

History of Indo-French Scientific Partnership

The future belongs to science and those who make friends with science. – Jawaharlal Nehru

<https://hos.ifindia.in/>

Indo-French Cooperation in Mathematics

Michel Waldschmidt

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Brahmagupta (598 – 670)

Brāhmasphuṭasiddhānta - The Opening of the Universe (628) :

$$1151^2 - 92 \cdot 120^2 = 1.$$

$$1\,324\,801 - 92 \cdot 14\,400 = 1$$

The smallest solution of

$$x^2 - 92y^2 = 1$$

is

$$x = 1151, \quad y = 120.$$

Composition method : *samasa* – Brahmagupta identity

<http://mathworld.wolfram.com/BrahmaguptasProblem.html>

<http://www-history.mcs.st-andrews.ac.uk/HistTopics/Pell.html>

Bhāskara II or Bhāskarāchārya (1114 - 1185)

Bijagaṇita (1150)

$$1\,766\,319\,049^2 - 61 \cdot 226\,153\,980^2 = 1$$

The smallest solution of

$$x^2 - 61y^2 = 1$$

is

$$x = 1\,766\,319\,049, \quad y = 226\,153\,980.$$

Cyclic method (*Chakravala*) – continued fraction expansion

<http://www-history.mcs.st-andrews.ac.uk/HistTopics/Pell.html>

Narayaṇa Paṇḍit \sim 1340 – \sim 1400

$$227\,528^2 - 103 \cdot 22\,419^2 = 1$$

$$51\,768\,990\,784^2 - 103 \cdot 502\,611\,561^2 = 1$$

The smallest solution of






$$x^2 - 103y^2 = 1$$

is

$$x = 227\,528, \quad y = 22\,419.$$

<https://mathshistory.st-andrews.ac.uk/Biographies/Narayana/>

References to Indian mathematics

-  A. BAG, *Mathematics in ancient and medieval India*, Chaukhamba Orientalia, Benarès, (1979).
-  G. R. KAYE, *Indian mathematics.*, Calcutta & Simla, Thaker, Spink & co., (1915).
-  K. PLOFKER, *Mathematics in India*, Princeton University Press, Princeton, NJ, 2009.
-  C. N. SRINIVASIENGAR, *The history of ancient Indian mathematics*, The World Press Private, Ltd., Calcutta, 1967.
-  V. S. VARADARAJAN, *Algebra in ancient and modern times*, vol. 12 of *Mathematical World*, American Mathematical Society, Providence, RI, 1998.

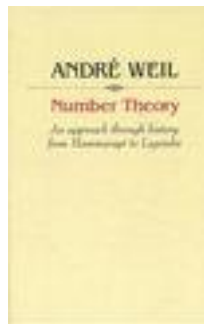
References

André Weil

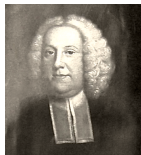
Number theory :

*An approach through history.
From Hammurapi to
Legendre.*

Birkhäuser Boston, Inc.,
Boston, Mass., (1984) 375
pp. — Reprint 2007.
MR 85c:01004



Pell – Fermat equation



John Pell
(1610 – 1685)



Pierre de Fermat
(1601 ?–1665)

It is often said that Euler mistakenly attributed Brouncker's work on this equation to Pell. However the equation appears in a book by Rahn which was certainly written with Pell's help : some say entirely written by Pell. Perhaps Euler knew what he was doing in naming the equation.

Johann Rahn (1622 - 1676) was a Swiss mathematician who was the first to use the symbol \div for division.

<https://mathshistory.st-andrews.ac.uk/Biographies/Pell/>

https://fr.wikipedia.org/wiki/John_Pell

On the Brahmagupta – Pell – Fermat equation



Lord William Brouncker
(1620–1684)



Pierre de Fermat
(1601?–1665)

Correspondence from Pierre de Fermat to Brouncker.
1657 : letter of Fermat to Frenicle de Bessy (1604–1674).

<https://mathshistory.st-andrews.ac.uk/Biographies/>

Challenge from Fermat to Brouncker

“ *pour ne vous donner pas trop de peine*” (Fermat)

“ *to make it not too difficult*”

$$x^2 - dy^2 = 1, \text{ with } d = 61 \text{ and } d = 109.$$

Solutions respectively :

$$(1\ 766\ 319\ 049, 226\ 153\ 980)$$
$$(158\ 070\ 671\ 986\ 249, 15\ 140\ 424\ 455\ 100)$$

$$809^2 - 2020 \cdot 18^2 = 1, \quad 45\ 495^2 - 2021 \cdot 1012^2 = 1, \quad 1\ 349^2 - 2022 \cdot 30^2 = 1.$$

History (continued)



Leonard Euler
(1707–1783)



Joseph-Louis Lagrange
(1736–1813)

L. Euler : *Book of algebra in 1770 + continued fractions*

The complete theory of the equation $x^2 - dy^2 = \pm 1$ was worked out by Lagrange.

<https://mathshistory.st-andrews.ac.uk/Biographies/>

Indian mathematical tradition (continued)

The Indian mathematical school flourished in Kerala between the 14th and the 17th Century. After the work on astronomy and on series by Madhava of Sangamagramma (1350–1425), the four most important works on astronomy and mathematics from that period are *Tantrasāṅgraha* of Nīlakaṇṭha Somayaji (1444–1544), *Yuktibhasa* by Jyesthdeva, *Karana Paddhati* by Putamana Somayaji and *Sadratnamala* by Sankara Varman. Another Indian mathematician from the 14th Century is Narayana (~1340–~1400), who studied Fibonacci-like sequences.

One of the main features of the mathematics from the Kerala School is the geometric treatment of algebraic problems. An example is the text *Karanamrta* by Citrabhanu written in 1530.

<https://mathshistory.st-andrews.ac.uk/Biographies/Madhava/>

The Kerala school

In his treatise on astronomy Madhava used a series for π and obtained 11 decimal digits, while Viète in 1579 could obtain only 9 decimal digits by computing the perimeter of a polygon with 393 216 sides. Three centuries before Newton, Madhava knew the expansions

$$\sin x = x - \frac{x^3}{3!} + \frac{x^5}{5!} - \frac{x^7}{7!} + \dots$$

and

$$\cos x = 1 - \frac{x^2}{2!} + \frac{x^4}{4!} - \frac{x^6}{6!} + \dots$$

The invention of infinitesimal calculus in India was motivated by the predictions of eclipses. Āryabhaṭa I, and later Brahmagupta, used the concept of instant motion. Bhāskarācārya used the derivative of the sine function to compute the angle of the ecliptic. These works were later pursued by the Kerala school.

One may consider Madhava as one of the founders of modern analysis.

French mathematical tradition



Henri Poincaré
(1854 – 1912)

French mathematician, theoretical physicist, engineer, and philosopher of science.



Nicolas Bourbaki
(1935 –)

First Bourbaki Conference 1935
Standing (L to R) : Cartan, de Possel, Dieudonné, Weil
Seated : Mirlès, Chevallez, Mandelbrojt

<https://mathshistory.st-andrews.ac.uk/Biographies/Poincare/>

<https://mathshistory.st-andrews.ac.uk/Biographies/Bourbaki/>

Indian mathematical tradition



Srinivasa Ramanujan
(1887 – 1920)

Fellows of the Royal Society

Fellow of Trinity College,
Cambridge.

An equation for me has no meaning unless it expresses a thought of God

<https://mathshistory.st-andrews.ac.uk/Biographies/Ramanujan/>

<https://mathshistory.st-andrews.ac.uk/Biographies/Bourbaki/>

André Weil in India



Weil (left) in Aligarh, India, with Vijayaraghavan (second from left) and two students, 1931.

Courtesy of Sylvain Weil and reprinted from the work *Approaches to a Mathematician* with permission from Birkhäuser.



André Weil
(1906 – 1998)

In 1929 Syed Ross Masood, Vice-Chancellor of Aligarh Muslim University, proposed a chair of French civilization to André Weil, who was recommended to him by a specialist of Indology, Sylvain Levi. A few months later this offer was converted into a chair of mathematics. Weil reached India in early 1930 and stayed there for more than two years.

Sylvie Weil



Sylvie Weil

Chez les Weil. André and Simone
Buchet-Chastel, Paris (2009)

At home with André and Simone Weil

translated from the French by Benjamin Ivry
Northwestern Univ. Press
(2010).

The Mathematical Intelligencer volume 34, pages 76-78 (2012)

https://fr.wikipedia.org/wiki/Sylvie_Weil

PV numbers



Charles Pisot
(1910 – 1984)



Tirukkannapuram Vijayaraghavan
(1902 – 1955)

Among the Indian colleagues of André Weil were T. Vijayaraghavan, D. Kosambi and S. Chowla whose intellectual qualities he appreciated.

T. Vijayaraghavan, who later became the first director of the Ramanujan Institute in Madras (at that time it was independent of the department of mathematics of the University) is known for his study of the so-called *P.V. numbers*, which were studied by C. Pisot. The influence of Weil on Vijayaraghavan was important.

<https://mathshistory.st-andrews.ac.uk/Biographies/Pisot/>





https://fr.wikipedia.org/wiki/Tirukkannapuram_Vijayaraghavan

André Weil in India

Weil wrote two reports on the situation of the universities in India. In his first report 1931 for the Indian Mathematical Society, he had suggested actions for the improvement of Indian mathematics.

The conclusion of his second report in 1936 deals with the potential of this country and the possibility for India to soon take one of the leading places in the international mathematical community.

References to André Weil

-  A. WEIL, *Mathematics in Indian Universities*, Seventh Conference of the Indian Mathematical Society, Trivandrum, (1931).
Scientific works. Collected papers pp. 127–128.
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Scientific works. Collected papers pp. 129–131.
-  ———, *Scientific works. Collected papers. Vol. I (1926–1951)*, Springer-Verlag, New York, 1979.
-  ———, *Souvenirs d'apprentissage*, vol. 6 of *Vita Mathematica*, Birkhäuser Verlag, Basel, 1991. English translation by Jennifer Gage, *The Apprenticeship of a Mathematician*, Birkhäuser, Basel, 1992.

Father Racine



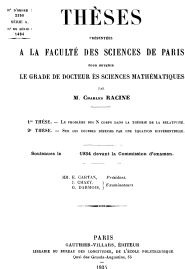
Fr Charles Racine
(1897 – 1976)

Father Racine reached India in 1937 as a Jesuit missionary after having taken his Doctorate in Mathematics in 1934 under Élie Cartan.

He taught mathematics first at St Joseph's College in Tiruchirappally (Trichy, Tamil Nadu) and from 1939 onwards at Loyola College (Madras). He spent forty-two years in India.

He had connections with many important French mathematicians of that time like J. Hadamard, J. Leray, A. Weil, H. Cartan.

Charles Racine's thesis



Doctorate in Mathematics in
1934 under Élie Cartan.
Le problème des N corps dans
la théorie de la relativité.
Thèse 1934

http://www.numdam.org/item?id=THESE_1934__158__1_0



M. SANTIAGO, *International conference on teaching and research in mathematics*, in Birth Centenary Celebrations of Father Charles Racine, S.J. Loyola College, Racine Research Centre, Chennai, January, 1997.

Fr D'Souza, rector, Loyola College, June 1, 1946

Loyola College
Cathedral Post,
Madras (Indes Anglaises)
le 1 ~~XX~~ 1946
Juin

Mon Révérend Père,

P.Xti

Le P.de Grangeneuve m'a prié d'écrire à votre Révérence sur deux ou trois sujets sur lesquels vous désirez avoir les opinions des Consultants de la Vice Province. J'ai cessé d'être Consultant depuis un an-je dois ajouter, par suite de ma prière instante en vue de la difficulté de voyage de Madras à Maduré. Ma place a été prise par le R.P.H.Pinto, Recteur de St. Joseph, Trichy, depuis Avril 1945. Pourtant j'ose écrire sur ces questions par déférence au cher P.de Grangeneuve, et aussi parceque j'en ai parlé au P.Pinto, et je sais qu'il partage mes opinions sur ces questions.

1. LE P.RACINE. Le P.de G. m'a demandé confidentiellement si je croyais qu'il doit retourner aux Indes après sa visite prochaine en Europe. Mon R.P. Pere, il m'est difficile de répondre à cette question catégoriquement. Le P.Racine avait espéré faire un grand apostolat-intellectuel et religieux aux Indes, il s'était formé une idée de l'Inde très au-dessus de la réalité. D'ou, déception profonde. Je crois qu'il n'a pas pu s'adapter à la réalité - l'optimisme lui manque. Il a dû certainement penser parfois à un retour en Europe pourvu qu'un genre de ministère lui agréable y soit trouvé.

Une des raisons pourquoi il n'a pas pu s'adapter ici avec plein contentement est qu'il ne comprend pas par certains côtés, il me semble, la psychologie indienne. Il regarde nos élèves, pratiquement parlant, comme s'ils étaient des jeunes Universitaires de Paris. L'attitude d'indes des réactions naturelles dans les cercles européens. Les remarques et les critiques qu'il fait devant eux, les directives qu'il leur donne quelquefois seraient plus de mal que de bien - ce que le Père ne s'en rend pas toujours compte.

Si en vue de tout cela, et en particulier en vue de la situation de sa famille, le P.Racine lui-même se montre incliné de rester en Europe, surtout si Votre Révérence croit qu'il pourra faire plus de bien en Europe, je crois qu'il ne doit pas être pressé de rentrer ici, mais plutôt approuvé dans cette idée. Si d'autre part, le Père, dans l'examen de la situation dans le recul, se sent plus reconcilié aux conditions dans l'Inde, plus dispose d'être patient avec les hommes et les situations, moins sévère dans ses jugements sur elles, et par conséquent sincèrement désireux de recommencer je crois qu'on doit lui permettre de revenir. Ses grandes qualités personnelles, et ses solides vertus religieuses lui assureraient encore un bel apostolat chez nous.

Fr D'Souza, rector, Loyola College, June 1, 1946

Le P. Racine. Le P. de Grangeneuve m'a demandé confidentiellement si je croyais qu'il doit retourner aux Indes après sa visite prochaine en Europe. Mon Révérend Père, il m'est difficile de répondre à cette question catégoriquement. Le P. Racine avait espéré faire un grand apostolat - intellectuel et religieux - aux Indes. Il s'était formé une idée de l'Inde très au dessus de la réalité. D'où, déception profonde. Je crois qu'il n'a pas pu s'adapter à la réalité - l'optimisme lui manque. Il a dû certainement penser parfois à un retour en Europe pourvu qu'un genre de ministère lui agréable y soit trouvé.

Une des raisons pourquoi il n'a pas pu d'adapter ici avec plein contentement est qu'il ne comprend pas par certains côtés, il me semble, la psychologie indienne. Il regarde nos élèves, pratiquement parlant, comme s'ils étaient des jeunes Universitaires de Paris et il attend d'eux des réactions naturelles dans les cercles européens. Les remarques et les critiques qu'il fait devant eux, les directives qu'il leur donne quelquefois feraient plus de mal que de bien - ce que le Père ne s'en rend pas toujours compte.

Si en vue de tout cela, et en particulier en vue de la situation de sa famille, le P. Racine lui même se montre incliné de rester en Europe, surtout si Votre Révérence croit qu'il pourra faire plus de bien en Europe, je crois qu'il ne doit pas être pressé de rentrer ici, mais plutôt approuvé dans cette idée. Si, d'autre part, le Père, examinant la situation dans le recul, se sent plus réconcilié aux conditions de l'Inde, plus disposé d'être patient avec les hommes et les situations, moins sévère dans ses jugements sur elles, et par conséquent sincèrement désireux de recommencer, je crois qu'on doit lui permettre de revenir. Ses grandes qualités personnelles, et ses solides vertus religieuses lui assureraient encore un bel apostolat chez nous.

Father Racine

His erudition was clear from his lectures, his courses were research oriented in contrast with the traditional way of teaching which aimed only at leading the largest number of students to success in their exams. At that time with Ananda Rao, a noted analyst, and Vaidyanathaswamy, who had broader interests, Madras was the best place in India for studying mathematics and starting into research.

In the words of C. S. Seshadri, he was not a good teacher in the classroom but nevertheless a great teacher.

Father Racine

Father Racine taught his students to read recent books, like the one of L. Schwartz on distributions.

Racine wrote a letter to the French mathematician Leray, commending the names Seshadri and Narasimhan to his attention.

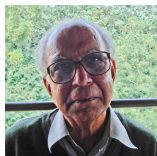
The French government conferred on him the coveted *Légion d'honneur* in 1962. In all the 42 years he spent in India, he made only two trips to France; yet he remained very much a Frenchman. But there can be little doubt that he loved India more than France.

Students of Father Racine

Father Racine encouraged his best students to join the newly founded Tata Institute of Fundamental Research (TIFR) in Bombay with K. Chandrasekharan and K.G. Ramanathan. This explains why so many mathematicians from that generation who were the leaders in TIFR came from Tamil Nadu.

The list of the former students of Father Racine who became well known mathematicians is impressive : Venugopal Rao, P.K. Raman, M.S. Narasimhan, C.S. Seshadri, Ramabhadran, K. Varadarajan, Raghavan Narasimhan, C.P. Ramanujam, Ramabhadran Narasimhan, Ananda Swarup, S. Ramaswamy, Cyril D'Souza, Christopher Rego, V.S. Krishnan and S. Sribala.

M.S. Narasimhan



M.S. Narasimhan
(1932–2021)

Recipient of the Padma Bhushan in
1990
Ordre national du Mérite in 1989
King Faisal International Prize for
Science in 2006

Head of the research group in Mathematics at the
International Centre for Theoretical Physics (ICTP) in Trieste
from 1993 to 1999.



R. NARASIMHAN, *The coming of age of mathematics in
India*, in *Miscellanea mathematica*, Springer, Berlin, 1991,
pp. 235–258.

<https://www.ictp.it/about-ictp/media-centre/news/2021/5/in-memoriam-narasimhan.aspx>

M.S. Narasimhan

M.S. Narasimhan visited France in the 60's under the invitation of Laurent Schwartz and was exposed to the works of other French mathematicians including Jean-Pierre Serre, Claude Chevalley, Élie Cartan, and Jean Leray. He contracted pleurisy during his time in France and was hospitalized. He would later recount the incident as exposing him to the "real France" and further strengthening his leftist sympathies which were already triggered by his interactions with Laurent Schwartz.

S Ramanan. *M S Narasimhan, The Man and the Mathematician — A Personal Perspective*. Asia Pacific Mathematics Newsletter, April 2013, Volume 3 No 2, 21–24.

http://www.asiapacific-mathnews.com/03/0302/0021_0024.pdf

C.S. Seshadri



C.S. Seshadri
(1932 – 2020)

Paris 1957 - 1960

Doctorat honoris causa, Université
Pierre-et-Marie-Curie (UPMC),
Paris, 2013

Recipient of the Padma Bhushan in
2009

M.S. Narasimhan and C.S. Seshadri were among the first graduate students of the School of Mathematics, headed by K. Chandrasekharan.

https://fr.wikipedia.org/wiki/C._S._Seshadri



M.S. Raghunathan



PhD under M.S. Narasimhan in
1966

Recipient of the Padma Bhushan in
2012

Madabusi Santanam Raghunathan

-  M. S. RAGHUNATHAN, *Artless innocents and ivory-tower sophisticates : Some personalities on the Indian mathematical scene*, Current Science, 85 (2003), pp. 526–536. <http://www.ias.ac.in/currsci/aug252003/526.pdf>
-  M. S. RAGHUNATHAN, *India and the world of mathematics*, ICM 2010 (Hyderabad).

https://en.wikipedia.org/wiki/M._S._Raghunathan

The creation of the Tata Institute of Fundamental Research in Bombay is due to a physicist of the Indian Institute of Science of Bangalore, Homi J. Bhabha (1909–1966), who had political support from J. Nehru and financial support from the Tatas, a Parsi industrial family which is still extremely powerful. At the end of the 19th Century a member of this family, Jamsetji Nusserwanji Tata, was at the origin of the creation of the Indian Institute of Science in Bangalore. The goal of Bhabha was for India to acquire nuclear power, and for this purpose it was necessary to create a research school in physics of high level ; in turn, this objective made it necessary to create a strong mathematical research school.

<https://www.tifr.res.in/>

Laurent Schwartz



Laurent Schwartz

(1915 – 2002)

Alexandre Grothendieck



Alexandre Grothendieck

(1928 - 2014)

Right after its creation, many influential French mathematicians visited the Tata Institute of Bombay and gave courses. In the 50's, L. Schwartz visited it several times, followed by H. Cartan, F. Bruhat, J.L. Koszul, P. Samuel, B. Malgrange, J. Dieudonné, P. Gabriel, M. Demazure, A. Douady and many others, invited by the Director of that time, K. Chandrasekharan. Later, at the end of the 60's, A. Weil and A. Grothendieck visited TIFR.

<https://mathshistory.st-andrews.ac.uk/Biographies/Schwartz/>

<https://mathshistory.st-andrews.ac.uk/Biographies/Grothendieck/>

CMI began as the School of Mathematics, SPIC Science Foundation, in 1989. The SPIC Science Foundation was set up in 1986 by Southern Petrochemical Industries Corporation Ltd (SPIC), one of the major industrial houses in India, to foster the growth of Science and Technology in the country. The driving force was C.S. Seshadri.

In 1996, the School of Mathematics became an independent institution and changed its name to SPIC Mathematical Institute. In 1998, in order to better reflect the emerging role of the institute, it was renamed the Chennai Mathematical Institute (CMI).

Chennai Mathematical Institute is a centre of excellence for teaching and research in the mathematical sciences.

<https://www.cmi.ac.in/about/history.php>

Agreement CMI - ENS



Etienne Guyon



Pierre Cartier

Thanks to an agreement (MoU) between the CMI (*Chennai Mathematical Institute*) and ENS (*École Normale Supérieure*, rue d'Ulm, Paris), every year since 2000, some three young students from ENS visit CMI for two months and deliver courses to the undergraduate students of CMI, and three students from CMI visit ENS for two months. The French students are accommodated in the guest house of IMSc, which participates in this cooperation.

https://fr.wikipedia.org/wiki/Etienne_Guyon

<https://mathshistory.st-andrews.ac.uk/Biographies/Cartier/>

PICS

The influence of French mathematicians on the development of mathematics in India has played a leading role in at least two topics : algebraic geometry in the 1960's and theoretical partial differential equations in the 1970's.



Jean-Louis Verdier
(1935 – 1989)

J-L. Verdier was responsible of a PICS Inde (PICS=*Programme International de Coopération Scientifique*) of the CNRS (*Centre International de la Recherche Scientifique*) from 1986 to 1989.

https://opc.mfo.de/person_detail?id=3393

https://fr.wikipedia.org/wiki/Jean-Louis_Verdier

A report on this cooperation was published in the *Gazette des Mathématiciens* of the Société Mathématique de France (n° 49, juin 1991, pp. 59–61).

A second report dealing with the activities from 1986 and 1995 was published in the same *Gazette des Mathématiciens* (n° 71, 1997, pp. 62–65).



Jacques-Louis Lions
(1928 – 2001)

In applied mathematics also the cooperation between mathematicians from France and from India is quite strong. While J.L. Lions was at the head of INRIA (*Institut National de Recherche en Informatique et Automatique*) in Rocquencourt, he developed close relations with several Indian institutions : IISc (*Indian Institute of Science*) in Bangalore, IIT *Indian Institute of Technology* in Delhi, and most of all with the small group of mathematicians working on partial differential equations in the Bangalore section of TIFR.

https://mathshistory.st-andrews.ac.uk/Biographies/Lions_Jacques-Louis/



Olivier Pironneau

In September 1997 a Master of Scientific Calculus was created at the University of Pondicherry, thanks to a cooperation directed by O. Pironneau. The cooperation on *Scientific Calculus for Mechanics and Engineering* between the laboratory of Numerical Analysis of Paris VI and INRIA Rocquencourt in France and ISSc Bangalore, TIFR Bangalore and IIT Delhi in India, started in 1975 and the agreements have been renewed in 1993; this program is supported by IFCPAR, the French Ministry of Foreign Affairs and the *Pôle de recherche commun Dassault-Aviation/Université Paris VI*.

https://fr.wikipedia.org/wiki/Olivier_Pironneau

Coordination of the Indo–French cooperation in mathematics



Jean-Louis Colliot-Thélène



Gilles Lachaud
(1946 – 2018)

Data base - calls for applications

CEFIPRA – IFCEPAR



Indo-French Centre for the Promotion of Advanced Research (IFCPAR)/
Centre Franco-Indien pour la Promotion de la Recherche Avancée (CEFIPRA)



Indo-French Centre for the Promotion of Advanced Research (IFCPAR, CEFIPRA in French) is a bilateral programme of scientific cooperation between India and France under the Department of Science and Technology, Government of India and the Ministry of Foreign Affairs, Government of France.

<http://www.cefipra.org/>

CEFIPRA – IFCEPAR Annual Report 2019–2020



Indo-French Centre for the Promotion of Advanced Research (IFCPAR)/
Centre Franco-Indien pour la Promotion de la Recherche Avancée (CEFIPRA)



p -ADIC aspects of automorphic forms and their L-functions

Project No. 5601-1 Nov. 2016 to Oct. 2019

Interactions between dynamical systems, geometry and number theory

Project No. 5801-1 Jan. 2018 to Jan. 2021

Principal Collaborators



Anantharam Raghuram
Indian Institute of Science Education
and Research
Pune



Mladen Dimitrov
CNRS / Laboratoire Paul
Painlevé University of Lille
Lille

Principal Collaborators



Anish Ghosh
Tata Institute of Fundamental Research
Mumbai



Arnaldo Nogueira
Aix Marseille University
Marseille

http://www.cefipra.org/Publication/Annual_Report/AR_2019-20_Web.pdf

CEFIPRA – IFCEPAR Annual Report 2019–2020

High performance formation control in the presence of uncertainties and communication constraints

Project No. 6001-1 Feb. 2019 to Jan. 2022

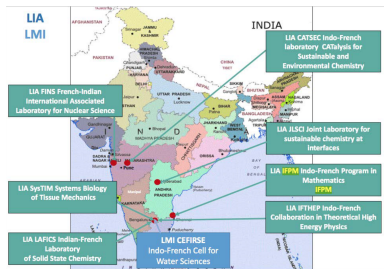


Maximal abelian subalgebras in operator algebras

Project No. 6101-1 Jun 2019 to May 2022



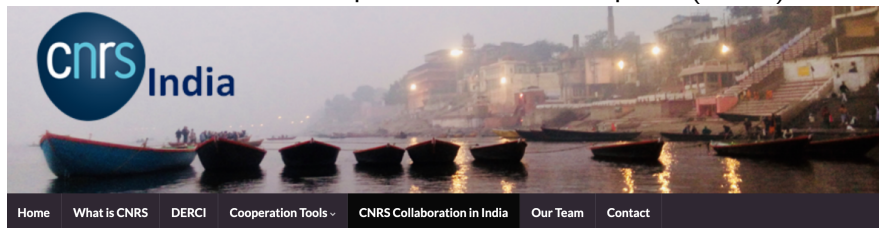
http://www.cefipra.org/Publication/Annual_Report/AR_2019-20_Web.pdf



The *Indo–French Institute of Mathematics (IFIM=Institut Franco–Indien de Mathématiques)* is a virtual institute which was created in 2003

with the support of NBHM (National Board for Higher Mathematics) and DST (Department of Science and Technology) on the Indian side and MAE (Ministère des Affaires Étrangères) and CNRS (Centre National de la Recherche Scientifique) on the French side. One of the main objectives is to provide financial supports for doctoral, postdoctoral and research positions.

LIA "Centre franco-indien pour les mathématiques" (CFIM)



<https://india.cnrs.fr/cnrs-collaboration-in-india/>

Indo-French Program in Mathematics (IFPM)

INDO-FRENCH PROGRAM IN MATHEMATICS (IFPM)

Duration: 2016-2019

The Indo-French Program in Mathematics (IFPM) was created to promote and reinforce Indo-French cooperation in all areas of mathematics including the mathematical aspects of Information and Communications Science and Technology. A particular attention will be given to funding and encouragement of graduate students, postdoctoral scientists and young promising faculty members.

The LIA IFPM, will reach its objectives through a broad spectrum of programs:

- Exchange of graduate students and postdoctoral fellows between both countries.
- Ensuring a continuous flow of exchange visitors, with a special emphasize on young mathematicians.
- Promoting cooperation in new areas of interdisciplinary mutual interest.

The LIA IFPM is national in its scope and objective in both countries. Consequently, any scientist in both countries whose program falls into the scientific spectrum of the LIA is eligible to apply for its programs. Moreover, in France the LIA will pay special attention to departments and laboratories which fall in the scope of the regional funding institutions which are Partners to the present project.

Partners:

The Centre National de la Recherche Scientifique
CNRS acting on behalf of the Université Pierre et Marie Curie Paris 6
The Université Paris Diderot Paris 7
The Institute of Mathematical Sciences

Coordinators:



Ramachandran Balasubramanian
Institute of Mathematical Sciences, Chennai



Patrice Philippon
Institut de mathématiques de Jussieu
- Paris Rive Gauche

IFPM is the new name for CFIM, it is scheduled to continue until 2022.

<https://cnrsindiacom.wpcomstaging.com/wp-content/uploads/2017/11/IFPM.pdf>

International research Laboratory (IRL)

INDO-FRENCH CENTRE FOR APPLIED MATHEMATICS



[Home](#) [Committees](#) [Sponsors](#) [Joint Research Projects](#) [Events](#) [Downloads](#) [Visitors Programme](#) [Contact](#)

The Indo-French Centre for Applied Mathematics (IFCAM) has been jointly set up by the Indian and French Governments at the Indian Institute of Science, Bangalore as an international joint research unit (UMI). IFCAM is designed as a platform for cooperation in mathematical sciences with the primary focus being the area of applied mathematics.

IFCAM funds joint research projects between Indian and French investigators, exchange visits of faculty and students (within the ambit of a research collaboration), exploratory visits, post-doctoral fellowships, joint research workshops, annual summer/winter school, and visits by Indian researchers (particularly from universities and colleges) to IFCAM.

Director: Prof. Govindan Rangarajan, Indian Institute of Science, India.

Deputy Director: Prof. Fabrice Gamboa, Université Paul Sabatier, France.

Financial Management: Indo-French Centre for the Promotion of Advanced Research (CEFIPRA), India

Joint Research Proposals

Deadline for submitting Joint Research Proposals is **May 7th 2019**

Indo-French Workshop 2021

<http://www.math.iisc.ac.in/~ifcam/index.html>

UMI Relax à Chennai

Unité mixte internationale franco-indienne en informatique



© CMI

Accueil > Espace presse

Création d'une unité mixte internationale franco-indienne en informatique

20 novembre 2017

INSTITUTIONNEL

Le CNRS, l'université de Bordeaux, l'ENS Paris-Saclay, et leurs partenaires indiens du CMI (Chennai Mathematical Institute) et du IMSC (Institute of Mathematical Sciences) viennent de créer Relax, une unité mixte internationale en informatique.

A - / A+

Director Madhavan Mukund, deputy director Pascal Weil.

<https://www.cnrs.fr/fr/creation-dune-unite-mixte-internationale-franco-indienne-en-informatique>

The MODULI IRSES project



AN INTERNATIONAL RESEARCH STAFF EXCHANGE SCHEME **MODULI**

Indo European Collaboration on Moduli Spaces
January 1, 2014 – December 31, 2017

The main objective of this project is to establish new collaborations and reinforce existing collaborations between Europe and India in the field of moduli spaces, as well as training young researches. This will be done through the exchange of both experienced and early stage researchers, and the organization of conferences, specialized workshops and schools.

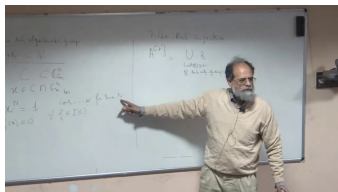
The project is a Marie Curie International Research Staff Exchange Scheme (irses) project in the 7th European Framework Program.

<https://www.icmat.es/projects/irsesmoduli/home.xhtml>

The MODULI IRSES project



MODULI
AN INTERNATIONAL RESEARCH STAFF EXCHANGE SCHEME



Sinnou David

First conference of the Indo-French Program for Mathematics

ORGANISER : Sinnou David
from CNRS

VENUE : IMSc

DATE : 11 - 24 January 2016

Former deputy scientific director at INSMI
Institut National des Sciences Mathématiques et leurs Interactions

<https://www.icmat.es/projects/irsesmoduli/events.xhtml>

IRP – Indo French Center for Applied Mathematics

IRP- INDO FRENCH CENTRE FOR APPLIED MATHEMATICS



Govindan Rangarajan
Director
Indo French Centre for Applied Mathematics
–UMI3494.
Bangalore – INDIA

“Mathematicians can also address real world problems while being in academics”
“IFCAM greatly strengthened Indo-French cooperation in applied mathematics”

India and France share a profound fascination for Mathematics. André Weil, Father Racine followed by several other French mathematicians have interacted with India right from the 30s. However, a structured entity, the prestigious International Mixed Unit (UMI), the Indo-French Centre for Applied Mathematics came into existence in 2012. Could you relate the progression of early events that ultimately culminated in the creation of IFCAM?

MOU

- There are several MoU (*Memorandum of Understanding*) between French and Indian Universities. One of them involved the University of Pondicherry in India and the universities of Paris VI and Poitiers in France. During a number of years there were many scientific exchanges under this agreement with a strong support of the French Embassy in Delhi.

MOU

- Another MoU has been signed in 2009 between the University of Paris VI Pierre et Marie Curie and the two institutes of Chennai, CMI (*Chennai Mathematical Institute*) and IMSc (*Institute of Mathematical Sciences*). An item in this MoU follows a recommendation of the COPED (*Committee for Developing Countries*) of the French Academy of Sciences : each year, one full time teaching duty of a mathematician from Paris VI will be given in Chennai. In practice, two professors from Paris 6 will go to CMI each year to teach an graduate program for one term each.

Further supports

- Several other sources of funding enable senior mathematicians from India and France to visit the other country. Among them are supports from CNRS and the Ministry of Education in France, from the NBHM (*National Board of Mathematics*) in India. As an example, an agreement between CNRS and NBHM from 1999 to 2003 enabled each year some three mathematicians from each country to visit the other one, when no other support from one of the other programs was suitable. There are also agreements between the Académie des Sciences de Paris and the Indian National Science Academy (INSA) in New Delhi.

Scholarships

- A number of scholarships enable young mathematicians from India (as well as from other countries) to pursue their studies in France. This includes *cotutelle theses* (codirection). The website of the French Embassy gathers some information on this matter and proposes a number of links to several institutions in France : Campus France, Egide, CNOUS (*Centre National des Œuvres Universitaires et Scolaires*), ONISEP (a French provider of student career and job information), CEFI (*Centre de ressources et de prospective sur les Grandes écoles d'ingénieurs et de gestion, et sur les emplois d'encadrement*). . .

http://ambafrance-in.org/france_inde/spip.php?article4158



The CIMPA, already mentioned, a non-profit international organization established in Nice (France) since 1978, whose aim is to promote international cooperation in higher education and research in mathematics and related subjects, particularly computer science, for the benefit of developing countries, organized several research schools in India, starting in 1996.

<https://www.cimpa.info/>

KOLKATA	2002	02/12/2002 to: 13/12/2002	Soft Computing approach to pattern recognition and image processing
MUMBAI	2002	09/09/2002 to: 22/09/2002	Probability measures on groups: Recent Direction and trends
PONDICHERRY	2003	02/02/2003 to: 14/02/2003	Discrete Integrable Systems
BANGALORE	2005	25/01/2005 to: 04/02/2005	Security for Computer Systems and Networks
MUMBAI	2008	02/01/2008 to: 12/01/2008	Commutative algebra
NEWDELHI	2013	25/11/2013 to: 06/12/2013	Generalized Nash Equilibrium Problems, Bilevel programming and MPEC
SHILONG	2013	18/11/2013 to: 30/11/2013	Fourier analysis of groups in combinatorics
BANGALORE	2013	08/07/2013 to: 19/07/2013	Current Trends in Computational Methods for PDEs
MUMBAI	2015	06/07/2015 to: 17/07/2015	Summer School on Current Research in Finite Element Methods
KOLKATA	2016	01/12/2016 to: 12/12/2016	On Geometric Flows
KANPUR	2017	10/07/2017 to: 21/07/2017	Summer School on Multiscale Computational Methods and Error Control
PUNE	2017	19/06/2017 to: 30/06/2017	Recent Trends in Non-Commutative Algebras
VARANASI	2019	05/12/2019 to: 15/12/2019	Finsler Geometry and Applications
KOLKATA	2021	18/01/2022 to: 29/01/2022	Groups and Geometry (postponed in 2022)
VARANASI	2022	12/12/2022 to: 22/12/2022	Geometric Structures on Surfaces, Moduli Spaces and Dynamics
KOLKATA	2022	18/01/2022 to: 29/01/2022	Groups and Geometry (2021 CIMPA School postponed due to Covid 19)

Waring's Problem



Edward Waring
(1736 – 1798)



F.D, R.B, J-M.D

E. Waring, 1770 : *Every integer is a cube or the sum of two, three, . . . nine cubes ; every integer is also the square of a square, or the sum of up to nineteen such ; and so forth. Similar laws may be affirmed for the correspondingly defined numbers of quantities of any like degree.*

$g(4) = 19$: R. Balasubramanian, J-M. Deshouillers, F. Dress
(1986)

<https://mathshistory.st-andrews.ac.uk/Biographies/Waring/>

Serre's Modularity Conjecture



Jean-Pierre Serre



Chandrashekhara Khare



Jean-Pierre Wintenberger
(1954–2019)

Serre's Modularity Conjecture was proved in 2006 in a joint work by Chandrashekhara Khare and Jean-Pierre Wintenberger.

K. Ramachandra



Kanakanahalli Ramachandra
(1933 – 2011)

PhD 1965

1965 –1995 Tata Institute of
Fundamental Research Bombay

1995 – 2011 National Institute of
Advanced Studies, Bangalore

K. Ramachandra, *Contributions to the theory of
transcendental numbers*. *Acta Arith.* **14**, (1968), pp. 65–88.

1976 : my first visit to India at TIFR.

https://en.wikipedia.org/wiki/Kanakanahalli_Ramachandra

French Science Today 2006

12 lectures from November 13 to November 24, 2006

Indore, CAT = Raja Ramanna Centre For Advanced Technology

Indore, Devi Ajilya University

Bhopal, Regional Sciences Centre

Chandigarh, Punjab Engineering College

Chandigarh, Colloquium du Département de Maths de l'Université

Delhi, St Stephen's College

Ranchi, Birla Institute of Technology Mesra

Kolkata, Bose Institute

Kolkata, M.P. Birla Planetarium

Kolkata, College RKM Vidyamandira (Belur Math)

Kolkata, Indian Statistical Institute (ISI)

Chennai, Institute of Mathematical Sciences (IMSc)

<http://www.imj-prg.fr/~michel.waldschmidt/articles/pdf/MissionIndeFST2006.pdf>

<https://in.ambafrance.org/-Science-Technology->

French Science Today 2007

13 lectures from October 17 to November 10, 2007

Mumbai, Tata Institute of Fundamental Research TIFR

University of Mumbai, Department of Mathematics

Pune, Bhaskaracharya Pratishthana

Pune, Department of Mathematics

Hyderabad, Planetarium, B.M. Birla Science Centre

Hyderabad Central University

Kolkata, Indian Statistical Institute

Kolkata, M.P. Birla Planetarium

Guwahati, Indian Institute of Technology

Bangalore, Indian Institute of Science

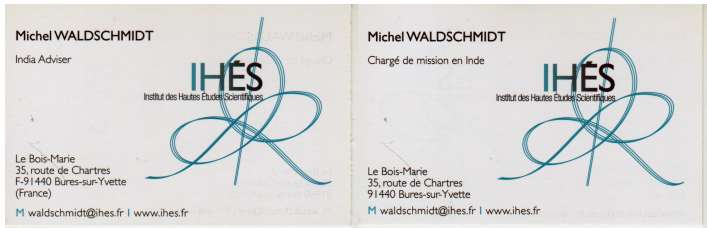
Trivandrum, St. Thomas School

Trivandrum, Kerala University, Department of Mathematics

Chennai, The Institute of Mathematical Sciences IMSc.

<http://www.imj-prg.fr/~michel.waldschmidt/articles/pdf/MissionIndeFST2007.pdf>

<https://in.ambafrance.org/-Science-Technology->



<https://www.ihes.fr/>

Kerala School of Mathematics (KSoM)

International Conference on Class Groups of Number Fields and Related Topics-2021

(October 21-24, 2021)

A conference celebrating Michel Waldschmidt's 75th birth year honoring his contribution to Mathematics and Education

<https://sites.google.com/view/iccgfnt2021/home>

Indian Mathematical Society



 **87th Annual Conference of the Indian
Mathematical Society**
-An International Meet (Online)



December 04-07, 2021

Organized by
Department of Applied Sciences, JNEC, MGM University,
Aurangabad 431003, India.

<http://www.mgmu.ac.in/ims/>

Special functions

November 22 - 24, 2018 : 17th Annual Meeting of SSFA - International Conference on Special Functions & Applications (ICSFA-2018), Amal Jyothi College on Engineering, Kanjirapalli, Kottayam (Kerala).



M.A. Pathan

Aligarh Muslim University
(AMU)
Department of Mathematics

Lidstone interpolation

References

Indo–French cooperation in Mathematics Special issue on Mathematics Newsletter of the Ramanujan Mathematical Society , Vol. 19, Sp. No. 1, August 2010, 1-12.

Seminar on Successful Indo–French S & T Co-operation through CEFIPRA

May 17, 2013, Paris.

CEFIPRA 25th Anniversary Silver Jubilee Celebration and the expansion of its activities

<https://in.ambafrance.org/CEFIPRA-25th-Anniversary-7-March>

History of Indo-French Scientific Partnership

The future belongs to science and those who make friends with science. – Jawaharlal Nehru

<https://hos.ifindia.in/>

Indo-French Cooperation in Mathematics

Michel Waldschmidt

Professeur Émérite, Sorbonne Université,
Institut de Mathématiques de Jussieu, Paris

<http://www.imj-prg.fr/~michel.waldschmidt/>