GEOMETRY AND TOPOLOGY OF MANIFOLDS
BANACH CENTER PUBLICATIONS, VOLUME 76
INSTITUTE OF MATHEMATICS
POLISH ACADEMY OF SCIENCES
WARSZAWA 2007

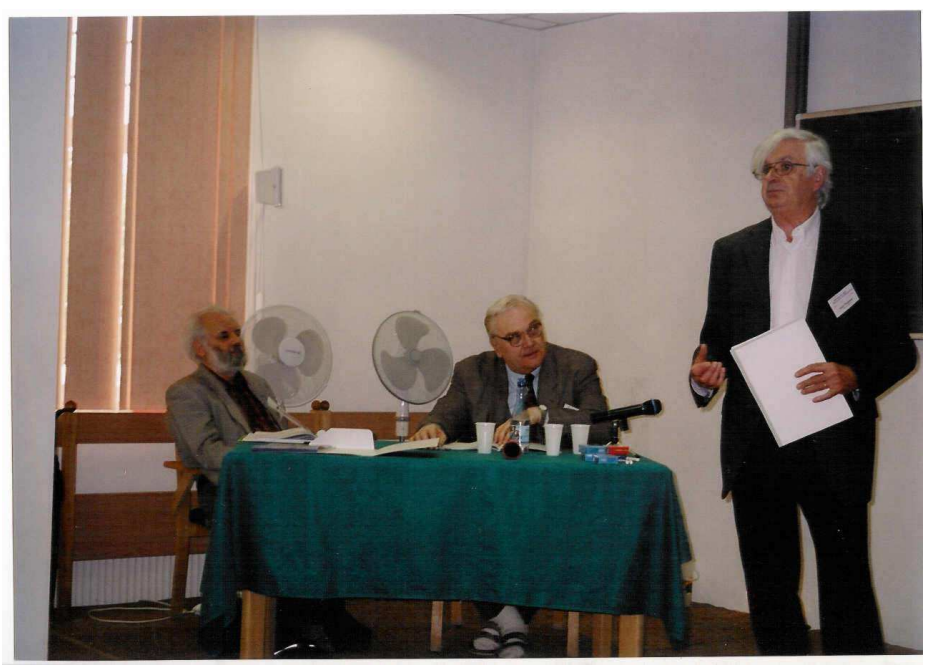
PREFACE

The conference *Geometry and Topology of Manifolds* was held at the conference center of the Banach Mathematical Center of the Polish Academy of Sciences in Będlewo, Poland, from the 8th May to 15th May 2005. It was dedicated to the memory of Charles Ehresmann to commemorate his 100th anniversary. Over 60 mathematicians from 20 countries participated in the conference.

A series of lectures by invited speakers recalled Ch. Ehresmann's achievements, his great ideas, and their influence on modern differential geometry and topology. Some of the lecturers knew Prof. Ehresmann personally and they shared their recollections with those who did not have the chance to meet and work with him. The other lectures dealt with elements of the theory of groupoids and algebroids, index theory, symplectic and Poisson geometry and their applications in geometry, topology and physics. They have amply demonstrated that Ehresmann's ideas are still of great importance and continue to influence modern geometry and topology.

The Editors

Jean Pradines during his lecture "In Charles Ehresmann's footsteps, from Group Geometries to Groupoid Geometries"; standing next to him Charles-Michel Marle, the Chairman of the session.



During the first session dedicated to Charles Ehresmann, *Free reminiscences on Professor Ehresmann*, from the left: Ronnie Brown, Ivan Kolář, Jean Pradines.

The first row: Bogdan Bojarski, Anders and Hanna Kock, Alexandre Rodrigues, Jean Pradines, Paulette Libermann, Michel Zisman. The second row: Pierre Lecomte, Dmitry Roytenberg, Johannes Huebschmann.

Alexandr S. Mishchenko during his lecture "K-theory over C^*-algebras, Minicourse"; standing on the left Anders Kock, the Chairman of the session.

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PROGRAMME OF THE CONFERENCE

SESSIONS DEDICATED TO CHARLES EHRESMANN (Lectures and speeches)

Session I

1. Paulette Libermann, Ch. Ehresmann's concepts in differential geometry
2. Andrée Charles Ehresmann (widow), How Charles Ehresmann's vision of geometry developed with time (read by Ronnie Brown)
3. Pierre Molino (speech read by Jean Pradines)
4. Wen-Tsun Wu (speech read by Jean Pradines)
5. Free reminiscences on Professor Ehresmann
6. Charles-Michel Marle, The works of Charles Ehresmann on connections: from Cartan connections to connections on fibre bundles, and some modern applications

Session II

1. Ronnie Brown, Groupoids, local-to-global, higher dimensions: three themes in the works of Charles Ehresmann
2. Ivan Kolář, Functorial prolongations of Lie groupoids
3. Anders Kock, Pregroupoids and their enveloping groupoids

Session III

1. Jean Pradines, In Charles Ehresmann's footsteps: from group geometries to groupoid geometries
2. Bertrand Monthubert, Groupoids and index theory in the singular manifolds setting
3. Alexandre A. M. Rodrigues, Contact and equivalence of submanifolds of homogeneous spaces

Session IV

1. Gaël Meigniez, The nature of fibrations and of bundles
2. Michel Zisman, Quasi-commutative cochains in algebraic topology (after Max Karoubi)
3. Jean-Claude Hausmann, Robot arms and Moebius transformation (the snake charmer algorithm) (joint work with Eugenio Rodriguez)
4. Włodzimierz Tulczyjew, Modernization of Ehresmann's jet theory

MINICOURSE

Alexandr S.Mishchenko, K-theory over C^*-algebras

1. Some elementary and evident examples
2. Almost flat bundles from the point of view of C^*-algebras
3. Twisted K-theory due to M. Atiyah and G. Segal

OTHER LECTURES

1. Kōjun Abe (joint work with Kazuhiko Fukui), On the first homology group of the group of diffeomorphisms of a smooth orbifold and its applications
2. Bogdan Balcerzak, Secondary characteristic classes for extensions of anchored Leibniz algebras
3. Marcin Bobieński (joint work with P. Nurowski), On SO(3) geometry in dimension five
4. Beniamino Cappelletti Montano, On Legendrian foliations on almost $\mathcal{S}$-manifolds
5. Jürgen Eichhorn, Absolute and relative characteristic numbers for open manifolds, their application to bordism theory and the Novikov conjecture
6. Sarah Hansoul, Existence of natural and projectively equivariant quantizations
7. Johannes Huebschmann, Stratified Kähler structures on adjoint quotients
8. Josef Janyška, Higher order Utiama's theorem
9. Giorgi Khimshiashvili (joint work with Bogdan Bojarski), Riemann–Hilbert problems in loop spaces.
10. Rémi Léandre, Stochastic Poisson-sigma model
11. Jacek Lech (joint work with Tomasz Rybicki), Perfectness at infinity of diffeomorphism groups on open manifolds
12. Pierre Lecomte, From a Euclidian space to Cartan geometries: how to rebuild a differential operator from its principal symbol?
13. Piotr Mormul, Nilpotent algebras hidden in special multi-flags
14. Ryszard Nest, The geometry of the calculus of Fourier integral operators
15. Andriy Panasyuk, Algebraic Nijenhuis operators and Kronecker Poisson pencils
16. Krzysztof Pawałowski (joint work with Ronald Solomon and Toshio Sumi), A proof of the Laitinen conjecture
17. Norbert Poncin (joint work with Janusz Grabowski), On the Chevalley–Eilenberg cohomology of some infinite-dimensional algebras of geometric origin
18. Paul Popescu (joint work with Marcela Popescu), On the high order geometry on osculator spaces and anchored vector bundles
19. Anatoliy Prykarpatsky, Ergodic measures of Boole type dynamical systems on an axis: analytical aspects
20. Dmitry Roytenberg, Higher Lie algebras in Poisson geometry and elsewhere
21. Tomasz Rybicki, Commutators of equivariant homeomorphisms on G-manifolds with one orbit type
22. Michał Sadowski, Complete flat manifolds

23. Pavol Severa, Dirac structures and deformation quantization
24. Vladimir Sharko, The L^2-invariants and non-singular Morse–Smale flows on manifolds
25. David Szeghy, Conjugate and focal points in semi-Riemann geometry
26. Nicolae Teleman, Linear quasi-connections
27. Cornelia Vizman, A geometric construction of abelian Lie group extensions
28. Robert Wolak, Minimality and Poincaré duality for basic cohomology of singular riemannian foliations
29. Weiping Zhang, Bergman kernel and symplectic reduction
30. Nina Zhukova, Singular foliations with Ehresmann connections
31. Henryk Żołądek (joint work with Maciej Borodzik), Classification of complex plane affine algebraic curves with zero Euler characteristic

THE MATHEMATICAL LEGACY OF CHARLES EHRESMANN

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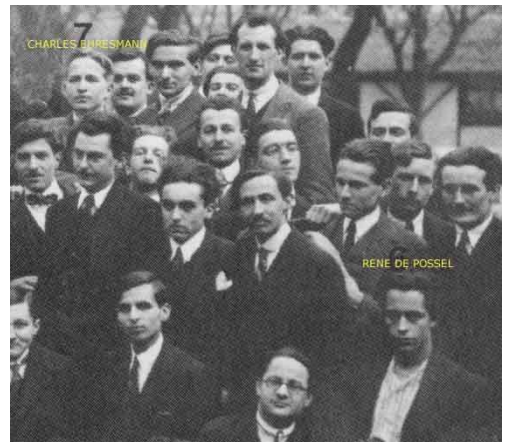
CHARLES EHRESMANN

Charles Ehresmann was born in Strasbourg on the 19th April 1905. From 1924 to 1927 he studied at the prestigious École Normale Supérieure in Paris.

The years 1932–34 Ehresmann spent in Paris and Göttingen where he worked with Elie Cartan and Hermann Weyl, respectively. Then he continued his research in Princeton. In 1934 he received the degree of Docteur ès Sciences Mathématiques for a thesis prepared under the supervision of Elie Cartan. From 1934 to 1939 he was a researcher at C.N.R.S. In 1939 Ehresmann was nominated an assistant professor and then a professor at the Faculté des Sciences de Strasbourg.



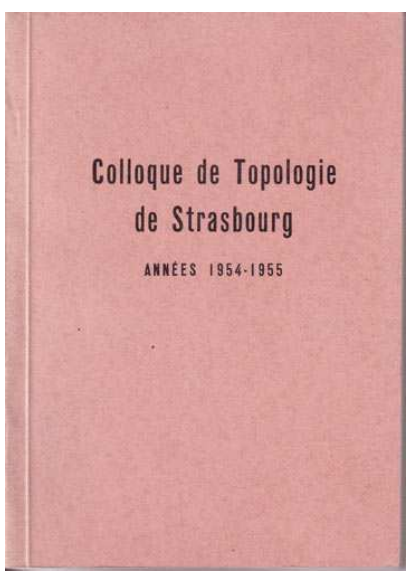
From 1955 to 1975, he was a professor at Sorbonne and then l'Université Paris VII.

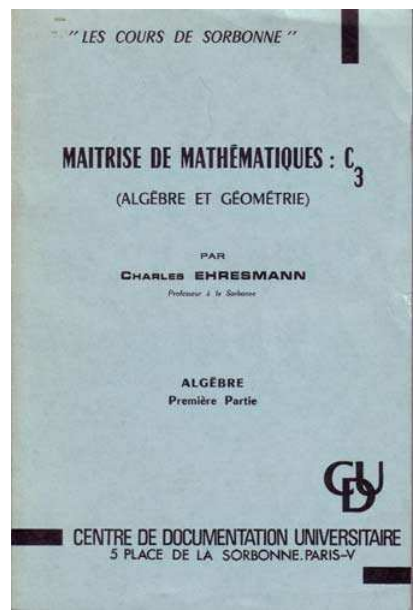
In 1975 he retired, but continued to lecture at l'Université de Picardie in Amiens. He died in 1979.

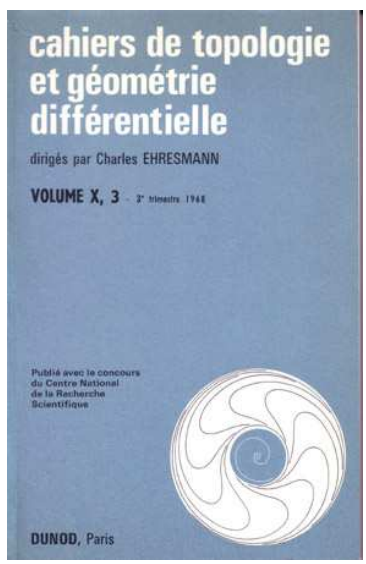
During his active university career he was a visiting professor, among other places, at Universidad do Brasil à Rio de Janeiro, Princeton University, Tata Institute à Bombay, Université de Mexico, University of Buenos Aires, University of São Paulo, Université de Montréal and Kansas University at Lawrence.

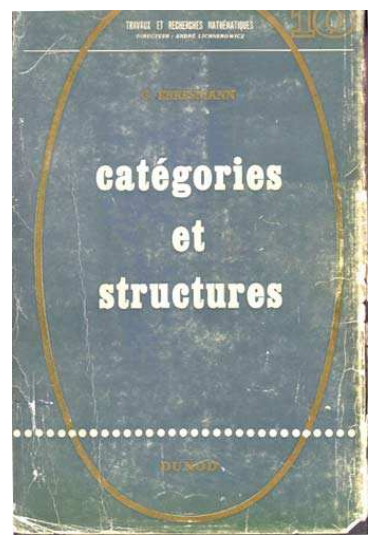
In 1957 he founded the international journal *Cahiers de Topologie et Géométrie Différentielle*, whose editor he remained till his death.From 1970 he was the editor of the publication series *Esquisses Mathématiques.*

In 1965, Ch. Ehresmann was the President of the *Société Mathématique de France.*









In 1967, he received the honorary doctor's degree from the Bologna University.

Ehresmann received the following prizes of l'Académie des Sciences : Prix Francoeur, Prix Bordin, Prix Petit d'Ormoy (in 1965).

He was the supervisor of 29 *thèses de Doctorat d'Etat*, 4 *thèses de Doctorat d'Université*, and 47 *thèses de Doctorat de troisième cycle*.

Compiled by Robert Wolak
from information and photographs
provided by Mme Andrée Ch. Ehresmann

Pierre Molino
Montpellier, France (speech read by Jean Pradines)

L'œuvre originale de Charles Ehresmann mérite d'autant plus d'être commémorée que ce grand visionnaire a été, dans une certaine mesure, méconnu. Peu de mathématiciens ont innové comme lui, à la manière d'un artiste qui découvre de nouveaux paysages, dans une rêverie féconde où apparaissent des perspectives que d'autres découvriront plus tard. Ainsi de la théorie la plus générale des feuilletages singuliers. Souvent, on a eu peine à le suivre dans des anticipations dont, seul peut-être, il voyait d'emblée le contenu géométrique (ainsi de ses travaux sur les catégories). Il a devancé bien des développements à venir, comme le héros Balzacien du "Chef d'œuvre inconnu", ce peintre génial dont les toiles restent indéchiffrables dans leur modernité abstraite, laissant pourtant deviner, par un détail admirable, une vision nouvelle et profonde.

Wen-Tsun Wu
Beijing, People's Republic of China (speech read by Jean Pradines)

In the winter of 1947 several Chinese students including myself arrived at Strasbourg to study Mathematics there. We were ardently accepted by Ch. Ehresmann and began our mathematics research. During my stay of about two years in Strasbourg, I studied several topics about complex manifolds and Grassmannians. For both subjects Professor Ehresmann was doubtless one of the main creators. In particular the Grassmannians have become henceforth one of the main tools in my further research work. Even in quite recent years I have discovered by means of Grassmannians a method of defining the Chern classes and Chern numbers for an algebraic variety with arbitrary singularities. These newly defined classes and numbers may be computed explicitly in an easy way through the well known structure of Grassmannians mainly due to Ehresmann. All these were achieved owing to my acquaintance with the Grassmannians during my stay in Strasbourg. I shall explain in some detail how this is done in a mathematical paper dedicated to my teacher Charles Ehresmann in the near future.

André Haefliger
Genève, Switzerland (speech read by Jean Pradines)

Chers amis,

Je regrette beaucoup de ne pas pouvoir participer avec vous à cette commémoration du centième anniversaire de la naissance de Charles Ehresmann.

Celui qui a été mon maître dans les années 50 a eu une influence essentielle sur ma formation mathématique, et je lui en suis très reconnaissant. Je garde un souvenir lumineux de son accueil chaleureux à Strasbourg, de sa générosité de pensée et des longues conversations dans les bistrots du quartier latin.

C'est maintenant, avec le recul, que son rôle de pionnier dans de multiples directions est pleinement apprécié. Je pense en particulier à la notion de groupoïde différentiable, qui est au cœur de développements récents dans des domaines très variés. J'ai eu l'occasion d'évoquer dans un article récent intitulé *Naissance des feuilletages, d'Ehresmann-Reeb à Novikov* (à paraître chez Hermann dans un volume sur l'histoire de la géométrie dans la seconde moitié du $20^{ème}$ siècle) ses contributions essentielles aux fondements de la théorie des feuilletages. Il faudrait aussi rappeler bien sûr son rôle dans les développements de la topologie algébrique dans les années 30 et 40, alors qu'il côtoyait André Weil.

Je souhaite un grand succès pour votre rencontre et je serai en communion de pensée avec vous.