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THE ORIGINS OF SEMINAR SOPHUS LIE

A KEYNOTE ADDRESS TO THE 50th SESSION OF SEMINAR SOPHUS LIE

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Editorial Note. Karl Strambach was invited to open the 50th meeting of Seminar Sophus Lie with a keynote address about its origin and its early history. When he accepted this invitation, neither could he know that his presentation on September 26 of 2016 would be his last public appearance nor did he foresee that the notes of his lecture would be his last publication. He died most unexpectedly on October 10 of 2016.

It was finally possible to retrieve the text of his lecture in Będlewo from the electronic files in his computer. As is immediately visible, he had put considerable effort in reconstructing the historical background and the developments that led to the opening of Seminar Sophus Lie in January of the year of 1991 in Leipzig and to trace the first couple of meetings up to the point when their proceedings were consolidated to a rigorously formal opening of *Journal of Lie Theory*. We publish his notes now as the introduction to the present collection. It is a legacy to the mathematical community whom he has faithfully served during all of his professional life and who will sorely miss his collegial and warmhearted spirit.[1]

The Editors

Dear Friends, Ladies and Gentlemen!

It is a strange feeling that I should speak on some historical and philosophical aspects of mathematics and not on proper mathematics itself. But Karl Heinrich Hofmann and Karl-Hermann Neeb asked me to report on the origins of Seminar Sophus Lie as an institution. Although I was a member of Seminar Sophus Lie from the beginning, I am not

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The paper is in final form and no version of it will be published elsewhere.

[1] An obituary of Karl Strambach appeared recently: Theo Grundhöfer and Rainer Löwen, *In memoriam Karl Strambach*, Adv. Geom. 17 (2017), 1–3, DOI: 10.1515/advgeom-2016-0035.

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the right person to give a completely competent presentation of the history of Seminar Sophus Lie since I followed and supported the "spiritus rector" and main founder of this seminar, Karl Heinrich Hofmann. Since I had not taken part in the original discussions which led to its foundation, for this retrospect, I sought to obtain more original information about the start of the Seminar by visiting Günter Czichowski and Hartmut Schlosser in Greifswald and by having a telephone interview with Konrad Schmüdgen in Leipzig. Together with Professor Helmut Boseck, these mathematicians played a significant role in the realization of Seminar Sophus Lie on the part of East Germany. Helmut Boseck passed away in 2012. I regret that of the three living actors none is present.

The foundation of Sophus Lie Seminar is intimately related to the German reunification. From 1890 to the construction of the Berlin Wall in 1961, German mathematicians had been organized in the Deutsche Mathematiker Vereinigung (DMV). The Wall rendered natural scientific contacts between mathematicians in East and West Germany impossible. A consequence was the foundation of the Mathematische Gesellschaft der DDR (MGDDR) in July 1962. Not until the fall of the Berlin Wall in November 1989 and the election of the new, democratically authorized Government of the German Democratic Republic in March 1990, could contacts between scientists from East and West Germany reopen. Accordingly, in September 1990, hundred years after the foundation of the Deutsche Mathematiker Vereinigung, the two associations DMV and MGDDR were united again under the name of "Deutsche Mathematiker Vereinigung".

Professor Hofmann from Darmstadt in West Germany understood immediately that the new political situation would permit a reconstruction of close relations between the West German and the East German mathematical communities. In the summer of 1990 he invited Professor Konrad Schmüdgen from Leipzig to give a lecture in Darmstadt. He was the responsible director for mathematical research at the University of Leipzig. The opportunity of his visit allowed him and Karl Heinrich Hofmann to ventilate the possibilities of possible financial support on the part of the Deutsche Forschungsgemeinschaft for enhancing the scientific collaboration between mathematicians of Federal Republic of Germany and German Democratic Republic in the area of Lie Theory and its applications. To both of them it was clear that for the success of a grant application at least four universities, two from West Germany and two from East Germany had to be included in a proposal. The result of their discussion was that mathematicians in Erlangen and Greifswald were to be asked to join Darmstadt and Leipzig in a grant application to the Deutsche Forschungsgemeinschaft.

For myself and Professor Plaumann it was self-evident and a great honor to have steady contact with Professor Hofmann. We knew him since 1965, when we, as students in Frankfurt, listened to the marvelous lectures given by him as guest of Reinhold Baer. At that time he was a very young university teacher in Tübingen and New Orleans, and he was the most elegantly dressed man I knew. The choice of Greifswald was based not only on the fact that the research field of Helmut Boseck, Günter Czichowski and Hartmut Schlosser covered Lie groups and their applications with particular emphasis on the theory of differential equations and their symmetries, but also on the fact that Helmut Boseck at the time of the German Democratic Republic, was the director of mathematical

research at the university of Greifswald. Indeed, in the subsequent period from 1990 to 1996, as the director of the mathematical institute, he organized the restructuring of the institute in such a way that none of its members was forced to leave the university.

The application for support from the Deutsche Forschungsgemeinschaft by the universities Leipzig, Greifswald, Darmstadt and Erlangen was submitted on August 22, 1990. Since it was quickly approved, the first session of *Seminar Sophus Lie* could take place in Leipzig in January 1991.

The content of the mathematical lectures given at this conference is documented in issue 1 of the first volume in 1991 of the proceedings of Seminar Sophus Lie. They were organized in 4 chapters, one for each of the 4 universities.

Ch 1 *Quantum Lie groups* by Konrad Schmüdgen and by Rainer Mathes from Leipzig.
Ch 2 *The Lie Theory of Semigroups* by Karl H. Hofmann, Anselm Eggert, Karl-Hermann Neeb, Ulrike Zimmermann, Norbert Dörr and Christian Terp—which documents the enormous mathematical power of the Darmstadt group.
Ch 3 *Computer Algebra and Lie Theory* by Günter Czichowski and Hartmut Schlosser.
Ch 4 *Lie Groups in Geometry* by Peter Plaumann and Karl Strambach on simply connected solvable Lie groups having a system $\mathcal{S}$ of closed subgroups such that each element different from the identity belongs to precisely one subgroup of $\mathcal{S}$.

The stay in Leipzig left in me, beyond mathematics, lasting impressions. The temperature in the university hotel in which I stayed overnight was so high that I was forced to sleep in January with open windows. —The next day, a visit in a café gave me a bit of a shock. Three months after the reunification I noticed an officer in the uniform of West German Army calmly drinking his cup of coffee and nobody of the other guests seemed astonished.

As usual, Deutsche Forschungsgemeinschaft required reports about the Sophus Lie conferences. But who would finance the proceedings from here on out? The university in Darmstadt rejected any long term financial support. In this situation it was fortunate that Professor Hofmann was a series editor and consultant of the mathematics publisher Norbert Heldermann of Heldermann Verlag. Some monographs recommended by Professor Hofmann, even though some of them dealt with relatively exotic subjects such as quasi-groups and loops, turned out to be profitable from a financial point of view. Norbert Heldermann, himself a Professor of Mathematics at the University of Applied Science Ostwestfalen-Lippe in Lemgo, meanwhile having retired from this commitment since last year, accepted the proposal by Professor Hofmann to attempt the publication of the proceedings for some one-time financial support, hoping that Seminar Sophus Lie would have a long-term future. So Heldermann agreed tentatively to publish the initial issues of the proceedings of Seminar Sophus Lie.

The second session of the Seminar Sophus Lie took place in Darmstadt, in June 1991. The collection of reports which appeared in *Seminar Sophus Lie* volume 1, number 2, falls into four domains of specialization.

Ch 1 *Lie superalgebras and Lie supergroups* with a contribution by Helmut Boseck, Greifswald,
Ch 2 *Quantum Lie Groups* with a contribution by Konrad Schmüdgen, Leipzig.

The main body of the contributions belong to

Ch 3 *Lie Groups, Convex Cones, Order and Semigroups.* The reports here originate not only from Karl-Hermann Neeb, Norbert Dörr, Dirk Mittenhuber, Angelika May, K. H. Hofmann, Darmstadt, and Joachim Hilgert, Erlangen, but also from Jacques Faraut, Paris, Jimmie Lawson, Baton Rouge, and Wolfgang Ruppert, Vienna.

Ch 4 *Structure Theory, Harmonic Analysis and Representation Theory* with contributions by Götz Gelbrich, Greifswald, Jürgen Friedrich and Frank Leitenberger, both from Leipzig.

The contributions by foreign mathematicians show that, after six months of its existence, Seminar Sophus Lie was attractive enough to motivate an international meeting of mathematicians. Since the opus magnum *Lie Groups, Convex Cones, and Semigroups* by Joachim Hilgert, Karl Heinrich Hofmann and Jimmie Lawson appeared in 1989, and since in this book fundamental theorems on Lie semigroups had been published, in the last part the contributions on Lie semigroups in issue 2 of the proceedings of Seminar Sophus Lie were scarcer than in issue 1.

During my inspection of the reports in issue number 2, I have been stirred by my memories of Hans Freudenthal from the time I was his assistant. In the introduction of her contribution, Angelika May included a short biography of Charles Loewner. It shows her firm respect which reflects the same admiration which Hans Freudenthal felt for Loewner. Although Freudenthal was only 12 years the junior of Loewner, he nevertheless considered the latter a strong source of inspiration for him. A photo of Charles Loewner decorated his desk.

The third session of the Seminar Sophus Lie took place in Erlangen in the winter of 1991/92. Most of the talks were divided into the same basic domains of specializations as in the second session. This is reflected by the names of the contributors: Helmut Boseck, Karl-Hermann Neeb and Dirk Mittenhuber, Karl Heinrich Hofmann, Michael Wüstner, Anselm Eggert, Hartmut Schlosser and Günter Czichowski. But in this session the participants were willing to include in the program of Seminar Sophus Lie topics less familiar to the majority of participants. For example, there were two contributions by Markus Stroppel on solvable groups of automorphisms of topological planes as well as on endomorphisms of topological planes.

After one year of successful existence of the Sophus Lie Seminar, the organizers were convinced that the Seminar should break out of the narrow confines of four universities. It would have to be open for a broader mathematical community around Lie groups and should acquire the greater permanence of a scientific project. To realize this aim they decided to ask the Deutsche Forschungsgemeinschaft for a four year grant in the domain of Lie theory (such as Lie groups, Lie algebras, super-Lie groups, super-Lie algebras, quantum groups, Lie semigroups, ordered symmetric spaces, representation theory) and appropriate applications. The applicants of this proposal from April 6, 1992 were not only members of the 4 universities organizing Seminar Sophus Lie from the beginning, namely, Helmut Boseck and Günter Czichowski from Greifswald, Karl Heinrich Hofmann from Darmstadt, Konrad Schmüdgen from Leipzig, Joachim Hilgert, Peter

Plaumann and Karl Strambach from Erlangen, but also Detlev Poguntke from Bielefeld. For Seminar Sophus Lie it was a great success that Detlev Poguntke and with him a link to the University of Bielefeld joined the group of the four original universities. Poguntke is not only an excellent mathematician, but also an outstandingly upright person who under no circumstances will hold back his own opinions. The proposal to the Deutsche Forschungsgemeinschaft is to be considered the founding document of Seminar Sophus Lie in its present form. In its content, the tasks of the Seminar are defined as follows:

1. To support in any participating mathematical department the research in Lie Theory.
2. To take care of young scientists, lead them to specific research and include them in current projects.
3. To meet in any semester for a common session.
4. To present the obtained scientific results in the series *Seminar Sophus Lie* which was already well known at the time and had the level of a good mathematical journal.

The proposal suggests the establishing of contacts with foreign groups working around Lie groups and the strengthening of those that already existed (Denmark, France, the Russian Commonwealth of Independent States, the Netherlands, Austria, Poland, USA). The proposal continues in describing research projects which in the participating universities are in the center of interest and which should be deepened. The subjects which had been presented in the first three issues of the proceedings of Seminar Sophus Lie would be complemented by *Harmonic Analysis and Spectra of Group Algebras*, a branch of mathematics that was intensively studied in Bielefeld.

The fourth session of Seminar Sophus Lie in the summer of 1992 took place in Greifswald. The majority of talks dealt with Lie groups while Lie semigroups remained in a minority. The new member of Seminar Sophus Lie, Detlef Poguntke, spoke on *Rigidly symmetric L^1-group algebras*. The foreign participants were Jimmie Lawson, Baton Rouge, Alexander Levichev and V. Levicheva, Novosibirsk, Sidney A. Morris, Melbourne. In issue 2 of volume 2 of the proceedings there are also two contributions dedicated to Karl Heinrich Hofmann on the occasion of his sixtieth birthday and one contribution dedicated to the life and work of our namesake Sophus Lie, authored with painstaking detail by Bernd Fritsche, the most faithful participant of Seminar Sophus Lie from Leipzig. Originally a physicist, he was employed at different institutions of the University of Leipzig where mostly historical questions were treated with the aim of explaining the development of mathematics on the basis of historical materialism. Bernd Fritsche, however, was not convinced that this philosophy should apply to mathematics. Indeed, he believed that the historical course of mathematics is determined by extraordinary mathematicians. Pursuing these ideas he developed a passion for Sophus Lie and left us a marvelous biography of him as a person and a scientist.

During the time of the German Democratic Republic, the University of Leipzig had many permanent positions for academic personnel below the professorial level. After the reunification of Germany, Leipzig was one of the locations where many employees on this level lost their jobs. We observed this social development within Seminar Sophus Lie. The number of members from Leipzig decreased substantially as the seminar sessions

progressed through the calendar. After Professor Schmüdgen, towards the end of the last century, requested a leave from Seminar Sophus Lie in order to concentrate his research fully on quantum groups, in the present century we have no member from Leipzig in Seminar Sophus Lie. But after my calls with Professor Schmüdgen I am permitted to convey good news to this audience: Professor Schmüdgen will organize a session of Seminar Sophus Lie in December 2017 on the occasion of the 175th anniversary of Sophus Lie's birth.

Bernd Fritsche was among the scientists dismissed in Leipzig. For me, he was a prototype of a noble scholar with a background of admirable universality. Yet he was unable to fight for himself in a world of high specialization and self-profiling. Nevertheless he was one of the inaugurators of the Arnold-Sommerfeld-Gesellschaft in Leipzig which was to provide a professional homestead for jobless scientists from the University of Leipzig. Both the Deutsche Forschungsgemeinschaft and the Federal Ministery of Science supported interdisciplinary scientific projects realized by members of the Gesellschaft and thus assisted them in their professional survival. Happily, through personal contacts, Bernd Fritsche found a teaching position at a technology-oriented Swiss school in Luzern. Although financially secure, he felt unhappy in this position which he saw as lacking intellectual challenges. Perhaps this was one reason for his premature death in February of 2012 at the age of sixty.

From the fifth session of Seminar Sophus Lie forward, which took place in Leipzig in the winter of 92/93, its organizers aimed to establish it as the most significant event around Lie groups in the whole mathematical community. So they contemplated the creation of a permanent outlet for outstanding publications in the field. At one of the Oberwolfach Conferences in Lie Theory, with the active and lasting cooperation of Ernest Borisovich Vinberg, intensive discussions were conducted to convert the proceedings of Seminar Sophus Lie into an international mathematical journal of high profile. So, after a brief delay in the publication sequence, after the appearance of volume 3 of *Seminar Sophus Lie* in 1993, volume 4 appeared under the new title of *Journal of Lie Theory*. Since that time the *Journal of Lie Theory* has established itself, first under the managing editor Karl Heinrich Hofmann, and since 1999 under the management of Karl-Hermann Neeb as a prestigeous mathematical periodical. The high acceptance under the active mathematicians and the ever increasing stream of good manuscripts made it necessary from 2006 on to increase the volume of published issues per year from two to four. The *Journal of Lie Theory* is included in the annual backlog survey of the American Mathematical Society and is classified to be one of the rank A journals in the "Journal Ranking of the Australian Mathematical Society for the ARC". It is also included in the Scopus database with the index 0.78 and an impact factor that has been oscillating around 0.5 for years. The 25 editors ensure that all aspects of Lie Theory and its applications are represented.

Although after 1993 the sessions of Sophus Lie Seminar regularly took place in Darmstadt, Erlangen, Bielefeld and Greifswald, the periods between two successive sessions in these places became longer. The reason for this is that young members of the Seminar obtained offers from other universities, for instance to Clausthal-Zellerfeld and

Paderborn, and these universities organized sessions, or new participants succumbed to the charming atmosphere of the seminar and convinced their institutions to join the seminar by organizing sessions. Under the places which offered the Sophus Lie Seminar a platform are Berlin, Bad Honnef, Göttingen, Stuttgart, Marburg an der Lahn, Vienna, Budapest, Lyon, Metz, Mulhouse, Nancy, Reims, Cluj-Napoca and Luxembourg. The structure of the sessions of Sophus Lie Seminar changed according to the laws of all successful scientific events. Mathematicians of all continents wanted to be an invited speaker and to present their results to an audience which can appreciate them.

A potential loss of a successful development of an established institution may threaten if the familiar intimacy and a certain permissiveness of occasional weakness and an isolated show of incompetence were to disappear. As in all areas of public life, so also in science we appear to be confronted with merely two possibilities: become great or become extinct. One important strength for the persistence of an institution prevails: namely, its attractiveness for young members of the community who are able to carry forth the tradition and to replace the gradual but noticeable disappearance of previous generations of supporters. I confess myself that I did not participate in recent sessions of Seminar Sophus Lie because I, too, was apprehended by the same old fear of attending big international conferences: the fear of being in the midst of dynamical young supermathematicians who show us all how mathematics should be done.

For Seminar Sophus Lie, Będlewo is not a new place. I participated here already in the fall of 2000 in an extended session which was, like the present one, a one week conference rather than, as is usual, a weekend meeting. The relations between Seminar Sophus Lie and Polish mathematics started early and soon developed into a permanent condition. Even in the first years of the existence of Seminar Sophus Lie, Polish mathematicians participated in its meetings and presented remarkable contributions. Among places of origin from which Polish mathematicians joined the sessions I notably recall the names of Warszawa, Wrocław and Olsztyn. Among the names of attending persons, two remain forever in my mind: Andrzej Hulanicki and Aleksander Strasburger. Both of them worked in harmonic analysis on nilpotent Lie groups. I surmise that herein lies the reason that Detlef Poguntke initiated contacts between Seminar Sophus Lie and the Polish analysts. However, I was shocked to learn that Professor Hulanicki passed away as early as in the year of 2008. All the more I am happy now that Professor Strasburger remains full of energy and organized this excellent meeting. He finished his university studies in 1967; so I estimate that he and I are of the same age, approximately. And in my mind I still hear him present his lectures on spherical harmonics at the earlier sessions of Seminar Sophus Lie.

Today the topics of the presentations and the participation of the audience show that Seminar Sophus Lie maintains all major present streams of Lie Theory. Yet the themes today are almost disconnected from the subject matters considered in the first year of the seminar. This is an impressive illustration of the fact that the taste in mathematical research changes as time progresses through the ages. I am afraid that, by way of example, a presentation of the mathematical subjects in which I am interested nowadays would hardly be allowed today. Perhaps they would be permitted to be shown on a poster.

Indeed it seems to me that the half-life period of most theorems is around ten years. Belonging to the best of mathematicians is based on the ability of swimming with the mainstream.

However, finally, I am convinced that Seminar Sophus Lie will meet and master all of these challenges and that, at a festive session celebrating the next 25 years of existence, Seminar Sophus Lie will still be in the center of trend-setting research in Lie Theory.