Reading extension

The reading extension section is designed to provide supplementary reading material to work on your reading skills and learn more about real-world applications through learning about leading figures in various fields.

Sofia Kovalevskaya

Quick Info

Sofia Kovalevskaya was a Russian born mathematician who made valuable contributions to the theory of differential equations and made large contributions to mechanics.

Sofia Vasilyevna Kovalevskaya (1850-1891) was a Russian mathematician whose contributions to the theory of differential equations are of great importance. She was born into a family of the Russian nobility that forbade her to study maths during her childhood.

At 18 years old, Sofia married palaeontologist Vladimir Kovalevsky out of convenience to pursue a higher education. In 1869 they moved to Heidelberg, where she attended lectures unofficially by Kirchhoff, Helmholtz, Königsberger, and Du Bois-Reymond, because women could not matriculate at the university. In 1871 she started studying with Karl Weierstrass. By 1874, Kovalevskaya had completed three papers on Partial differential equations, Abelian integrals and Saturn's Rings. She was granted her doctorate summa cum laude from Göttingen University. The couple returned to Russia and, unable to obtain an academic position, Sofia conducted no research for six years.

From 1880 she returned to her studies after an invitation from Chebyshev to the Congress of Natural Scientists in St Petersburg. In 1882 she began work on the refraction of light. Mittag-Leffler obtained for her a position as privatdocent in Stockholm, and she would be appointed to an extraordinary professorship the following year. Kovalevskaya was awarded the Prix Bordin of the French Academy of Sciences in 1886 for her paper on the study of rigid bodies. She also won a prize from the Swedish Academy of Sciences in 1889, and was elected a corresponding member of the Imperial Academy of Sciences. In 1891, at the height of her career, Kovalevskaya died of influenza complicated by pneumonia.

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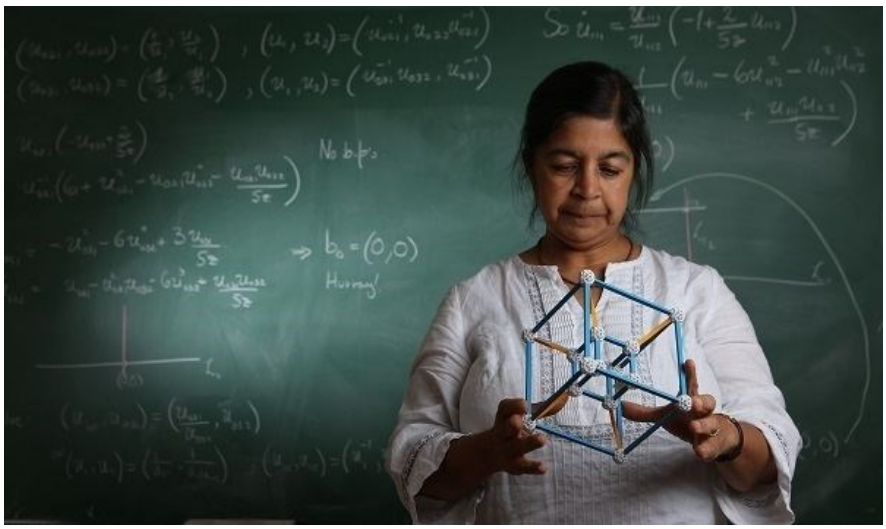
Nalini Joshi



Quick Info

Nalini Joshi is an Australian mathematician known for her work in nonlinear differential equations and integrable systems. She is a professor at the University of Sydney and has been a strong advocate for women in STEM. Joshi has received numerous awards for her contributions to mathematics and education.

Nalini Joshi (1958-) is a Burmese-Australian mathematician renowned for her work on non-linear differential equations and integrable systems. Her love of maths began as a child in Myanmar where she loved counting (particularly in the Burmese number system) and games with repetitive patterns, and continued while adjusting moving to Australia at age 12 when she would often contemplate and read about big scientific questions. Joshi wanted to be an astronaut and study astronomy, but in university she found she enjoyed maths much more. “After trying it for a while, I realized that I could take my time, try alternative beginnings, do one step after another, and get to glimpse all kinds of possibilities along the way.”

Throughout her career, Joshi has been very vocal about promoting diversity and inclusion in academia. She co-founded the Science in Australia Gender Equity initiative, and she is very vocal about challenging the various problems she and others encounter. Joshi was formerly head of the Australian Mathematical Society, and the first female chair of applied mathematics at the University of Sydney. Her work focuses on Painlevé and soliton equations, which are differential equations describing integral systems. She employs tools from analysis, algebra, geometry and the many other interweaving areas of maths to solve these equations, and is renowned for visualising problems in different and unique ways.

“Instead of describing solutions as functions of an independent variable like time, they can be tracked by curves that go through initial values. The first perspective is like pointing a telescope to one point in the sky at night and taking pictures while time is changing. The second perspective is like tracking one star as it follows circular arcs of light in the sky at night.”

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Emmy Noether

Quick Info

Emmy Noether is best known for her contributions to abstract algebra, in particular, her study of chain conditions on ideals of rings.

Emmy Amalie Noether was a mathematician (1882-1935). Emmy was born in a wealthy Jewish family and her father was well known mathematician at Erlangen, Germany. She lived in Göttingen, Germany during the WWI.

Emmy Noether is best known for her contributions to abstract algebra, in particular, her study of invariant theory and also chain conditions on ideals of rings. She also worked in special relativity where she proved: "To every infinitesimal transformation of the Lorentz group there corresponds a Conservation Theorem", known in physics as Noether's theorem. Before women were allowed to matriculate at German universities, she sat in lectures in the University of Erlangen and University of Göttingen. It was in 1904 when she was able to matriculate to the University of Erlangen, obtaining her degree and later doctorate in 1907 under Paul Gordan's supervision.

During WWI she worked with Hilbert and Klein in the University of Göttingen under poverty conditions. Thanks to their continuous support, in 1919 Noether was given the position of Privatdozent.

Before this, much of her work was under the name of her father or under other male mathematicians. In April of 1933 she was dismissed from her position by the Nazis due to her Jewish heritage. In October of 1933, she was invited by Anna Johnson and Pell Wheeler to visit Bryn Mawr College, USA, for a year, during which period she also collaborated at Princeton. After a short visit back to Germany, Noether was invited to return until her unexpected death. Noether died in 1935 after the detection and operation of a benign tumour.

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Kathleen Olleren-shaw

Quick Info

Dame Kathleen Ollerenshaw (1912-2014) was an English mathematician and politician. She was deaf from the age of 8 and claimed to enjoy learning maths, although out of necessity she very quickly learned to read lips.

"Mathematics is the one school subject not dependent on hearing."

Ollerenshaw had many achievements in her life, including being appointed Dame Commander in 1970 for services to education, being appointed in Lord Mayor of Manchester in 1975, and being the founding president of the Institute of mathematics and its applications in 1978. She was renowned for using statistics to impact government policy on social issues and campaigning improving school standards, especially for girls.

As a mathematician, Ollerenshaw received her doctorate from Oxford University for her work on critical lattices, which describe how to most efficiently stack geometric objects. She was able to complete her Ph.D. without even submitting a thesis after submitting five papers on the subject within two years. Later in her career, she transitioned into amateur astronomy and solving recreational maths puzzles alongside her political work and education. In 1980, Ollerenshaw was the first person to create an algorithm for solving a Rubik's cube, and she also made notable breakthroughs with magic squares and many other puzzles

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Peter Landin

Quick Info

Peter Landin was a British computer scientist known for pioneering the use of lambda calculus in programming languages. His work laid the foundation for functional programming and influenced languages like Lisp and Haskell. He introduced key concepts such as the SECD machine (a virtual machine for functional languages) and the use of closures in programming.

Landin was a computer scientist, whose discovery of the 'off-side rule' and the application of Lambda calculus in programming languages, changed the face of computer programming.

From a young age, Landin showed clear aptitude for maths, having completed his Cambridge maths degree in 2 years. During the 60's he moved to New York and then later Massachusetts before returning home and taking on a role at Queen Mary University of London where he worked on building up the computer science department.

Landin wanted to create a programming language that would not be tied to one machine but could rather be used across different machines and manufacturers. This led him to using Lambda calculus to model a new language. By using Lambda calculus as the basis for his coding he was able to integrate it into his own language, ISWIM, which used higher order functions, automatic storage management and abstract syntax notation. This language became the basis of LISP, ML and Haskell. His work, also led to the introduction of 'Landin's Off-side Rule', which describes the indentation rule commonly used in Python. This was published in his paper, 'The Next 700 Programming Languages', and is vital in ensuring the structure and scope of the code.

Aside from his ground-breaking work in computer science, Landin was an avid campaigner for LGBT rights, and as Bisexual himself was close to the cause and was actively involved with the Gay Liberation Front during the 70's. He separated from his wife in 1973, and began to pursue gay politics, hosting dinner parties in his London flat and encouraging fundraisers and protests. Towards the end of his life Landin shifted away from computer science as he felt it had become a capitalist subject with a focus on profit making and was ashamed of the turn it was making.

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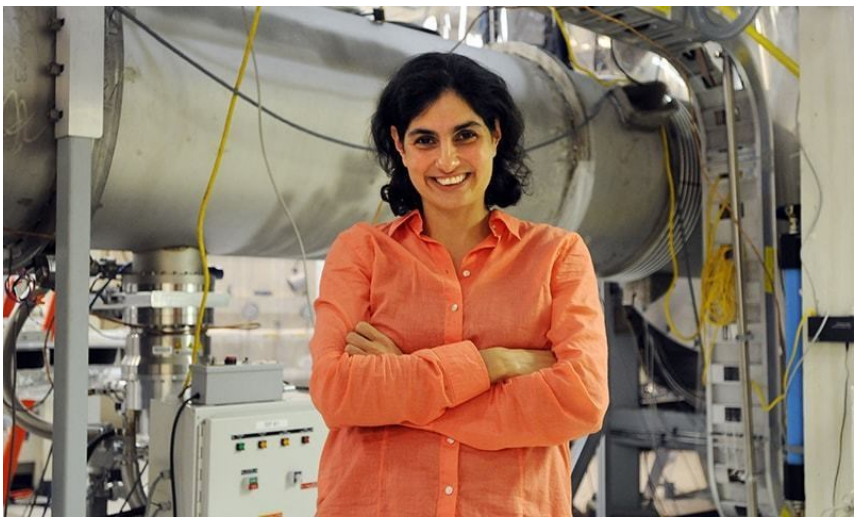
Nergis Mavalvala



Quick Info

Nergis Mavalvala (1968-) is a Pakistani physicist known for her leading work in the discovery of gravitational waves.

Her Ph.D. work solved the problem of how to precisely align mirrors less than a metre wide separated by four kilometres, and this method is implemented today in LIGO to detect gravitational waves. She began working in the field well before most people had heard of gravitational waves, and her work has been an integral part of an international collaboration of thousands of scientists.

In 2014, Mavalvala and her group were working on the quantum technologies being implemented in the Advanced LIGO system. When the new system came online, the group needed to validate the data analysis techniques of the new system by feeding fake signals into the data stream and seeing if these signals were detected. This was important, because the project was able to detect gravitational waves which produced very strong signals compared to the signals from background noise with high statistical significance.

Mavalvala was a recipient of the MacArthur genius award in 2010, was named LGBTQ Scientist of the year in 2014, and in recent years she was appointed Dean of the School of Sciences at MIT. She is also renowned for her advocacy in challenging racial and social injustices in STEM.

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Diophantus of Alexandria (200BC - 284BC)

Quick Info

Diophantus of Alexandria wrote *Arithmetica*, a collection of problems dealing with algebraic equations, particularly Diophantine equations (equations with integer solutions). His work influenced later mathematicians, including Fermat and the development of modern algebra.

Diophantus, the 'father of algebra', is best known for his Arithmetica, a work on the solution of algebraic equations and on the theory of numbers. Essen□tially nothing is known of his life and the date at which he lived (about 200-284 in Alexandria, Egypt) is also not sure. The Arithmetica is a collection of 130 problems giving numerical solutions of determinate and indeterminate equa□tions. The method for solving the latter is now known as Diophantine analysis. Even if Diophantus is regarded as the 'father of algebra' there is no doubt that many of the methods for solving linear and quadratic equations go back to Babylonian mathematics. Diophan□tus' work has become famous in recent years due to its connection with Fer□mat's Last Theorem.

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