INFOMAT

Mars 2016

ABELPRISEN FOR 2016 TIL SIR ANDREW JOHN WILES

The Norwegian Academy of Science and Letters has decided to award the Abel Prize for 2016 to Sir Andrew J. Wiles, University of Oxford

"*for his stunning proof of Fermat's Last Theorem by way of the modularity conjecture for semistable elliptic curves, opening a new era in number theory.*"

INNMELDING/ÅRSAVGIFT I EMS

Det er på tide å fornye medlemskapet i EMS, fristen er 31. mars. Medlemmer av Norsk Matematisk Forening betaler 25 € i året, og både innmelding og årsavgift betaler man via lenken

http://www.euro-math-soc.eu/ems_payment_new/ems_payment_new.html

Alternativt: gå inn på matematikkforeningen.no, følg lenken "Medlemskap i NMF" og deretter underlenken "Medlemskap i EMS."

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

infomat at math.ntnu.no

Foreningen har hjemmeside http://www.matematikkforeningen.no/INFOMAT

Ansvarlig redaktør er Arne B. Sletsjøe, Universitetet i Oslo.

Matematisk kalender

2016:
Mars:
16.-20. *27. Nordic Congress of Mathematicians,* Stockholm
April:
21.-22. *ASGARD Math 2016*, Oslo
Mai:
23.-25. *Abeluken med prisutdeling*, Oslo
Juni:
30.-1. juli: *AGMP 2016,* Tromsø
August:
16.-19. Abelsymposiet: *Computation and Combinatorics in Dynamics, Stochastics and Control,* Baroniet Rosendal
2017:
Januar:
27.-29. *Ragni Piene 70,* Oslo

ASGARD MATH 2016

A Scandinavian Gathering Around Remarkable Discrete Mathematics, UiO, 21.-22. april 2016

The ASGARD Math meetings are informal two-day meetings aimed at facilitating communication and interaction between mathematicians in Scandinavia interested in discrete mathematics and other related fields. These meetings will take place every year during the spring.
https://sites.google.com/site/asgardmath/

AGMP 2016

Algebraic Geometry and Mathematical Physics, Tromsø, 30. juni-1. juli 2016

A conference in honor of Arnfinn Laudal on his 80'th birthday. The conference will take place at the University of Tromsø (Norway), 30th June and 1st July 2016. The conference will consist of 4 invited lectures and contributed presentations. The conference will cover, but is not limited to, the main themes: Algebra, Geometry, dynamical symmetries and conservation laws, mathematical physics and applications.
http://site.uit.no/agmp/

Abel Symposium 2016

Computation and Combinatorics in Dynamics, Stochastics and Control

August 16-19, 2016
Barony Rosendal
Norway

ABEL PRIZE

Speakers

Philippe BIANE (Paris, France)
Anthony BLOCH (Ann Arbor, USA)
Percy DEIFT (New York, USA)
Fred ESPEN BENTH (Oslo, Norway)
Loïc FOISSY (Calais, France)
Geir BOGFJELLMO (Gothenburg, Sweden)
W. Steven GRAY (Norfolk, USA)
Robert GROSSMAN (Chicago, USA)
Massimiliano GUBINELLI (Paris, France)
Alice GUIONNET (Massachusetts, USA)
Martin HAIRER (Warwick, UK)
Uwe HELMKE (Würzburg, Germany)
Yaozhong HU (Lawrence, Kansas, USA)
Xue-Mei LI (Warwick, UK)
Simon J. A. MALHAM (Edinburgh, UK)
Dominique MANCHON (Clermont-Ferrand, France)
Frédéric MENOUS (Paris, France)
Ander MURUA (San Sebastian, Spain)
Giovanni PECCATI (Luxembourg)
Christophe REUTENAUER (Montreal, Canada)
Roland SPEICHER (Saarbrücken, Germany)
Agnès SULEM (INRIA, Paris, France)

Scientific Committee
Elena CELLEDONI (Trondheim, Norway)
Terry LYONS (Oxford, UK)
Bernt ØKSENDAL (Oslo, Norway)
Frédéric PATRAS (Nice, France)
Jesus SANZ SERNA (Valladolid, Spain)

Organizing Committee
Giulia DI NUNNO (Oslo, Norway)
Kurusch EBRAHIMI-FARD (Madrid, Spain)
Alexander LUNDERVOLD (Bergen, Norway)
Hans MUNTHE-KAAS (Bergen, Norway)
Brynjulf OWREN (Trondheim, Norway)
Olivier VERDIER (Bergen, Norway)
Antonella ZANNA (Bergen, Norway)

Nye doktorgrader

M.Sc. **Erlend Briseid Storrøsten** forsvarte 11. mars 2016b sin avhandling *Convergence Rates for Stochastic and Degenerate-Parabolic Balance Laws* for graden Ph.d.
Veiledere har vært Professor Nils Henrik Risebro og Professor Kenneth Hvistendahl Karlsen, Matematisk institutt, Universitet i Oslo.
Sammendrag:
Første del av avhandlingen omhandler endelig-differanse approksimasjoner for degenererte konveksjons-diffusjonslikninger, en type likninger som blant annet brukes til å beskrive strømning i porøse medier. Dette er blant de aller enkleste måtene å konstruere numeriske approksimasjoner for denne typen likninger. Likevel eksisterer det knapt resultater som karakteriserer hvor fort den numeriske metoden

konvergerer mot den eksakte løsningen. Dette har å gjøre med at det oppstår sjokk (diskontinuiteter) i løsningene, noe som krever spesielle teknikker for å behandle spørsmål knyttet til eksistens, entydighet og numeriske approksimasjoner. I denne avhandlingen presenteres konvergensrater for disse numeriske approksimasjonene betraktet i både en og flere romlige dimensjoner.
Andre del av avhandlingen omhandler konveksjonslikninger med en stokastisk kilde. På samme måte som for degenererte konveksjons-diffusjonslikninger oppstår sjokk i løsningene. I denne avhandlingen presenteres en ny karakterisering av løsninger for denne typen likninger basert på såkalte «Kružkov entropier». Dette rammeverket brukes så til å vise en konvergensrate for en approksimasjon basert på «operator splitting».

Utlysninger

2018 CIMPA RESEARCH SCHOOLS CALL FOR PROJECTS

• Proposals in applied mathematics or related to applications of mathematics are especially welcome.
• The proposals for the most mathematically or economically deprived areas are encouraged and will be given priority.
• A project of a Research School should not coincide with one of a conference.
• We receive many projects. The selection by the Scientific Council and the Steering Council of CIMPA takes into account firstly the scientific value, but also thematic and regional balance. Read the road-map before filing a project. Anticipate that a project could be moved aside despite its large qualities.
The aim of the International Centre for Pure and Applied Mathematics CIMPA is to promote international cooperation in higher education and research in mathematics and their interactions, as well as related subjects, for the benefit of developing countries. Our action concentrates at the places where mathematics emerges and develops, and where a research project is possible.

CIMPA is a UNESCO centre based in Nice, financed by France, Switzerland, Norway and Spain, counting with the support of the University of Nice Sophia-Antipolis and the University of Montpellier.
We organize research schools of about two weeks in developing countries. The purpose of these schools is to contribute to the research training of the new generation of mathematicians, women and men.
The research schools are organized locally with the help of CIMPA. CIMPA's financial contribution is essentially for young mathematicians from neighbouring countries to be able to attend the research school. CIMPA can help with obtaining funds from other sources. Additional and essential information can be found in the road-map (available on the web site of CIMPA). You can also write to CIMPA for further information.
Research schools call for projects begins on March 1st, 2016. The deadline for a (non-mandatory) pre-proposal is **June 15, 2016.** The complete proposal is due **October 1st, 2016.**
The application form can be found on CIMPA website: http://proposals.cimpa.info
http://cimpa.info/

LEDIGE STILLINGER VED HØGSKOLEN I BERGEN

Her er lenker til de to stillingene:

https://www.jobbnorge.no/ledige-stillinger/stilling/121680/phd-research-fellows-in-mathematical-modelling-and-numerical-simulation
Søknadsfrist: **20. mars 2016**

https://www.jobbnorge.no/ledige-stillinger/stilling/122312/matematikk-foersteamanuensis-foerstelektor-hoegskolelektor-inntil-to-stillinger
https://www.jobbnorge.no/ledige-stillinger/stilling/122438/phd-research-fellowship-positions-in-computational-mathematics
De to siste stillingene har søknadsfrist 3**0. mars 2016**

ABELPRISEN 2016

ABELKOMITEENS BEGRUNNELSE

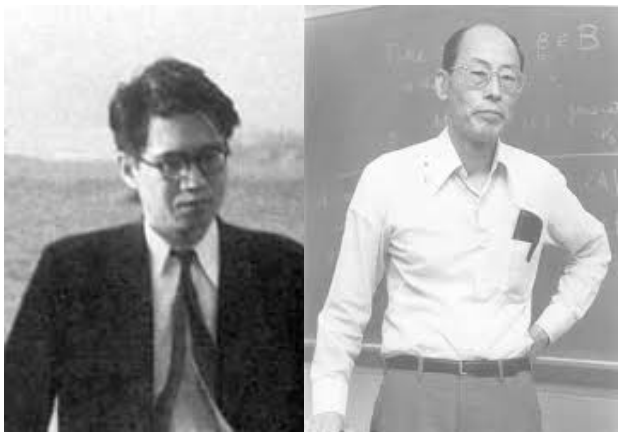
The Norwegian Academy of Science and Letters has decided to award the Abel Prize for 2016 to Sir **Andrew J. Wiles**, University of Oxford

"*for his stunning proof of Fermat's Last Theorem by way of the modularity conjecture for semistable elliptic curves, opening a new era in number theory.*"

Number theory, an old and beautiful branch of mathematics, is concerned with the study of arithmetic properties of the integers. In its modern form the subject is fundamentally connected to complex analysis, algebraic geometry, and representation theory. Number theoretic results play an important role in our everyday lives through encryption algorithms for communications, financial transactions, and digital security.

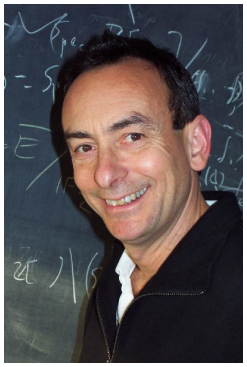
Fermat's Last Theorem, first formulated by Pierre de Fermat in the 17th century, is the assertion that the equation $x^n + y^n = z^n$ has no solutions in positive integers for n>2. Fermat proved his claim for n=4, Leonhard Euler found a proof for n=3, and Sophie Germain proved the first general result that applies to infinitely many prime exponents. Ernst Kummer's study of the problem unveiled several basic notions in algebraic number theory, such as ideal numbers and the subtleties of unique factorization. The complete proof found by Andrew Wiles relies on three further concepts in number theory, namely elliptic curves, modular forms, and Galois representations.

Elliptic curves are defined by cubic equations in two variables. They are the natural domains of definition of the elliptic functions introduced by Niels Henrik Abel. Modular forms are highly symmetric analytic functions defined on the upper half of the complex plane, and naturally factor through shapes known as modular curves. An elliptic curve is said to be modular if it can be parametrized



by a map from one of these modular curves. The modularity conjecture, proposed by Goro Shimura, Yutaka Taniyama, and André Weil in the 1950s and 60s, claims that every elliptic curve defined over the rational numbers is modular.

In 1984, Gerhard Frey associated a semistable elliptic curve to any hypothetical counterexample to Fermat's Last Theorem, and strongly suspected that this elliptic curve would not be modular. Frey's non- modularity was proven via Jean-Pierre Serre's epsilon conjecture by Kenneth Ribet in 1986. Hence, a proof of the Shimura-Taniyama-Weil modularity conjecture for semistable elliptic curves would also yield a proof of Fermat's Last Theorem. However, at the time the modularity conjecture was widely believed to be completely inaccessible. It was therefore a stunning advance when Andrew Wiles, in a breakthrough paper published in 1995, introduced his modularity lifting technique and proved the semistable case of the modularity conjecture.



ABELPRISEN 2016

The modularity lifting technique of Wiles concerns the Galois symmetries of the points of finite order in the abelian group structure on an elliptic curve. Building upon Barry Mazur's deformation theory for such Galois representations, Wiles identified a numerical criterion which ensures that modularity for points of order p can be lifted to modularity for points of order any power of p, where p is an odd prime. This lifted modularity is then sufficient to prove that the elliptic curve is modular. The numerical criterion was confirmed in the semistable case by using an important companion paper written jointly with Richard Taylor. Theorems of Robert Langlands and Jerrold Tunnell show that in many cases the Galois representation given by the points of order three is modular. By an ingenious switch from one prime to another, Wiles showed that in the remaining cases the Galois representation given by the points of order five is modular. This completed his proof of the modularity conjecture, and thus also of Fermat's Last Theorem.
The new ideas introduced by Wiles were crucial to many subsequent developments, including the proof in 2001 of the general case of the modularity conjecture by Christophe Breuil, Brian Conrad, Fred Diamond, and Richard Taylor. As recently as 2015, Nuno Freitas, Bao V. Le Hung, and Samir Siksek proved the analogous modularity statement over real quadratic number fields. Few results have as rich a mathematical history and as dramatic a proof as Fermat's Last Theorem.

"Cubum autem in duos cubos, aut quadratoquadratum in duos quadrato- quadratos et generaliter nullam in in- finitum ultra quadratum potestatem in duos eiusdem nominis fas est dividere cuius rei demonstrationem mirabilem sane detexi. Hanc marginis exiguitas non caperet."

Pierre de Fermat

(Det er umulig å dele en tredjepotens i to tred- jepotenser, eller en fjerdepotens i to fjerde- potenser, eller helt generelt, en høyere potens enn to i to ledd av samme type. Jeg har funnet et praktfullt bevis for dette, men margen er for liten til å romme det.)

Andrew Wiles med norske venner under Abel-konferansen i 2002

ABELPRISEN 2016

ABELs BREV TIL HOLMBOE

Sommeren 1823 besøkte den unge Niels Henrik Abel matematikeren Carl Ferdinand Degen i København. I et brev til sin gamle lærer Bernt Michael Holmboe skriver Abel om sine matematiske undersøkelser og diskusjoner med Degen:
Den lille Afhandling som Du erindrer handlede om de omvendte Functioner af Transcendantes elliptiqves, og hvori jeg havde beviist noget umueligt har jeg bedet ham læse igjennom; men han kunde ikke opdage nogen Feilslutning, eller begribe hvori Feilen stak; Gud veed hvorledes jeg skal komme ud deraf.
Det Abel refererer til i dette brevet er hans innledende undersøkelser av elliptiske funksjoner, et tema han jobbet videre med i senere avhandlinger. Elliptiske kurver er en matematisk disiplin som baserer seg på Abels oppdagelser av elliptiske funksjoner. Modularitetsteoremet gir en dyp sammenheng mellom elliptiske kurver og modulære former. Dette gir en interessant kopling mellom Abel og Andrew Wiles.
Mot slutten av det samme brevet forklarer Abel Holmboe hva han har drevet med den siste tiden. Han skriver:
Foruden at jeg læser arbeider jeg ogsaa selv. Saaledes har jeg søgt at bevise Umuligheden af Ligningen $a^n=b^n+c^n$ i hele Tal naar n er større end 2; men jeg har jeg været hældet. Jeg har ikke kommet videre end til indlagte Theoremer, som ere snorrige nok.
Abel lister opp fire teoremer, alle uten bevis. Vi gjengir to av dem, Theorem I og Theorem III:

Theorem I.

Ligningen

$$a^n=b^n+c^n$$

hvor n er et Primtal er umuelig naar een eller flere af Størrelserne:

$$a,\ b,\ c,\ a+b,\ a+c,\ b-c,\ a^{(1/m)},\ b^{(1/m)}\},\ c^{(1/m)}$$

ere Primtal.

Theorem III.

For at Ligningen

$$a^n=b^n+c^n$$

skal være muelig maa a have een af følgende tre Former

$$1)\ a=(x^n+y^n+z^n)/2$$
$$2)\ a=(x^n+y^n+n^{n-1}z^{n)}/2$$
$$3)\ a=(x^n+n^{n-1}(y^n+z^n))/2$$

hvor x og y og z ingen fælleds Factorer maa have.

Dette knytter et nytt matematisk bånd mellom Abel og Wiles.
Brevet til Holmboe er skrevet sommeren 1823. Det er imidlertid vanskelig å fastslå en eksakt datering. Grunnen til det er at Abel angir datoen på følgende måte:

$$(6.064.321.2191)^{1/3}$$

og føyer til *tag Decimalbrøken med*. Gjør vi det får vi

1823,59083

Vi trekker fra 1823, og regner ut

0,59083*365=215,65

Dag nr. 216 i året 1823 er 4. august, som antas å være datoen Abel har datert brevet.
Som en siste kuriositet, med hentydning til at årets Abelpris-vinner er født i England, gjengir vi følgende setning fra brevet:
Bibliothekerne ere ikke godt forsynede med mathematiske Bøger; men de besidde en god Deel Videnskabers Selskabs Skrifter. I blandt andre Philosophical transactions, hvori findes mange meget gode Sager; saa at Engellænderne ikke ere saa daarlige i Mathematiken som jeg havde tænkt.