptians were identifying for each decan?

SS: *We know some of them although many remain unknown. Our star Sirius was definitely one of the decanal stars, as were Pleiades and Antares. But the identification of the others depends on our understanding of exactly how these observations were taken and at what part of the sky people were looking at.*

SN: Is it true the Egyptians believed that souls can be reborn as stars after death? Was the interpretation that these star maps were required for the dead to navigate to their proper place in the heavens after death?

SS: *We have some texts that describe how the Pharaoh will become a star in the northern area of the sky or that the King would become an immortal star in the northern sky. It seems, though, that by the time coffins with diagonal star tables appear on them, perhaps everyone could become a star! Or, if you could afford a really nice coffin with a star table on it, maybe you would become a star as well, certainly in the lower part of the heavens.*

You cannot study ancient Egyptian astronomy without studying ancient Egyptian religion because the process of astronomy in ancient Egypt was explained by religious concepts. Stories that involved gods doing this and that explained the movement of the sky and why it behaved the way it did. One of the key things that you have to get to grips with in Egyptian religion and the Egyptian view of the natural world was that nothing happened in the natural world without supernatural cause. Therefore, a lot of the things that we look at would have been knowledge held by priests. Temple libraries, and temple walls and ceilings were covered with this sort of knowledge and these would have been used a bit like textbooks. One of the most important astronomical texts in ancient Egypt is usually called the Book of Nut, *or, the original title seems to have been* The Fundamentals of the Course of the Stars. *It was something like a textbook to teach young priests about the motions of the stars, because they would then be expected to keep time for the temple and have that knowledge.*

SN: You use planetarium software to go back and study what the sky really looked like 4000 years ago so that you can reinterpret and understand what these ancient documents really say. Tell us a little bit about how you meld tools of the present with records from the ancient past in your research.

SS: *The sky was different in ancient times. We have to adjust for place and time to consider which stars they may have seen. For example, we take for granted our poll star Polaris is pointing North. But it's just a coincidence that our earth's axis of rotation happens to point to the bright star right now. It didn't in ancient Egyptian times as the earth's pole wobbles as it rotates, with a period of about 25,000 years. To see the sky 4000 years ago we have to correct for that wobble. Back in the 1960s, if you wanted to correct for that you would have had to grab a pencil and start making incredibly time consuming calculations just to determine the ancient position of one star we know about today. But I can set up my planetarium soft-*

ware and just type in the dates and it will make the sky look precisely right for that ancient time and day. So it is much easier to go back in time and actually look at what the ancients would have been looking at.

The great thing about studying ancient astronomy today is that we can just produce that image of the ancient sky pretty accurately. By comparison, if we're reading ancient literature and trying to verify it, we have to look at place names and we don't know where all the places were in ancient Egypt. Through lost context about those places and what they would have meant we may never be able to verify certain ancient documents. But with the sky, we can use the planetarium to try some experiments that investigate the astronomical observations that may underlie these diagonal star tables and other forms of astronomical records from ancient Egypt. We would not be able to tell how these tables correspond to actual ancient observations if we were not able to sit in the middle of a simulation of the ancient sky, working out what can be seen, to imagine how they observed in this way and what star movements were possible. Using the planetarium we can run simulation after simulation in order to investigate that.

Star maps began to be noticed in the 1890s. At that time, these records began to be found on the inside of lids to caskets that held mummified remains of the Egyptian dead. It wasn't until the 1960s that anyone developed a theory as to what these tables represented and why they might have been created. The first idea about what these charts might be was put forward by Otto Neugebauer sixty years ago. That theory said the information in Star Maps traced the order in which select stars rose over the eastern horizon during the nights of each week throughout the year. Noting which star was coming up over the horizon at any given moment would reveal how much time had passed since sunset. So went the prevailing theory about Star Maps. Dr. Symons has come to some alternate conclusions about star maps, using a careful study of artifacts and the computer simulation of the appearance of stars in the ancient sky using planetarium software. To find out more about Dr. Symons' research go to `https://aea.physics.mcmaster.ca/index.php/en/` and `https://experts.mcmaster.ca/display/symonss`

2022 CSHPM/SCHPM Nominating Committee Report

In keeping with the by-laws of CSHPM/SCHPM, the Nominating Committee (comprising Christopher Baltus, Tom Drucker and Glen Van Brummelen) has contacted the following people who have agreed to be nominated as officers of the Society for the period 2022-2024 (May to May). It is thereby the recommendation of this Committee that the following people stand for election:

President: Nicolas Fillion, Simon Fraser University
Vice President: Robert Bradley, Adelphi University
Secretary: Patricia Allaire, Queensborough Community College, CUNY
Treasurer: David Orenstein, Danforth CTI (Retired)

Council:
Marion (Wendy) Alexander, Houston Community College
Amy Shell-Gellasch, Eastern Michigan University
Jemma Lorenat, Pitzer College
Jean-Pierre Marquis, Université de Montréal

The Nominating Committee thanks the candidates for their willingness to serve the society. Other executive positions (Past President, various editors, Webmaster, Archivist, CMS Liaison) do not require elections. The Nominating Committee wishes to communicate that Jean-Pierre Marquis, at the request of the Nominating Committee, agreed to serve for only one two-year term. As a result, two Council seats will open for election in 2024, which this Committee sees as helpful to the maintenance of a balance of seasoned and new members to serve on Council in the future.

Executive positions will be elected via electronic ballot. Links to these ballots were sent to members by email on 4 April 2022. Members must cast their ballot by noon EDT on 15 May 2022. Results of the election will be communicated at the Annual General Meeting to be held on 15 May 2022 from 4-6 p.m. EDT over Zoom.

Christopher Baltus, Tom Drucker, Glen Van Brummelen

New Members

Congratulations to the following new members who have joined the Society since our last Bulletin. We

look forward to your contributions.

Patricia Blanchette
South Bend, IN
USA

John Brewer
London
UK

Ximena Catepillán
Lancaster, PA
USA

Jennifer Cuffe
Gatineau, QC
Canada

Barry Davies
Newtown, CT
USA

Emerson Doyle
London, ON
Canada

Patrick Finnigan
USA

Shiv Gupta

Emily Hamilton
Northampton, MA
USA

Dr. David Hoeflin
Greenville, SC
USA

Scott Kolodziejski
Perkasie, PA
USA

Chanwoo Lee
Davis, CA
USA

Benjamin Linowitz
Oberlin, OH
USA

G. Arthur Mihram
Seal Beach, CA
USA

Jessica Oddan
Coaldale, AB
Canada

Jorge Nuno Silva
Parede
Portugal

Valérie Lynn Therrien
Montreal, QC
Canada

Julia Tomasson
New York, NY
USA

Mario Bacelar Valente
Sevilla
Spain

Ruigang Xu
Montreal, QC
Canada

From the Editor

This issue takes on the mathematics of universe builders past and present. Two book reviews highlight volumes about cosmology and astronomy, and the Q&A with historian of astronomy Dr. Sarah Symons may have value to those open-minded enough to expand the boundaries of history of mathematics to include decoding ancient Egyptian star charts using planetarium software. This issue also includes a recap of several past meetings, notices the passing of important members of the history of mathematics community, and highlights programming at our upcoming annual meeting. Each issue has a slightly different focus. Your contributions are welcomed for the upcoming fall issue. Submissions for the fall issue are due anytime before 1 October 2022.

I teach several courses in history of mathematics, science communication and data visualization at University of Toronto and McMaster University in Hamilton, Ontario, Canada. Recently I created a new syllabus that I illustrated because art is another way of showing affection for the many wonderful ideas students discover in our field. I've included the image for your curiosity and viewing pleasure. Titled "Beautiful Mathematics," you may notice some of the mathematical objects illustrated include Napier's bones, a spiral defined by the golden ratio, Hindu-Arabic numerals, Cardano's cube for algebraic solution to the cubic equation, a sinusoidal function, Coxeter graph, Armillary sphere, Pascal's arithmetical triangle, diagrammatic proof of the gou gu theorem (Pythagorean theorem in China), Fibonacci's rabbit breeding problem, and a sphere.

The *Bulletin* welcomes contributions from all members of the society be these news items of interest to

Figure 5: Beautiful Mathematics

historians and philosophers of mathematics or personal and professional announcements. We welcome suggestions for memorials, reports on conferences relevant to historians and philosophers of mathematics, book and web reviews, and informative or thought-provoking column-style articles. Ongoing column series include Models of Mathematics, Off the Shelf, and Mathematical Ephemera. New lines of investigation that members may wish the *Bulletin* take up can be created, especially from younger scholars pursuing new lines of research or re-evaluating well travelled paths in new ways. Contributions of opinion or editorial style articles offering arguments or particular perspectives on the state of the field are welcome. The contributions of philosophers are welcomed and they are encouraged them to make this space their own.

Microsoft Word (please turn off its auto-formatting features such as "curly quotes") and LaTeX data files (not compiled PDFs) are easiest for the editors to deal with. We also prefer that image files be sent separately, rather than embedded into a Word or PDF document. Submissions may be sent to *s.nickerson@utoronto.ca*. The *Bulletin* reaches your hands or screen due to the continued labors of Eisso Atzema, Layout Editor; Maria Zack, Production Editor; Pat Allaire, Secretary; and Mike Molinsky, Webmaster.

Sylvia Nickerson

About the Bulletin

The *Bulletin* is published each May and November by a team of 3 volunteers: Content Editor Sylvia Nickerson (s.nickerson@utoronto.ca), Layout Editor Eisso Atzema (eisso.atzema@maine.edu), and Production Editor Maria Zack (Maria-Zack@pointloma.edu). Material without a byline or other attribution has been written by the editors. Les pages sont chaleureusement ouvertes aux textes soumis en français. Comments and suggestions are welcome and can be directed to any of the editors; submissions should be sent to Sylvia Nickerson at the above email address. Members, readers and prospective contributors may also contact Sylvia by post. Direct correspondence to 115 Mary Street, Hamilton, Ontario, L8R 1K4, CANADA.