Andrzej Trautman
Institute of Theoretical Physics
University of Warsaw

MYRON MATHISSON:
What little we know of his life

About the conference and this talk

Primary sources

Several articles by Bronisław Średniawa; in particular

Myron Mathisson (1897-1940) *Postępy Fizyki*
33 (1982) 373-383 (in Polish)

Myron Mathisson's and Jan Weyssenhoff's Work on the Problem of Motion in General Relativity, pp. 400–406 in:
Studies in the History of General Relativity
J. Eisenstaedt and A. J. Kox eds, Birkhäuser, Boston 1992

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12 papers published by Myron Mathisson (MM)

The Mathisson file in the Albert-Einstein-Archives (thanks to Tilman Sauer; he recently found new material that will be

described in his lecture)

Material in possession of Stanisław Bażański:

- excerpts from the University of Warsaw Archive
- two letters from Mrs Irena Gill, the widow of MM
- a letter from prof. B. L. Laptev, University of Kazan

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An important **secondary source** is Peter Havas *The Early History of the "Problem of Motion" in General Relativity* (in: *Procs of the 1986 Osgood Hill Conf.*, D. Howard and

J. Stachel eds, Birkhäuser, Boston 1988)

In this historical account, Havas is very critical of the work on the problem of motion done by Einstein and (especially) Infeld; he gives much credit to MM and writes that "Mathisson's contributions were far more original than Infeld's and introduced far better mathematical methods." He speculates that "if Einstein had succeeded in getting Mathisson to join him in Berlin or Princeton...there would have been no EIH, but presumably an EMH..."

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The article of Havas was scheduled to be reviewed at this conference by John Stachel who, unfortunately, could not come for health reasons.

Early years

Myron Mathisson was born in Warsaw on 14 December 1897; his parents, Hirsh and Khana were relatively well-off, as may be inferred from their 'good' address here (Polna 70, now Noakowskiego 16) and the excellent education received by MM

Early years

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Namely, he attended, from 1906 to 1915, a Russian philological gymnasium named after *The Great Prince Aleksy Mikolayevich, The Successor to the Throne*, one of the best secondary schools in Warsaw at the time.

His high school diploma ('matura') contains grades in Russian, Latin, Greek, German and French (Polish was then not allowed in schools), also mathematics and physics; all excellent, gold medal.

Questions: What language was spoken in the Mathisson household? Hebrew? Russian? Polish? Yiddish never mentioned by MM

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When did they move from Riga to Warsaw?

What was the profession or business of Hirsh Mathisson?

1915-31 Studies and Ph.D.

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In 1917 he started to follow the activity of the physics lab at Warsaw University.

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interrupt his studies and resulted in a deterioration of the financial situation of the family.

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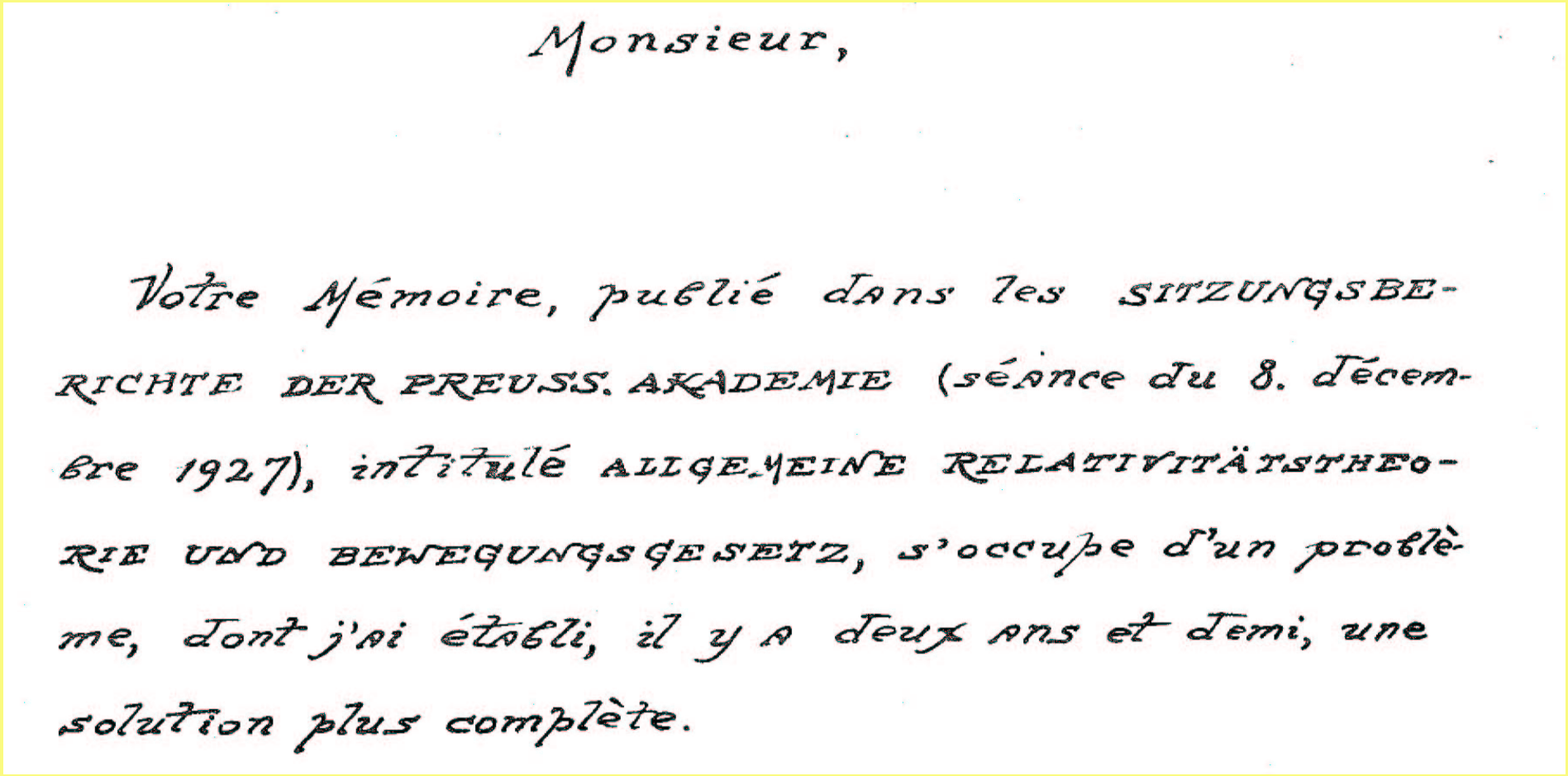
After having returned to Warsaw, he continued to work, in solitude, on the problem of motion in GRT. His small income was derived from giving lessons of Hebrew and performing some auxiliary tasks for the construction engineers.

On 18 December 1929 MM wrote his first letter to Einstein



Monsieur,

Votre Mémoire, publié dans les SITZUNGSBERICHTE DER PREUSS. AKADEMIE (séance du 8. décembre 1927), intitulé ALLGEMEINE RELATIVITÄTSTHEORIE UND BEWEGUNGSGESETZ, s'occupe d'un problème, dont j'ai établi, il y a deux ans et demi, une solution plus complète.

On reading it, one is impressed by the quality of his French

and the audacity of his criticism of Einstein's paper: MM writes that Einstein neglects radiation and deviations from spherical symmetry, these approximations being due to the

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In this 11-page letter MM described, in general terms, without equations, his views on the problem of motion in general relativity; he also complained of his difficult financial situation.

Je ne vous écris pas en hébreu (ce qui serait bien commode pour moi), parce que je ne sais pas, si vous en seriez content.

Veuillez excuser, Monsieur, le dérangement que je vous occasionne et agréez l'expression de mon dévouement et de mon admiration profondes.

Myron Mathisson.

Einstein replied by inviting MM to come to Berlin to collaborate with him (no trace of that letter in the Archive; it may have been hand-written).

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An exchange of several letters followed; Einstein wrote to Białobrzeski suggesting that MM be awarded a Ph.D. degree on the basis of his results on the problem of motion; he also offered to cover the expenses connected with presenting the thesis and criticized MM's use of an elaborate (Schouten's) notation for integrals on manifolds.

SUMMIS AUSPICIIS

SERENISSIMAE REI PUBLICAE POLONORUM

NOS

MIECISLAUS MICHAŁOWICZ

MEDICINAE DOCTOR, PAEDIATRIAE PROFESSOR, H. T. UNIVERSITATIS VARSOVIENSIS RECTOR MAGNIFICUS

STEPHANUS MAZURKIEWICZ

PHILOSOPHIAE DOCTOR, MATHEMATICES PROFESSOR, FACULTATIS SCIENTIARUM H. T. DECANUS

ET

CESLAUS BIAŁOBRZESKI

PHYSICAE ET GEOPHYSICAE MAGISTER, PHYSICAE THEORETICAE PROFESSOR, PROMOTOR RITE CONSTITUTUS

IN VIRUM CLARISSIMUM

MYRONEM MATHISON

natione Polonum, Varsovia oriundum,
postquam et dissertatione quae inscribitur:
„Ogólna teorja względności a dynamika elektronu"
et examinibus legitimis laudabilem primum in physica, deinde in mathematica
et in philosophia doctrinam probavit,
doctoris philosophiae
nomen et honores, iura et privilegia contulimus
in eiusque rei fidem
hasce litteras Universitatis sigillo sanciendas curavimus.

VARSOVIAE, DIE XXXI OCTOBRIS ANNI MCMXXX.

MIECISLAUS MICHAŁOWICZ
H. T. RECTOR MAGNIFICUS

STEPHANUS MAZURKIEWICZ
H. T. DECANUS

CESLAUS BIAŁOBRZESKI
PROMOTOR

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Those papers contain an implicit polemic with Einstein and his approach to the problem of motion. In particular, MM shows that nonlinearity of the field eqs is not essential for obtaining from them the equations of motion.MM uses in his papers the geometry of null elements, a novelty at that time; e.g. in

Minkowski space, given a time-like world-line $z^\mu(s)$, he introduces two functions u and r of $x = (x^\mu)$, such that the vector $l^\mu(x) = x^\mu - z^\mu(u(x))$ is null and oriented towards the future and $r = \dot{z}_\mu l^\mu$; he shows that the Liénard–Wiechert potential is then $A^\mu = e\dot{z}^\mu/r$.

Einstein tried to obtain a Rockefeller fellowship for MM; in spite of his many efforts, that included writing a personal letter to John D. Rockefeller Jr, MM never obtained that fellowship, presumably because he had no permanent academic position.

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In 1931 MM wrote his first paper on a new approach to the study of fundamental solutions of partial differential equations of the hyperbolic type; the paper was sent by Einstein to the

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In September 1931, MM wrote to Einstein, in German, that he had saved some money and could visit him in Berlin; he also mentioned that he was considering looking for a job in Russia or the Palestine, because *'in Polen ist kein Platz da für Leute meiner Nationalität'*. The visit was not realized because Einstein was then about to go to the United States. They never met.

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1932-35: Habilitation, lectures in Warsaw and first visit to Paris

In 1932 MM obtained a habilitation at Warsaw University that allowed him to use the title of 'docent' (analog of the German

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During the academic year 1933-34, MM gave at Warsaw University, in his capacity of docent, four courses of lectures: *Applications of the theory of groups to quantum theory* (based on Wigner's book), *Theory of relativity*, *Tensor calculus* (according to Schouten), and *Cosmology*. He also conducted, together with Białobrzeski and Nikodym, the main seminar on theoretical physics.

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MM's work on partial differential equations attracted the attention of Jacques Hadamard who, in 1933, wrote to Einstein saying that his recommendation could secure a stipend for

Mathisson to come to Paris. Einstein, then himself a refugee in Belgium, wrote such a letter of recommendation for MM to the mathematician Paul Montel in Paris. MM continued work on partial differential equations and published, in 1934, in a Polish journal, another paper on the subject.

Some time during 1934-35 MM went to Paris and collaborated with Hadamard. He also attended a conference at the Niels Bohr Institute in Copenhagen

‘Erst muss ich essen!’

Mathisson, Pauli, Dieke

(Question: dates?)

1936-37: appointment in Kazan

On 3 Nov. 1935 Einstein wrote to Hadamard saying that MM could come for a year to the IAS in Princeton and asking for his current address. He also wrote a letter to MM sent to Paris and containing an invitation for MM (no copy in the Archive). The letters were forwarded by Mlle Jacqueline Hadamard, a daughter of the mathematician, to MM who was then in Russia

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Presumably, the letters had taken a long time to reach MM; his reply was dated 'Moscou, le 23 juin 1936'. Delighted by the invitation, MM wrote that he could come to Princeton for the academic year 1937-38, after a year spent in Moscow and Kazan. He also commented favorably on the conditions of work

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Questions: How and by whom was MM's appointment in Kazan arranged?
What did he do in Moscow?

In a letter of July 7, 1936, Einstein expressed delight with the news that MM had found good conditions to work in Soviet Russia. He wrote that, considering how many scientists have now been deprived of the possibility to work, it would not be right to invite MM to IAS. In a PS, Einstein mentions that he has shown, with Rosen, that there are no gravitational waves.

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MM's next letter, from Kazan, is dated 18 April 1937; he refers to Einstein's results on gravitational waves as being in agreement with his work on Huygens' principle and the diffusion of waves in curved spaces. He expects to travel in June to Paris and gives, for correspondence, his mother's address in Warsaw (Leszno 47, not as good as the previous one).

The letter of May 7, 1937, is the last, in the Archive, from Einstein to MM. It is a little cooler than earlier letters; Einstein writes about his collaboration with 'your colleague' Infeld (and with Hoffmann). They have developed a new method (EIH) of deriving the equations of motion of point masses and have shown that there are no additional conditions that could be interpreted as corresponding to quantum phenomena.

MM left Kazan at the end of May, 1937 and went on a short visit to Paris; in a letter from Warsaw, dated 5 Sept. 1937, he explained that he would not return to Kazan because 'already at the end of May the situation of a foreigner there was unbearable'; he left behind all his belongings and books

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A few months after returning from Kazan, MM sends to *Acta Physica Polonica* his most important paper $Neue\ Mechanik\ materieller\ Systeme$, recently translated into English by Anita Ehlers and due to appear as a 'Golden Oldie' in the *Journal on General Relativity and Gravitation*. In this paper, MM introduced the notion of a 'gravitational skeleton' and gave a derivation of the coupling between spin and curvature.

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1938-39: Cracow

Some time at the end of 1937 or beginning of 1938, MM went to Cracow at the invitation of Jan Weyssenhoff, who, in 1935, had been appointed as professor of theoretical physics at the Jagellonian University. Unlike in Warsaw, he found there a congenial atmosphere to work; he collaborated with Weyssenhoff, J. Lubański and A. Bielecki; Weyssenhoff found financial support for him from private sources (Leon Rappaport, his colleague from Warsaw University, was among those helping him; information from Andrzej Schinzel).

A young mathematician from Cracow, Irena Jungermann,

became MM's wife

His stay in Cracow exerted a long-lasting influence on research in theoretical physics there; Weyssenhoff and his students continued to work on the motion of particles with structure in gravitational and electromagnetic fields until the late 1960s. Especially important was the extension, due to Weyssenhoff and Antoni Raabe, of Mathisson's ideas to continuous media and, in particular, the development of a relativistic theory of 'spinning fluids'. A review of that work is in
B. Średniawa *Three essays on the history of relativity in Cracow Universitatis Jagellonicae Folia Physica* **37** (1994)

1939-40: Paris and Cambridge

In the spring of 1939, the Mathissons went to Paris. Presumably during the stay there, MM wrote a short note on *Le problème de M. Hadamard relatif à la diffusion des ondes*, that Hadamard presented to the *Comptes Rendus*. Later that year a longer paper under the same title appeared in the Swedish *Acta Math.* **71** (1939) 249–282. It is considered to be the most important mathematical paper by MM: it presents the first proof, in a special case, of Hadamard's conjecture on the class of hyperbolic differential equations that satisfy Huygens' principle.

This work, and further developments, will be reviewed here by Ray McLenaghan.

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that Myron's parents came to Warsaw from Riga, that Myron was not an easy man to reach and to get to know, and that he died of TB, not of hunger, as suggested by Infeld in his autobiographical sketch *Kordian, fizyka i ja*.

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MM had good contacts with physicists in Cambridge; in the first paper written there he thanks M H L Pryce for valuable suggestions. MM made an impression on P A M Dirac who edited and published, posthumously, his last paper and wrote his obituary for *Nature*

RELATIVISTIC DYNAMICS OF A SPINNING MAGNETIC PARTICLE

By MYRON MATHISSON†

Communicated by P. A. M. Dirac

Received 1 July 1941

The work is a continuation of the author's paper 'The variational equation of relativistic dynamics' (*Proc. Cambridge Phil. Soc.* 36 (1940), 331). The same notation is used as in that paper, and references to equations numbered from (1·1) to (10·30) apply to that paper‡.

11. Solution of the variational equation

Some questions which were only treated in a summary way, or not at all, in the paper quoted above, will now be elucidated.

We call a solution of the equation (9·7) a system of relations between the m's, the X's, and the path L. The relations have to be independent of the field ξ_β and to form necessary and sufficient conditions under which the variational equation is satisfied by every field ξ_β compatible with the conditions at the limits.

Let us consider $P(s)$ as a variable point on L, and refer the world to a variable Lorentz system (x'), like that introduced on p. 332 of the earlier paper, in which, for each value of s, the origin is at $P(s)$ and the tangent u^λ to L at $P(s)$ is the x'^4-axis. The arbitrary character of the field ξ_β allows us to define it by the Taylor series

$$\xi'_\beta(x'^1, x'^2, x'^3, 0) = (\xi'_\beta)_P + x'^i(\partial'_i\xi'_\beta)_P + \tfrac{1}{2}x'^i x'^j(\partial'_i\partial'_j\xi'_\beta)_P + \ldots, \qquad (11\cdot1)$$

given for every $P(s)$, each series being referred to the respective frame of co-ordinates. Each series (11·1) is defined by the following quantities which are independent of one another:

$$\left.\begin{aligned} &(a)\ 4 \text{ components } \xi'_\beta \text{ at } P,\\ &(b)\ 12 \text{ components } \partial'_i\xi'_\beta \text{ at } P,\\ &(c)\ 24 \text{ components } \partial'_i\partial'_j\xi'_\beta \text{ at } P, \text{ etc.} \end{aligned}\right\} \qquad (11\cdot2)$$

† This work was found in an unfinished state among the papers left by Dr Myron Mathisson, who died on 13 September 1940. I have edited it and have added a summary. There was also some work to show that the condition of integrability of the magnitude of the angular momentum requires the electric moment to vanish (and not merely to be parallel to the magnetic moment), but I was not able to follow the arguments and have omitted this part. [P.A.M. Dirac.]

‡ The following misprints have been noted. The integrands of (8·8) and (8·13) should

Dr. M. Mathisson

THE death of Dr. Myron Mathisson on September 13 at the early age of forty-three has cut short an interesting line of research. Mathisson had been engaged for many years in studying the general dynamical laws governing the motion of a particle, with possibly a spin or a moment, in a gravitational or electromagnetic field, and had developed a powerful method of his own for passing from field equations to particle equations. The subject is of particular interest at the present time, as it has now become clear that quantum mechanics cannot solve the difficulties that arise in connexion with the interaction of point particles with fields, and a deeper classical analysis of the problem is needed. It is much to be regretted that Mathisson's death has occurred before the relations between his method and those of other workers on the subject have been completely elucidated.

Mathisson carried out his work at the Universities of Warsaw and Kazan and at an institute which he started in Cracow, and, since the spring of 1939, at Cambridge.

P. A. M. DIRAC.

Hadamard was so impressed by the work of Mathisson that, after his death, living then in New York as a refugee from Nazi-occupied Paris, he published in the prestigious *Annals of Mathematics* a paper dedicated to MM and containing an exposition of his result:

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THE PROBLEM OF DIFFUSION OF WAVES

BY J. HADAMARD

(Received March 26, 1942)

To the memory of MYRON MATHISON, whose premature death is a cruel loss to Science, I dedicate this treatment of the problem which he has solved so beautifully.

1

The various forms of Huygens' principle concern (as studied heretofore) phenomena governed by linear partial differential equations of the second order[1]

$$\text{(E)} \qquad F(u) = A^{kl}\frac{\partial^2 u}{\partial x^k\,\partial x^l} + \cdots = \begin{cases} 0 & \text{(homogeneous equation)} \\ f(x) & \text{(inhomogeneous equation)}, \end{cases}$$