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A PIONEER REMEMBERED
BIOGRAPHICAL NOTES ABOUT
ARTHUR CONSTANT LUNN

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In the living memory of
Samuel Isaac Weissman,
a great scientist and a great man

Abstract

In 1929 A. C. Lunn and J. K. Senior published in the *Journal of Physical Chemistry* a seminal, and often quoted paper *Isomerism and Configuration*. In spite of the importance of the work of these scholars, contemporary mathematical chemists know almost nothing about them. The present text is the result of an effort to reconstruct the lost biographical data on these pioneers. A few facts, some quite surprising, on Arthur Constant Lunn and almost nothing on James K. Senior could be established. It is hoped that this article will stimulate other colleagues to seek for, find, and publicize more.

INTRODUCTION

The fast run of time in our days makes any biography soon looks like an ancient one. In spite of the new technologies that help us preserving giant fragments of somebody's discourse, we know astonishingly less of our grandfather's generation, than they did of their grand–grandfathers. In the ocean of fabricated stories one's road through life usually passes unnoticed, although sometimes it bears the impress of genius. The greatest scientific achievement of Arthur Constant Lunn — the time-independent, now-called Schrödinger, equation discovered by him at the end of 1921 and applied to hydrogen atom — is in the same time the cornerstone of the greatest scientific achievement of the 20th century, quantum mechanics. This confirms once again a well known "metatheorem" claiming that (almost) any theory, theorem or notion, is not named after the right person.

It has been difficult to find out much about the life of A. C. Lunn (1877–1949). We have little left: Internet, his publications, our colleagues, and especially the memories of one of his students – Samuel Isaac Weissman [1], Professor Emeritus, Department of Chemistry, University of Washington. We traced the name of Lunn in a public lecture of his son — Professor Michael B. Weissman, Department of Physics, University of Illinois at Urbana Champaign. He was so kind to share with us the stories about Lunn that he heard from his father, as well as to have interviews with him — listen to the recording at

http://www.math.bas.bg/algebra/valentiniliev/samweissman

Below we follow closely the tape with Sam's voice and the memories of Michael, with their kind permission, as well as our e-mail correspondence. We have not deleted the repetitions in these memories in order to resemble the recurrent themes of a music piece. Although Michael Weissman found some biographical materials in the archives of the University of Chicago (where Lunn worked) several years ago, they merely confirmed some of the stories of S. I. Weissman, providing little new information. A recent request to the Archives for these materials produced only some class notes.

E–MAILS

In this section we reproduce a few "successful" e-mails that resulted in acquiring information about Lunn and Senior. Several other colleagues were contacted, who could not help; these futile efforts are, of course, not presented.

* * * * * * *

November 25, 2006

Dear Professor Weissman,

My name is Valentin Vankov Iliev. I am a Senior Research Associate at the Institute of Mathematics and Informatics of the Bulgarian Academy of Sciences.

I am writing a book on a mathematical theory of isomerism in organic chemistry. The main ideas of this theory were published in the paper: A. C. Lunn, J. K. Senior, Isomerism and Configuration, J. Phys. Chem. 33 (1929), 1027–1079. When I red the paper, I thought (and now I continue to think) that this is the theory of isomerism in organic chemistry and that it has the impress of genius.

Today I wondered who A. C. Lunn is (of course I knew something about him but this was not enough) in order to write a biographical note, and found in Internet your lecture "Quantum Mechanics: Stranger than we can imagine?" that confirms my opinion. In this lecture you assert that A. C. Lunn discovered in 1921 the wave theory, before De Broglie (1923) and Schrödinger (1925) (the paper rejected by Physical Review). What is the degree of reliability of the source of your information, and may I cite this in my book on Lunn–Senior's theory? Do you know more information about A. C. Lunn (mathematical physics, University of Chicago) and about J. K. Senior (chemistry, University of Chicago)?

Many thanks in advance.

Sincerely yours,

Valentin

* * * * * * *

November 26, 2006

Dear Valentin —

It is a pleasure to hear from you. By chance, I happen to be visiting my 94-year old father, Prof. Samuel I. Weissman, who is the principle source of my information concerning Lunn. Some of it is on record with the Chemical Heritage Society, which recently recorded some of his reminiscences. I told Sam of your note, and he went over many of his stories about Lunn, which I have been hearing essentially unchanged for about 50 years. I consider the information 100% reliable because:

1. Sam is extraordinarily careful about the truth.

2. I had a chance to check archives at the University of Chicago, and they were consistent with many details of Sam's accounts, and inconsistent with none of them.

3. The records of the changing editorial board of Physical Review was consistent with his accounts.

4. After we published a brief account of the Lunn quantum mechanics paper in a letter to Physics Today, the nuclear physicist Alvin Weinberg [2] wrote Sam of his own memories of the Lunn paper, which were complementary to Sam's.

By the way, as soon as I mentioned your inquiry, Sam said "That must be the 1927 J. Phys. Chem. paper" — not quite exact, but very close for a 94 year old.

So here's a few of the memories.

The beginning of the Quantum mechanics paper, which Sam remembers, started with the equation $E = \hbar\omega$ and pointed out that the relativistic 4-vector must be completed to make $p = \hbar k$, i. e., the De Broglie result. The last part of the paper, which Sam did not read but which he heard about and which Weinberg remembered, went on to obtain the H energy spectrum by solving an eigenvalue problem, i. e., the Schrödinger result. The paper was rejected by Physical Review, with the referee (Fulcher) insisting that it was meaningless abstraction. Lunn then resigned as Associate editor of PR, and was replaced with Fulcher. This was either at the end of 1921 or 1922.

Sam wanted to make sure I mentioned that several people remember Lunn saying in lecture in 1919 that the explanation of the Zeeman effect would be found in the Abelian property of the magnetic field symmetry group!

The industrial physicist Davisson [3], who first confirmed the De Broglie relation for electrons was not, as we have been taught, just accidentally scattering electrons off nickel, but had been an undergraduate in classes in which Lunn had urged that "someone should study the wave properties of beta-radiation".

Sam remembers the Lunn–Senior paper well. Senior's job was to calculate the group tables. Unfortunately, this led to Senior becoming responsible for Lunn's scientific papers after his death. Senior destroyed the quantum paper, saying that if he couldn't understand it, no one could. The Chicago archives have some correspondence concerning Senior's lax treatment of the Lunn material, although not specifically mentioning the key paper.

There are many other stories of Lunn: He was very neurotic and easily offended, etc. I can try to remember more of them if you're interested.

Sam still regrets not explicitly thanking him for being the only teacher at Chicago

who taught something beyond what could be gleaned from text books.

Perhaps this is a good point to stop for now.

Best wishes,

Michael

* * * * * * *

Dear Michael,

Thank you very much! Your information is invaluable. Of course, I am interesting, and I would be glad if you and your father try to remember more. I intend to include (with your permission, and with reference to our correspondence) the whole story in my book.

Thank you once again!

Valentin

* * * * * * *

No, thank you!

We'd be delighted to see this come out in your article. I managed to record my father today and will send you the CD. The discussion rambles to many topics, but a good deal concerns Lunn. A compressed version of the file may be short enough to send electronically.

One important correction should be made to what I had written earlier. Weinberg had heard discussions of the eigenvalue solutions in the paper, but had not himself read the paper.

One story on the tape concerns Lunn's first experiment: sending his little sister out to the end of a pier in Racine, Wisconsin, in order to measure the radius of the Earth from how high she needed to be above water level to be visible.

One story not on the tape concerns why Lunn refused to give grades. The president of University of Chicago had approached him near the start of his career to get the grade of a football player raised. He decided to give no more grades.

One story concerns Lunn's politics. He was a moderate conservative but didn't mind that most of the good students were socialists. His favorite economic story was about the time he offered to pay his kids for each fly they killed inside the house. The first thing they did was to prop the door open.

There are many stories of his extraordinary musical gifts. His father was a piano tuner. Lunn was employed to listen to the high notes after his father lost hearing in that range. He was always rewarded with cookies, which he then tasted whenever he

heard certain notes. Apparently he could pick up almost any instrument and play it competently.

The tape includes an account of Lunn's construction of an musical instrument with ultrasonic fundamentals. He set up a set of pipes tuned to proper values so that non-linear beats gave audible analog of H atom lines. Used 1890 Rydberg–Ritz recombination rules. Not sure of date instrument made.

* Making the instrument already required thinking of the characteristic frequencies as coming from solutions of a wave equation.

Here and below the sign * denotes comments made by Michael Weissman.

Sam remembers a good deal of emphasis on the relation between the symmetries of a differential equation and its solutions. The idea that it was the collection of solutions, not the individual solutions, which preserved the symmetries was a revelation to Sam. It was in this context that Lunn made his point about the Abelian magnetic field group.

Lunn was very unhappy with many aspects of the physics community. It is unclear from Sam's account which aspects of the interpretation of quantum mechanics he found most unpleasant. Certainly he was scornful of the Bohr theory, which he described as "obscene — they bring down the curtain just when it gets to the interesting part." On the other hand, he liked von Neumann's Mathematical Foundations book.

Another story that I believe is not on the tape describes Lunn presenting the

$$\nabla \cdot E = \frac{\rho}{\varepsilon_0}$$

equation and saying, with a slight smile : "Sometimes this is called the inverse square law."

I'll try to remember some more, and will send a compressed audio file when I get home.

* * * * * * *

December 30, 2006

Dear Michael,

Nevertheless, thank you. I will expect the CD. Do you know how to find the standard biography of Lunn (something like CV + birth date + family +...) and the same for Senior?

Best wishes,

Valentin

* * * * * * *

Dear Valentin —

This information was in the University of Chicago archives, perhaps they will retrieve it, see http://www.lib.uchicago.edu/e/spcl/research/findarms.html

One thing I've been remiss about is checking with the editors of Physical Review about any correspondence which they may have preserved.

I've enclosed a compressed Garage-Band record (made on a Mac.) Let me know if it works and has good enough quality.

Best —

Michael B. Weissman

* * * * * * *

Dear Valentin —

I owe you some thanks too. You stimulated us to make that recording. Two weeks ago, my father suffered a memory loss (mostly short-term), probably due to a stroke. Although his memories of Lunn remain vivid, it would be much harder to make a recording like that now than it was a month ago.

Best wishes,

Michael

* * * * * * *

January 03, 2007

Dear Valentin —

While looking for the PT letter, I found some old notes on an old computer. These are from July, 1996.

Notes on Lunn, taken by Michael during conversation with Sam Weissman, on 6/21/96, in the random order of the conversation. Mostly, these are just little anecdotes of no particular significance.

A common Lunn complaint — 1 microsecond characteristic resolution of the best optical kinetics data (then) "Like hearing a Wagner opera as a single bang".

Shrödinger visit to Chicago of some week or weeks in about 1927 (Sam started in 1929). Shrödinger apparently found out about Lunn's paper while there. This info seems to have come mainly from Lunn.

Lunn had worked on statistical mechanics. Coming back on a train from a symposium at University of Wisconsin, he was asked by H. A. Lorentz "Who's student are you? Milliken [4]? Michelson?" Lorentz was pleased with the reply — "I'm a student of Maxwell, Gibbs, and Lorentz."

According to rumor (* should be checkable) Davisson was in a class in which Lunn insisted someone should check "oscillatory properties of beta rays". Lunn reported making the statement.

Lunn's date for the claim that "The origin of the Zeeman effect will be found in the Abelian character of the magnetic field group" was 1919.

* Apparently indicating that, not too surprising for a group theorist, instrument maker, and musician, he was already thinking of the energy levels as eigenvalues of linear operators, hence the applicability of the group representation methods.

Lunn had a touchy personality, and was very wounded by treatment by physicists.

Hutchison [5] said that Senior said that since he couldn't understand the paper, nobody could. (Senior worked with Lunn on group tables.)

Kamen's [6] memoirs in Ann. Rev. Biochem. may have Lunn's cookie tasting story. He would lie down in pews of churches, listening to his father tune organs after his father had lost his high-frequency hearing. His job was to listen for the correct tuning, and his reward was home-baked cookies from his mother. Later in life, hearing the same tune, he would taste the same cookies.

He gave lectures on relativity, where he would work in this anecdote. Lunn played the organ in a church. The organ responded very slowly to the pedals — 1/2 beat delay. The conductor asked him to begin 1/2 beat before the baton was lowered.

He was unimpressed with Heisenberg matrix mechanics. "Nothing in life is commutative." Cited example of washing and drying.

I asked about some hints about a theory of gravity in a Phys. Rev. abstract. Sam didn't know what they referred to. He was aware of a Lunn toy theory of mass-spec lines, using a "wrinkled metric". Analogy: critter on a pebbled beach, geodesic depends on scale of feet.

* Vaguely anticipates many modern developments.

Taught undergrad vector analysis. Started with succotash as a linear vector space.

Measured size of earth when about 12 year old. Had younger sister (about 8) climb down the end of a very long pier in Lake Michigan (near Racine). Accurate to some 20.

(* In another telling, I believe that he got in some trouble.)

Played music with Kamen, who described him as the "finest amateur pianist" he had heard. Style like Schnabel [7]. Sam remembers Lunn grabbing a viola, playing it like a cello.

Became embittered — described atomic hypothesis as childish.

Strong advocate of using group theory for spectroscopy, etc.

Remarked after a talk by Hardy [8] describing math as "the only true reality" :

"Can he deduce his breakfast oatmeal from a set of non-contradictory postulates?"

Lunn laughed at mathematicians' preference for existence proofs. He preferred solutions: "Never mind how you got it, any more than you would judge someone by whether they were a bastard."

He referred to a class of theorems as "the almost mother theorems".

* For which there's an obscene explanatory story that I've heard on other occasions.

The University of Chicago administration didn't like him, complained about his teaching. But Sam remembers more from him than any other teacher, despite the digressions from physics to Beethoven.

In electromagnetism, started with Maxwell equations in integral form, as Faraday thought of them.

Not an original idea with Lunn, but he introduced General Relativity using Clifford's worm, raised in Euclidean $2d$, then moved to a sphere.

The key paper: Sam read the beginning, with the wave representation of momentum derived by extending the Planck relation to a complete relativistic 4-vector. Sam only glanced at the later parts. Lunn claimed that Shrödinger told him "You have done what I did."

* Sam's memory of the dates is confirmed by looking in old Phys. Revs. Lunn departed as editor and was replaced by Fulcher, the referee who rejected the paper. I think this was at the end of 1921, could check again.

Lunn was an operationalist, though not an extreme one. he held that no theory is perfect, that the "engineering test" is the ultimate test of physical theory.

In teaching, Lunn used the rutabaga as the example of a set with a one-element symmetry group. Definition: "The identity element means leave it alone."

* This by no means exhausts the Lunn stories. others that come to mind, form previous talks.

Lunn had a very low opinion of the Bohr quantum mechanics, with its "quantum leaps" "It's an obscene theory. They pull down the curtain just when it gets interesting."

Lunn's politics were conservative, at least by the standards of his better students. However, he thought it a good thing that they should be enthusiastic socialists. His explanation of his economic views involved an anecdote about the time he tried to pay his kid (or kids?) for each fly killed in the house. Lots of flies were killed, because the kid propped the door open.

Lunn's troubles with the administration began very early in his career, when he

was visited by the University of Chicago president. Expecting to be congratulated for his brilliant work, he was admonished to give a good grade to a football player.

In addition to perfect pitch, Lunn had idetic memory. He would answer questions by referring to specific portions of particular pages of books.

* Some of my interest in this business comes from the light it sheds on how science progresses. The lack of direct effects of Lunn's work (with possible exception of Davisson) certainly supports some elements of "social constructionism" Ideas need some sort of reasonable receptive audience to thrive. (Of course, Aristarchus is a better example.) However, the strong versions of social constructionism cannot account for why the midwestern conservative came up with the same theory as the Austrian romantic.

* * * * * * *

January 03, 2007

Dear Michael,

I am beginning to work on Lunn's biography. I would like to ask you several things:

1) Sam's and yours kind permission to follow closely the tape and Michael's memories (I could not say it much better) and to arrange the fragments.

— Absolutely!

2) Sam's and your kind permission to put the recordings on Internet in order to create a link for citation.

— Absolutely!

3) I need the text of Michael's letter to Physics Today and its coordinates in order to cite it.

— It was a joint letter from the two of us. I will attempt to find it.

Thanks again,

Michael B. Weissman

* * * * * * *

Dear Valentin —

Here's the PT letter reference:

"Alan Sokal's hoax and A. Lunn's theory of quantum mechanics", S. I. Weissman, M. Weissman (LET) June 15, 1997.

I'll look for the text.

Best,

Michael B. Weissman

* * * * * * *

May 02, 2007

Dear Michael,

I hope everything is O.K. with Sam — you wrote me that some kind of speech troubles occurred.

Those months I tried to use the resources of our Central Library in order to contact the Library of University of Chicago about Lunn and Senior's biographies but without any success.

I would like to ask you for an advise how to contact them. I am planning to finish my book on Lunn (-Senior's?) theory of isomerism in the end of the year. By the way, in accord with Sam's story about Lunn, his partner Senior contributed to their joint paper only the group tables. Do I have enough reasons (I think I have) to drop the name of Senior from the expressions "Lunn–Senior's theory", "Lunn–Senior's groups", etc., that are used in my book? Unfortunately I used these expressions in my papers, but on the other hand, the book is a good opportunity to restore the truth.

Best regards,

Valentin

* * * * * * *

Dear Valentin —

I'm glad to hear that your book is progressing well. According to what Sam said many times over the years in which his memory was very reliable, it is correct that Lunn was entirely the source of the ideas of the isomerism theory, and that Senior's role was to calculate group tables. As for what naming convention should be used, I think that no one would object to whatever choice you make.

I will contact them (UC library) for you. If that is unsuccessful, perhaps that will be a good excuse for me to visit Chicago and return to the archives, but it is unlikely that I will have a chance until June.

Best wishes,

Michael B. Weissman

* * * * * * *

June 07, 2007

Dear Ms. Gardner —

Sorry for the delay in responding to your note — I was interrupted by a trip and a flu. I'd be pleased to pay for copying of any archival material on Lunn that could

be found. The results could be mailed (or just sent as .pdf to my email address). If mailed, the address at the bottom of this note is best. How to I go about paying? I have not yet heard from Dan Meyer.

Thanks,

Michael B. Weissman

* * * * * * *

Dear Michael Weissman,

I am writing in response to your question about Arthur C. Lunn. Thank you for your interest in our collections.

I have forwarded a copy of your message to Dan Meyer, University Archivist. He will respond to your offer regarding the MP4 recording you have about Lunn.

Regarding your second query, it looks like the best source of Lunn material is found in the Benjamin Shackelford Papers, Box 1, folder 11. Unfortunately we do not have a biographical file for Lunn. We do provide photocopy services, including for those researchers who are unable to place an order in person. The cost is twenty-five cents per page, with a limit of 50 pages per archival box or bound volume. If it appears the contents of folder 11 referenced above exceed this page limit we will let you know. Please note that all orders placed off site are subject to a $ 10 service fee, and shipping is $ 5.00.

If you would like us to proceed with making these copies please let me know, along with your preferred mailing address.

Best wishes in your research. Please feel free to contact me with any further questions you may have.

Sincerely,

Julia Gardner
Reference/Instruction Librarian,
Special Collections Research Center,
University of Chicago Library

* * * * * * *

July 13, 2007

Dear Michael,

I deeply mourn the passing of Sam. He was a great scientist and a great man!

Truly yours,

Valentin

* * * * * * *

August 3, 2007

Dear Michael,

From today the recordings with Sam's memories about A.C. Lunn are accessible via Internet:

http://www.math.bas.bg/algebra/valentiniliev/samweissman

Sincerely yours,

Valentin

* * * * * * *

August 6, 2007

Dear Valentin —

Many thanks! I got those archive files from University of Chicago, but they only seem to be class notes, nothing really useful so far. For some reason the archivists couldn't find the files which I'd seen on a trip some years ago. Perhaps I'll get a chance to look again in the next few months.

Best,

Michael

REMARKS

1. Weissman, Samuel Isaac (1912–2007). American chemist. He completed a science degree at the University of Chicago in 1933 and his doctorate from the same university in 1938, and then worked on optical properties of rare earths, laying the foundation for certain lasers and some resonant energy transfer methods. He was resident chemist for the Manhattan Project, developing atomic weapons in the period 1942–43. Sam Weissman was an authority on chemical spectroscopy, fluorescence, electrical conductivity and paramagnetic resonance, and was a member of the United States National Academy of Sciences. At Washington University, he pioneered the use of electron spin resonance in chemistry in collaboration with other scientists.

2. Weinberg, Alvin Martin (1915–2006). American nuclear physicist. Member of the National Academy of Sciences. Weinberg helped developing the technology behind the atomic bomb in the 1940s at the University of Chicago, and, after that, at Oak Ridge. He remained a vigorous proponent of nuclear energy.

3. Davisson, Clinton Joseph (1881–1958). American physicist. He shared the Nobel Prize in Physics in 1937 with George Paget Thomson for the discovery of electron diffraction.

4. Millikan, Robert Andrews (1868–1953). American experimental physicist. 1923 Nobel Prize winner for his measurement of the charge on the electron and for his work on the photoelectric effect.

5. Hutchison Clyde Allen Jr. (1913–2005). American chemist. He received his bachelor's degree in 1933 from Cedarville College and his Ph. D. from Ohio State University in 1937. During the war years Hutchison participated in the Manhattan Project at Columbia University and the University of Virginia. He loved music and was an accomplished piano player.

6. Kamen, Martin David (1913–2002). American chemist who collaborated in 1940 with another chemist, Samuel Ruben, on the discovery of carbon-14 — the radioactive isotope that is constantly used in archaeology carbon–dating. He earned his B. S. and Ph. D. degrees in chemistry and physical chemistry from the University of Chicago. Winner of 1995 Enrico Fermi Award. Martin Kamen had toyed with a musical career, and, for instance, accompanied the great violinist Isaac Stern as a viola–player in social evenings of chamber music.

7. Schnabel, Artur (1882–1951). Austrian classical pianist, composer and musical pedagogue, who is widely considered to be one of the greatest pianists of the 20th century.

8. Hardy, Godfrey Harold (1877–1947). English mathematician, known for his achievements in pure mathematics — analytic number theory and mathematical analysis. Hardy regards as "pure" the branches of mathematics that are independent of the physical world.

MISCELLANEOUS BIOGRAPHICAL FACTS ABOUT ARTHUR C. LUNN

Online Computer Library Center (OCLC): Lunn, Arthur C. (Arthur Constant), 1877–1949.

Lawrence College – Appleton, Wisconsin; Alumni Record, Classes of 1857–1915: Lunn, Arthur Constant, Chicago, IL.

Wesleyan University – Middletown, Connecticut, Department of Astronomy: Lunn, Arthur Constant, Ph. D., Mathematics and Astronomy. Instructor, 1901–02.

The Mathematics Genealogy Project: Arthur Constant Lunn, Ph. D. The University of Chicago, The Department of Astronomy & Astrophysics, 1904, Dissertation: The Differential Equations of Dynamics, Advisor: George Myers. Students:

Irwin Roman, The University of Chicago, 1920;

Dio Holl, The University of Chicago, 1925, 84 Descendants.

The 23th regular meeting of the Chicago Section of the American Mathematical Society was held at the University of Chicago on April 17–18, 1908. The attendance of the three sessions included 45 persons, among whom were the following 33 members: ..., Dr. A. C. Lunn, ... The following papers were red:

...

(12) Dr. A. C. Lunn: "A continuous group related to von Seidel's optical theory."

(13) Dr. A. C. Lunn: "A minimal property of simple harmonic motion."

(14) Dr. A. C. Lunn: "The deduction of the electrostatic equations by the calculus of variations."

...

Abstracts follow below.

...

... In 1904, Nagaoka had suggested that an atom consists of a central sun or nucleus and a system of negative electrons as satellites. This theory was amplified by Rutherford, who showed that the positively charged atom nucleus appears to be extremely minute in comparison with the space occupied by the atom. For many years the phenomena of radioactivity had been extremely fascinating to me, and this was undoubtedly what caused my attention to be directed more specially to the nucleus, which determines the stability and even the existence of the atom as a whole.

A series of three papers by Harkins and his student E. D. Wilson in 1915 represents the first of a number of papers published over the years in which Harkins developed ideas on the structure of atomic nuclei. The papers distinguish carefully between chemical elements and atomic species. In general, an element is a mixture of atomic species (isotopes). In 1915 it was already clear that most of the lighter elements have atomic weights very close to a unit that is slightly (about 0.77 percent) less than the mass of the hydrogen atom. The 0.77 percent discrepancy was attributed by Harkins and Wilson (and also independently by Rutherford and others) to what they called a "packing effect", ascribed to a loss of mass predictable from Lorentz' electromagnetic theory if protons and electrons interact at sufficiently close range. They included a speculation that the conversion of hydrogen to helium might be a source of the energy for the sun and stars. A. C. Lunn, professor of mathematical physics, a friend

of Harkins, made the calculations for him. As time went on, it became increasingly clear from mass spectroscopic evidence that those elements whose atomic weights differ from integral multiples of the basic unit are mixtures of isotopes. ... (from Biographical Memories about William D. Harkins, written by Robert S. Mulliken).

... We wish to thank Professor A. C. Lunn of the Department of Mathematics, for outlining for us the method for determining the distances between the positive and negative electrons. ... (from the paper: W. D. Harkins, E. D. Wilson, *Proceedings of the National Academy of Sciences*, **1**, No 2 (1915) 276–283. Both scientists are from Kent Chemical Laboratory, University of Chicago).

The Innominates club (1917–1982) was an organization created by and for faculty in the physical, biological, and social sciences at the University of Chicago. ... The organizing members of the club were: Elbert Clark, Charles H. Swift (Anatomy); William E. Cary (Bacteriology); J. W. E. Glattfield, H. I. Schlesinger (Chemistry); L. I. Knight (Botany); J. H. Bretz, E. A. Stephenson (Geology); A. C. Lunn, A. R. Schweitzer (Mathematics); A. J. Dempster, Harvey B. Lemon (Physics); F. C. Koch, Arnold B. Luckhardt (Physiology); J. G. Sinclair (Zoology); and H. D. Kitson (Psychology). Harvey B. Lemon volunteered to serve as the group's first secretary. ...

Minutes of the Pittsburgh Meeting, December 27-29, 1917. ... G. K. Burgess, A. C. Lunn and A. D. Cole are the newly elected members of the Editorial Board of the Physical Review.

The following university courses in mathematics are announced:

...

University of Chicago (academic year 1918–1919). – Autumn quarter:... – By Professor A. C. Lunn: Heat and molecular physics, three hours; Electron theory, three hours. — Winter quarter:... –By Professor A. C. Lunn: Thermodynamics, three hours; Theory of sound, three hours. — Spring quarter:... – By Professor A. C. Lunn: Geometric optics.

The fifth summer meeting of the Mathematical Association of America was held at the University of Chicago on Monday, September 6, 1920, in conjunction with, and immediately preceding, the summer meeting and colloquium of the American Mathematical Society. 132 were present at the meeting, including the following 114 members of the Association :

...

A. C. Lunn, University of Chicago.

...

Pleasant arrangements were made for those attending the meetings. Comfortable rooms were furnished in Beecher and Hitchcock Halls, while all had meals as well as social opportunities at the Quadrangle Club. The courtesies shown to the members were recognized in a resolution of thanks offered by Professor Veblen. The joint banquet of the two organizations was held on Tuesday evening where about 110 members and friends were present. At this joint dinner brief speeches were made by the toastmaster, Professor Slaught, and by Professor Birkhoff as representing the Society, Professor Merrill as representing the Association, Professors Veblen, Killam, Hedrick and Hurwitz. On Thursday evening the members of the two bodies and their friends were delightfully entertained at a reception at the home of Professor and Miss Slaught. Professor Lunn contributed greatly to the enjoyment by his piano solos. ...

Vice-President Merrill presided at the morning session and Professor Veblen at the afternoon session. The following papers were read:

...

(5) "The debt of mathematics to the experimental sciences" by Prof. A. C. Lunn, University of Chicago.

6) Discussion of Professor Lunn's paper with respect to its bearing upon research in pure mathematics, by Professor E. H. Mooreu, University of Chicago.

(7) Discussion of Professor Lunn's paper with respect to its bearing on mathematical curricula, by Professor M. W. Haskell, University of California.

...

5. An important portion of the concepts of present mathematical science has emerged by abstraction and generalization from notions originally quite special and concrete occurring in experimental sciences. The successive steps in development have often been carried quite far under the impulse of suggestion from the experimental relations. Professor Lunn's paper was devoted primarily to a commentary of illustration from the theories of mechanics, heat and electromagnetism. Historical sketches were given of examples leading to familiar general notions in the theories of quadratic forms, modern geometry, differential and integral equations. It is to be hoped that this paper may be available to those not present at the meetings.

6. Professor Moore in his discussion discriminated between the different aspects of research. (1) The process. In research in applied mathematics this does not differ essentially from that in pure mathematics, except that the latter does not need the elaborate equipment necessary in the former. The main speaker, it was pointed out, had brought out the fact that he who comes to pure research with a large

background of experimental knowledge has a great aid in his work. Professor Moore instanced by reference to his own study of matrices the possibility of the discovery through generalization of tools of great usefulness. (2) Ideals of research, (a) of the individual, (b) of the group of individuals. Here distinct advantages come directly from the "right" of the experimental sciences to the "left" of the abstract fields; the "foundations" may well serve to make a contribution in the reverse direction. We have much in evidence at the present time in the way of scholarship and of research ability. We must develop the ideal of the group, as is beginning to be done in this country. (3) The form. One should choose the form in which he casts his research such that it shall be most clearly understood by those not conversant with his subject.

There must be a differentiation between various parts of research, yet if science is to advance, there must be a compensatory unifying principle. While mathematical principles have emerged, sometimes directly and logically, sometimes by way of analogy, from the various sciences as described by Dr. Lunn, in the higher reaches of pure mathematics there should be a working out of the principles embodied, in physical research in a form free from mere analogy. ...

The following advanced courses are announced for the summer session of 1922: University of Chicago: First term, June 19–July 16; second term, July 27–September 1. ... By Professor A. C. Lunn: Statistics and probability; Vector analysis.

The following advanced courses are announced by Professor A. C. Lunn, University of Chicago, for the academic year 1922–1923: Units and dimensions, Dynamics of continuous media, Canonical equations and quantum theory, Thermodynamics.

The following mathematical courses are announced by Prof. A. C. Lunn, University of Chicago, for the academic year 1923–1924: Vector analysis, Applications of vector analysis in the theory of electromagnetism, Thermodynamics, Vector analysis in Riemann–Einstein space.

The following graduate mathematical courses are announced by Prof. A. C. Lunn, University of Chicago, for the summer of 1926: Development of optical theories, Vector analysis, Reading and research in applied mathematics.

In the paper: George B. Kauffmann, In memoriam Martin D. Kamen (1913–2002), molecular scientist and biochemist, *The Chemical Educator* **7** (2002) 304–308, we find the following interesting sentence, referring to year 1933: *Mathematician and musician Arthur C. Lunn was the only professor who exerted any great influence on him,* [on Martin D. Kamen] *but Martin decided to continue graduate work at Chicago*

under nuclear chemist William Draper Harkins (1873–1951) because he was a senior professor, and, as his student, Martin would have a better chance of getting a job.

The 43th summer meeting of the American Mathematical Society was held at the Pennsylvania State College, State College, Pennsylvania, September 7–10, 1937. ... The titles and cross references to abstracts of papers read at this meeting are given below. ... Mr. J. K. Senior was presented by Professor A. C. Lunn,

...

100. The groups of order 64 (preliminary report), Mr. Philip Hall and Mr. J. K. Senior.

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SOME PAPERS BY A. C. LUNN AND J. K. SENIOR

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