INFOMAT

MARS 2023

LUIS CAFFARELLI FÅR ABELPRISEN FOR 2023

INFOMAT kommer ut med 11 nummer i året og gis ut av Norsk Matematisk Forening. Deadline for neste utgave er alltid den 15. i neste måned. Stoff til INFOMAT sendes til

arnebs at math.uio.no

Foreningen har hjemmeside http://www.matematikkforeningen.no/
Ansvarlig redaktør er Arne B. Sletsjøe, Universitetet i Oslo

Matematisk kalender

2023

Mars:

28. GENERALFORSAMLING, NMF
<web.matematikkforeningen.no>

Mai:

23. ABELPRISUTDELING, Oslo
<www.abelprisen.no>

31.-2.juni MATRIC-KONFERANSE OM DIGITAL VURDERING, Trondheim
<www.uia.no/konferanser-og-seminarer/the-1st-northern-e-assessment-meeting-may-31-june-2-2023>

Juni:

19.-23. OKA THEORY AND COMPLEX GEOMETRY CONFERENCE 2023, Nordfjordeid
<www.mn.uio.no/math/english/research/projects/grand-drm/events/conferences/oka-theory-and-complex-geometry-2023/index.html>

August:

13.-18. HIGHER STRUCTURES IN ALGEBRA AND GEOMETRY, Nordfjordeid
<wiki.math.ntnu.no/nordfjordeid2023>

17.-18. NORWEGIAN NATIONAL Ph.D. MEETING, Trondheim
< www.nnpm.no>

Arrangementer

GENERALFORSAMLING, NORSK MATEMATISK FORENING, 28. mars 2023

Kjære NMF medlemmer.

Det ble dessverre ikke avholdt generalforsamling for Norsk Matematisk Forening for 2022. Styret innkaller herved til forsinket generalforsamling for 2022.

Tid: tirsdag 28/3/23 kl. 19:00
Join Zoom Meeting
https://uit.zoom.us/j/64914909485?pwd=bnNva0xlK1hWVEZkbTNBcllQRDBuZz09
Meeting ID: 649 1490 9485
Password: 826754

Saksliste:
1) Godkjennelse av innkalling og saksliste
2) Valg av møteleder og referent
3) Årsberetning
4) Regnskap 2021
5) Valg
6) Eventuelt

Saksliste og sakspapirer:
https://web.matematikkforeningen.no/2023/03/14/nmf-generalforsamling-2022/webclip.png

Merk: Forsamlingen er beslutningsdyktig om minst 15 medlemmer deltar. Det er anledning å gi skriftlig (epost) fullmakt for at andre medlemmer kan stemme på dine vegne. Dette kan gis til en som stiller på møtet, eller til styret.

MINIKONFERANSE OM DIGITAL VURDERING I MATEMATIKK I HØGARE UTDANNING, Trondheim, 31. mai-2. juni 2023

NTNU saman med MatRIC ynskjer å invitera til ein minikonferanse om digital vurdering i matematikk i høgare utdanning:
https://www.uia.no/konferanser-og-seminarer/the-1st-northern-e-assessment-meeting-may-31-june-2-2023

Helsing Andrey Chesnokov, NTNU

OKA THEORY AND COMPLEX GEOMETRY CONFERENCE, Nordfjordeid, 19.-23. juni 2023

This is a meeting for updates in Oka theory and Complex Geometry. It is funded by Trond Mohn Foundation and Research Council of Norway.

Organisers: Tuyen Trung Truong (University of Oslo) and Erlend Fornæss Wold (University of Oslo)

https://www.mn.uio.no/math/english/research/projects/granddrm/events/conferences/oka-theory-and-complex-geometry-2023/index.html

CATMI 2023, Bergen, 26.-30. juni 2023

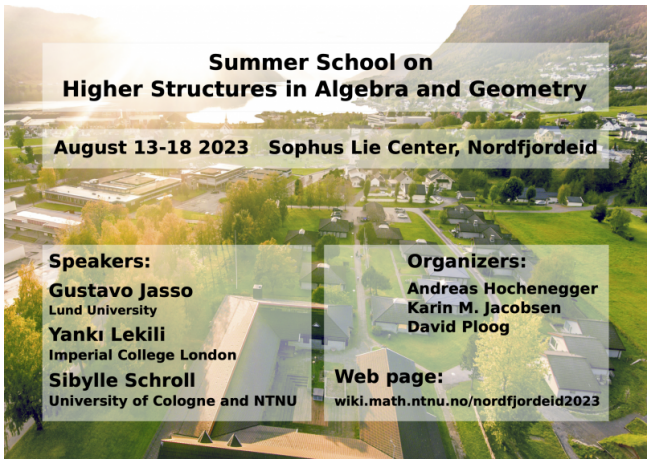
CATMI: Category Theory at Work in Computational Mathematics and Theoretical Informatics

The meeting is an activity organised by the Lie-Størmer Center, a newly founded Norwegian research center for fundamental structures in computational and pure mathematics, and aims at bringing together a mix of people from mathematics and informatics to exchange ideas on how we apply concepts and tools from category theory, type theory, and homotopy theory to structure complex problems and research in mathematics, computations and theoretical computer science.

Organisers: G. Fløystad (Bergen), H. Gylterud (Bergen), H. Munthe-Kaas (Tromsø/Bergen), U. Wolter (Bergen)

Scientific Committee: K. Ebrahimi-Fard (Trondheim), H. Gylterud (Bergen), C. Riener (Tromsø), M. Szymik (Sheffield), U. Wolter (Bergen)

SOMMERSKOLE, Nordfjordeid, 13.-18. august 2023



Dear colleagues,

We are pleased to announce a summer school: *Higher Structures in Algebra and Geometry* 13.-18. August 2023 at the Sophus Lie Conference Center, Nordfjordeid, Norway

Program: This school links three different areas, namely representation theory, symplectic geometry and algebraic geometry, using categorical approaches and higher structures in algebra. The target audience are categorically inclined PhD students and post-docs familiar with at least one of these fields, who want to broaden their vision of neighbouring areas.

Lecturers:
Gustavo Jasso (Lund): Higher Auslander algebras and their connections to symplectic geometry
Yanki Lekili (Imperial College London): Fukaya categories and symmetries
Sibylle Schroll (Cologne, Trondheim): Gentle algebras and Homological Mirror Symmetry

Organizing committee: Andreas Hochenegger (Milan), Karin M Jacobsen (Trondheim), David Ploog (Stavanger)
Sponsors: Trond Mohn Stiftelse (TMS), University of Bergen, University of Oslo, University of Stavanger, NTNU, UiT The Arctic University of Norway, Compositio Foundation

Registration deadline is May 2nd 2023.

For registration and further information check the web page: https://wiki.math.ntnu.no/nordfjordeid2023

NORWEGIAN NATIONAL Ph.D. MEETING, Trondheim, 17.-18. august 2023

We are organizing a Norwegian National Ph.D. meeting in Trondheim from the 17th to the 18th of August 2023. It will be accessible to all Ph.D. students in mathematics in Norway: that is, pure, applied, statistics and didactics. Based on the successful Ph.D. day at the National Mathematicians Meeting in Tromsø, this event shall be an opportunity to share experiences, connect research groups across Norway and give insight into career options after the Ph.D.

We aim to cover full board and accommodation expenses, possibly including travel expenses. You will find more information and the registration form on our webpage: www.nnpm.no

Abelprisen 2023

The Norwegian Academy of Science and Letters has decided to award the Abel Prize for 2023 to

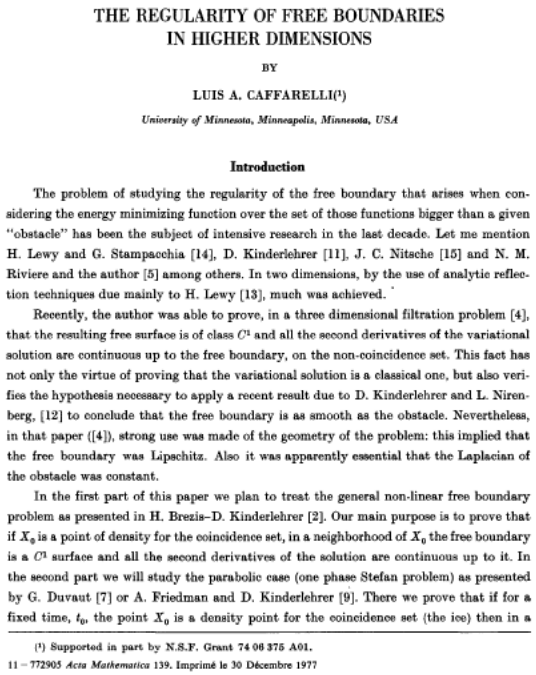
Luis A. Caffarelli, University of Texas at Austin, USA

for his seminal contributions to regularity theory for nonlinear partial differential equations including free-boundary problems and the Mange-Ampere equation.

Partial differential equations arise naturally as laws of nature, whether to describe the flow of water or the growth of populations. These equations have been a constant source of intense study since the days of Newton and Leibniz. Yet, despite substantial efforts by mathematicians over centuries, fundamental questions concerning stability or even uniqueness, and the occurrence and type of singularities of same key equations, remain unresolved.

Over a period of more than 40 years, Luis Caffarelli has made ground-breaking contributions to ruling out or characterizing singularities. This goes under the name of regularity theory and captures key qualitative features of the solutions beyond the original functional analytic setup. It is conceptually important for modelling - is for instance the assumption of macroscopically varying fields self-consistent? - and informs discretization strategies and is thus crucial for efficient and reliable numerical simulation. Caffarelli's theorems have radically changed our understanding of classes of nonlinear partial differential equations with wide applications. The results go to the core of the matter, the techniques show at the same time virtuosity and simplicity, and cover many different areas of mathematics and its applications.

A large part of Caffarelli's work concerns so-called free-boundary problems. Consider for instance the problem of ice melting into water. Here the free boundary is the interface between water and ice; it is part of the unknown that is to be determined. Another example is provided by water seeping through a porous medium - again the interface between the saturated and unsaturated part of the medium is to be understood.



THE REGULARITY OF FREE BOUNDARIES
IN HIGHER DIMENSIONS

BY

LUIS A. CAFFARELLI(1)

University of Minnesota, Minneapolis, Minnesota, USA

Introduction

The problem of studying the regularity of the free boundary that arises when considering the energy minimizing function over the set of those functions bigger than a given "obstacle" has been the subject of intensive research in the last decade. Let me mention H. Lewy and G. Stampacchia [14], D. Kinderlehrer [11], J. C. Nitsche [15] and N. M. Riviere and the author [5] among others. In two dimensions, by the use of analytic reflection techniques due mainly to H. Lewy [13], much was achieved.

Recently, the author was able to prove, in a three dimensional filtration problem [4], that the resulting free surface is of class C^1 and all the second derivatives of the variational solution are continuous up to the free boundary, on the non-coincidence set. This fact has not only the virtue of proving that the variational solution is a classical one, but also verifies the hypothesis necessary to apply a recent result due to D. Kinderlehrer and L. Nirenberg, [12] to conclude that the free boundary is as smooth as the obstacle. Nevertheless, in that paper ([4]), strong use was made of the geometry of the problem: this implied that the free boundary was Lipschitz. Also it was apparently essential that the Laplacian of the obstacle was constant.

In the first part of this paper we plan to treat the general non-linear free boundary problem as presented in H. Brezis–D. Kinderlehrer [2]. Our main purpose is to prove that if X_0 is a point of density for the coincidence set, in a neighborhood of X_0 the free boundary is a C^1 surface and all the second derivatives of the solution are continuous up to it. In the second part we will study the parabolic case (one phase Stefan problem) as presented by G. Duvaut [7] or A. Friedman and D. Kinderlehrer [9]. There we prove that if for a fixed time, t_0, the point X_0 is a density point for the coincidence set (the ice) then in a

(1) Supported in part by N.S.F. Grant 74 06 375 A01.

11 – 772905 *Acta Mathematica* 139. Imprimé le 30 Décembre 1977

A particular class of free-boundary problems are denoted as obstacle problems. An example is given by a balloon pressing against a wall or an elastic body resting on a surface. Caffarelli has given penetrating solutions to these problems with applications to solid-liquid interfaces, jet and cavitational flows, and gas and liquid flows in a porous media, as well as financial mathematics. Caffarelli's regularity results rely on zooming in on the free boundary, and classifying the resulting blow-ups, where non-generic blow-ups correspond to singularities of the free boundary.

The incompressible Navier-Stokes equations model fluid flow, such as water. The regularity of solutions of these equations in three dimensions is one of the open Clay Millennium Problems. In 1983, based on Scheffer's previous work, Caffarelli, with Kohn and Nirenberg, showed that sets of singularities of suitable weak solutions cannot contain a curve, that is, they have to be very "small".

Caffarelli's regularity theorems from the 1990s represented a major breakthrough in our under-

standing of the Monge-Ampere equation, a highly nonlinear, quintessential partial differential equation, that for instance is used to construct surfaces of prescribed Gaussian curvature. Important existence results were established by Alexandrov, and earlier central properties had been shown by Caffarelli in collaboration with Nirenberg and Spruck, with further key contributions by Evans and Krylov. Caffarelli however closed the gap in our understanding of singularities by proving that the explicitly known examples of singular solutions are the only ones. Caffarelli has - together with collaborators - applied these results to the Monge-Kantorovich optimal mass transportation problem, based on previous work by Brenier. Caffarelli and Vasseur gave deep regularity results for the quasi-geostrophic equation in part by applying the exceptionally influential paper by Caffarelli and Silvestre on the fractional Laplacian.

Furthermore, Caffarelli has made seminal contributions to the theory of homogenization, where one seeks to characterize the effective or macroscopic behaviour of media that have a microstructure, for instance because they are formed by a composite material. A typical problem regards a porous medium - like a hydrocarbon reservoir - where one has a solid rock with pores, posing a complex and - to a large degree - unknown structure through which fluids flow.

Caffarelli is an exceptionally prolific mathematician with over 130 collaborators and more than 30 PhD students over a period of 50 years. Combining brilliant geometric insight with ingenious analytical tools and methods, he has had and continues to have an enormous impact on the field.

Luis Angel Caffarelli was born December 8, 1948 and grew up in Buenos Aires. He obtained his Masters of Science (1968) and Ph.D. (1972) at the University of Buenos Aires. His Ph.D. advisor was Calixto Calderón. He currently holds the Sid Richardson Chair at the University of Texas at Austin. He also has been a professor at the University of Minnesota, the University of Chicago, and the Courant Institute of Mathematical Sciences at New York University. From 1986 to 1996 he was a professor at the Institute for Advanced Study in Princeton.

Nyheter

CALL FOR BIDS FOR THE 10. EUROPEAN CONGRESS OF MATHEMATICS

Outline bids from mathematicians to organize the 2028 Congress are now invited and should reach the EMS Secretariat by **June 30, 2023** by email; ems-office@helsinki.fi.

The information below may be helpful to possible organizers. Informal discussions are welcomed and may be addressed to the President of the EMS Jan Philip Solovej solovej@math.ku.dk.

European Congresses of Mathematics are organized every four years. The first Congress was held in Paris in 1992, and since then they have been held in Budapest, Barcelona, Stockholm, Amsterdam, Krakow, Berlin, and Portorož. In 2024 the Congress will take place in Seville (Spain).

Experience of previous Congresses suggests that over a thousand people may attend. The duration has so far been five days. Ten EMS Prizes are awarded to outstanding young European mathematicians at the opening ceremony, together with the Felix Klein and Otto Neugebauer Prizes. The Congress programme should aim to present various new aspects of pure and applied mathematics to a wide audience, to offer a forum for discussion of the relationship between mathematics and society in Europe, and to enhance cooperation among mathematicians from all European countries. The standard format of previous ECMs has been:
- about 10 plenary lectures;
- section lectures for a more specialized audience, normally with several held simultaneously;
- mini-symposia;
- special lectures;
- film and mathematical software sessions;
- poster sessions;
- round tables.

An exhibition space for mathematical societies, booksellers, and so on is required. No official language is specified and no interpretation is needed. Proceedings of the Congress are published by EMS Publishing House (https://ems.press/).