American Institute of Mathematics

THE FIRST DECADE

1998 - 2008

About AIM

The American Institute of Mathematics, a 501(c)(3) nonprofit organization, was founded in 1994 by Silicon Valley businessmen John Fry and Steve Sorenson, long-time supporters of mathematical research. The mission of AIM is to expand the frontiers of mathematical knowledge through sponsoring focused research projects and workshops and encouraging collaboration among mathematicians at all levels. AIM also works to preserve the history of mathematics through the acquisition and conservation of rare mathematical books and documents.

In 2002 AIM became one of only seven mathematical sciences institutes funded by the National Science Foundation. The NSF-sponsored AIM Research Conference Center (ARCC) holds weeklong focused workshops and hosts small research groups in all areas of the mathematical sciences.

AIM is overseen by a Board of Trustees, an Advisory Board, and a Human Resources Board. Workshops are selected by a Scientific Board. The Institute currently resides in Palo Alto, California, while awaiting the completion of its permanent headquarters in Morgan Hill, California. AIM maintains a website with more information at www.aimath.org.

American Institute
of Mathematics

Welcome from the Executive Director

Brian Conrey

The last 10 years have been an amazing time for AIM.

In January of 1998 we moved into the former corporate headquarters of Fry's Electronics, located next to the Palo Alto Fry's Electronics store. The "math warehouse," as we lovingly call it, has since been the site of some remarkable breakthroughs.

Research in mathematics is traditionally a slow and solitary endeavor. AIM seeks to encourage a different model of focused collaboration among mathematicians, in the hope of fostering significant progress on important questions. One of our earliest mathematical successes nicely illustrates this model. In 2000, AIM co-sponsored (together with Princeton) six months of full support for a small group of researchers who had the ambitious goal of solving the Perfect Graph Conjecture, which was regarded as perhaps the most challenging open problem in graph theory. The group's eventual proof of the conjecture was the topic of the very first AIM workshop, in 2002. You can read more about the proof of the Perfect Graph Conjecture and other mathematical breakthroughs in the "Major Research Achievements" section of this report (pp. 1-10).

AIM is one of only seven math institutes in the U.S. that are funded by the National Science Foundation. NSF sponsors the AIM Research Conference Center (ARCC), which holds focused research workshops and meetings for small research groups call Structured Quartet Research Ensembles, or SQuaREs. (You can read more about both types of activity in "Focused Workshops and SQuaREs." pp. 11-20.) SQuaREs is a relatively new program that is already producing promising results. Focused research workshops are AIM's signature program. We've now organized more than 100 workshops in the "AIM style" at ARCC and at other venues around the world! AIM-style workshops are focused on a specific goal and involve only around 30 participants so that significant progress toward the goal can be made during the week of the workshop. Our workshops employ what we like to call "dynamic scheduling," which new organizers are usually skeptical of but which ultimately allows for the content of the workshop to respond to the participants' needs each day. Comments from organizers and participants about these workshops have included, "This is the best workshop I've ever attended," "This workshop changed my life," and "This workshop started a new field!"

Some other highlights of our first decade include establishing the AIM Five-Year Fellowship Program for outstanding new PhDs in mathematics (our Fellows through 2008 are profiled in the "Five-Year Fellows" section, pp. 21-28); helping launch the San Jose Math Circle in Spring 1998 and starting the annual Morgan Hill Math Mardi Gras in 2006 (described in "Outreach" pp. 29-38); and getting our library off the ground through collecting reprints (our reprint library now consists of over 100,000 items) and acquiring the amazing Gian-Carlo Rota collection (read more in "Library," pp. 39-40).

Our biggest success in attracting public attention was unquestionably the mapping in early 2007 of the exceptional Lie group E8 by 18 mathematicians known as the Atlas Team. The story was carried in more than 1,000 newspapers around the world and on 200 television stations. The story broke on a Monday, and by Tuesday at 5 p.m. we had three different camera crews filming in our warehouse, one doing a live newscast from there!

As we look forward to our second decade we see many hopeful signs on the horizon, the biggest of which is the move to a magnificent new building modeled on the Alhambra in Granada, Spain, which is scheduled to open in Morgan Hill, California, in the near future (see "Future," pp. 53-54). The groundbreaking ceremony in 2007 was spectacular. More than 300 people attended. The President of the National Academy of Sciences sent a congratulatory letter, which was read by Master of Ceremonies Ron Graham. The keynote address was delivered by Congressman Jerry McNerney—the only member of the U.S. Congress with a PhD in mathematics, who also happens to represent the district that includes Morgan Hill!

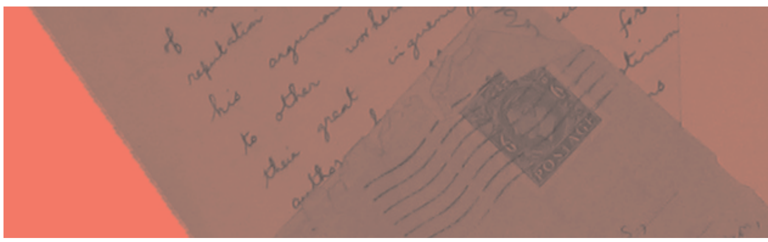
We are thrilled about relocating to Morgan Hill and about opening the "math castle" for business there. One of the most gratifying events of my tenure as AIM Executive Director was a Morgan Hill City Council meeting held in 2005 to vote on the fate of the new AIM facilities. Twenty-nine Morgan Hill residents, businesspeople from Silicon Valley, and mathematicians from all over the Bay Area spoke out in favor of the project, and the evidence for what AIM had already accomplished and the rich potential for the future overwhelmingly convinced the City Council to unanimously approve the building project. Since that time, we have also been energized by the formation of the Friends of AIM, a group of Morgan Hill residents who have been extremely supportive of AIM's efforts.

I hope you enjoy this book and the glimpses it provides of our first and future decades!

Brian Conrey

Major Research Achievements

Focused Workshops and SQuaREs

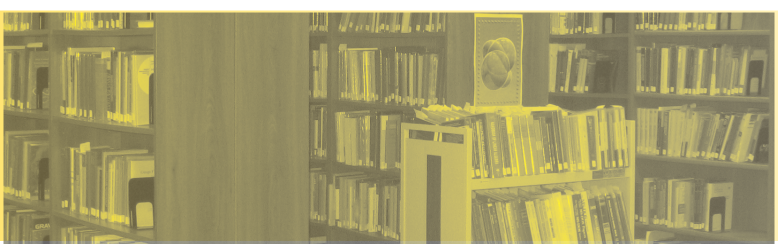


Five-Year Fellows

Outreach

Library

The Future



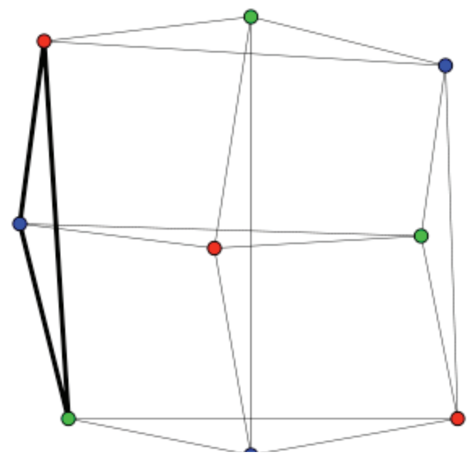
Major Research Achievements

The Perfect Graph Conjecture
The Mumford Conjecture
Small Gaps Between Primes
Mapping E8
Computing the First Transcendental *L*-Function of Degree 3
Quantum Unique Ergodicity
Selected AIM Publications

During the past ten years, AIM has fostered a number of research activities that have had a significant impact on the frontiers of current mathematical knowledge. For example, AIM funds the Five-Year Fellowship Program to provide time for outstanding young mathematicians to pursue their research interests, and we also occasionally support other mathematicians at their home institutions so that they have additional time for research at critical junctures in their work. In a number of instances, AIM has been able to help mathematicians secure funding for their projects from other organizations. Last but not least, AIM sponsors workshops for groups of researchers to work on "hot topics" in which new developments have the potential to make groundbreaking achievements possible.

This section highlights six significant research achievements that have been supported and advanced by AIM. Each has a different story, but all show the lasting impact of AIM's philosophy of focused, collaborative research to solve difficult problems.

The Perfect Graph Conjecture



The proof of the Strong Perfect Graph Conjecture, said to be one of the most beautiful conjectures in graph theory, was announced in 2002 by four mathematicians, Maria Chudnovsky, Neil Robertson, Robin Thomas, and Paul Seymour. This was especially significant for AIM because two of the mathematicians, Robertson and Thomas, were supported by an AIM grant that allowed them to join Seymour and Chudnovsky at Princeton to work together intensively for six months in the Spring of 2000. The Princeton Mathematics Department in turn reduced Seymour's teaching duties. Chudnovsky, a Ph.D student of Seymour, joined the project soon after.

The four worked together for 2 1/2 years before proving the conjecture. In an article called "How the proof of the strong perfect graph conjecture was found," Seymour wrote, "I am very grateful to AIM. They gave us a lot of help, and without their grant we might never have had the incentive or the opportunity to get started on perfect graphs. AIM funded us through the essential phase of trying out dozens of bad ideas that don't work."

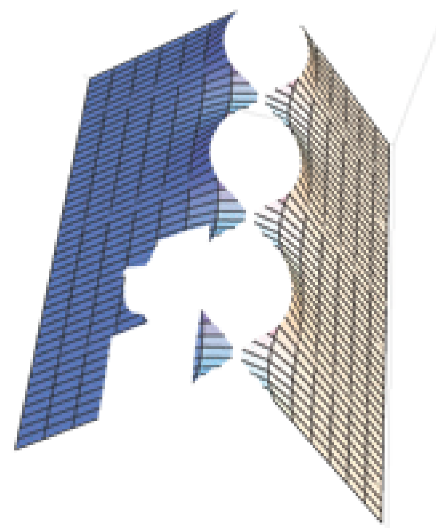
> ***"The idea of focusing on only one subject and nearly related subjects is a very good idea."***
>
> ***(excerpt from workshop participant survey)***

The proof of the conjecture became the basis of the very first AIM workshop held in late 2002. The purpose of the workshop was to present the complicated details of the 150-page-long proof and work on other related open questions. One of these questions was to see if one could recognize a perfect graph in what is called "polynomial time," that is, in a number of computations that are no more than some power of the number of vertices of the graph. In a wonderful confluence of events, the workshop participants discovered that several of them had already made progress on this problem, but from complementary directions. Indeed, by combining resources, the proof of the related polynomial time conjecture was completed only a week or so after the workshop ended.

The Mumford Conjecture

The Mumford Conjecture deals with certain geometric objects known as moduli spaces. The conjecture is named for David Mumford, who in 1974 received the Fields Medal, the most prestigious international award for mathematics. Just as molecules can be described by the number of atoms of each kind they contain, Mumford made a conjecture in 1983 about how moduli spaces can be described by their internal structure of simpler building blocks.

AIM played a significant role in the successful solution of the Mumford Conjecture. In 1998, the Danish mathematician Ib Madsen from the University of Aarhus was supported by AIM for three months to work on proving the conjecture. In the following years, AIM, Stanford University, and NSF supported two workshops related to the conjecture that were held at Stanford under the direction of Ralph Cohen. During these workshops, Madsen began to work collaboratively with Michael Weiss (now at University of Aberdeen), and the two mathematicians subsequently proved the Mumford Conjecture.



"This was a major result—a proof of a longstanding, important conjecture. Perhaps more importantly, the methods of the proof opened up a continuing, fruitful interplay between algebraic topology and algebraic geometry."
—Ralph Cohen

Following their solution, an AIM workshop on "Topology and Geometry of the Moduli Space of Curves" was organized by Ulrike Tillman and Ravi Vakil. This workshop spread the news of the solution by Madsen and Weiss and also brought together two different groups of mathematicians—algebraic geometers and topologists—so that each camp could learn the results and techniques of the other. At this workshop Madsen and Soren Galatius announced the proof of a further generalization of the Mumford Conjecture.

Small Gaps Between Primes

In work hailed by *Discover* magazine as one of the most important breakthroughs of 2005, Dan Goldston, Cem Yildirim, and János Pintz proved that infinitely often there are gaps between consecutive prime numbers that are much smaller than the average gap. The story of this work spans many years with AIM involved in different ways at different times.

Dan Goldston is a number theorist at San Jose State University and has been both a participant in and an organizer of AIM workshops. Working near AIM, he often made informal visits to AIM to listen to a talk or to meet with a visitor. In the fall of 2002, during one of these visits he had an inspiration about a new way to attack the Small Gaps Problem that he and Yildirim, a colleague from Bogazici University in Istanbul, had been working on for some time. To great fanfare and with extensive media coverage, they announced their result in the spring of 2003. But within a month they had to retract their claims after a serious problem in their proof was discovered by Andrew Granville and K. Soundararajan.

"The AIM workshop helped us to exhaust all the easy approaches that might have worked. It saved us a lot of time and focused our energy on more difficult paths that had some chance to succeed."
—Dan Goldston

All was not lost, however, and in the spring of 2004, Goldston found a crucial piece of information in a paper that he had been carrying around for years but had not read carefully. He and Yildirim continued to talk about their work with people at AIM and at meetings around the world, and then in December 2004, János Pintz in Hungary emailed them with a key idea. The three of them began serious work, using the internet as their means of communication, and finally succeeded in proving the theorem on Small Gaps Between Primes. AIM hosted a "Hot Topics" workshop on their work in late 2005, and at this workshop the three collaborators were all together in person for the first time.

Mapping E8

One of the great unsolved problems of mathematics, dating from the early 20th century, is to determine the unitary representations of all the Lie groups. The Atlas of Lie Groups and Representations project, an international collaboration of 18 mathematicians and computer scientists, has the ambitious goal of solving this problem. A major step toward their goal was completed in 2007, when they announced that they had found a complete description of the inner workings of the exceptional Lie group E8. AIM played a significant role in supporting the work of the Atlas team in the years leading up to this breakthrough.

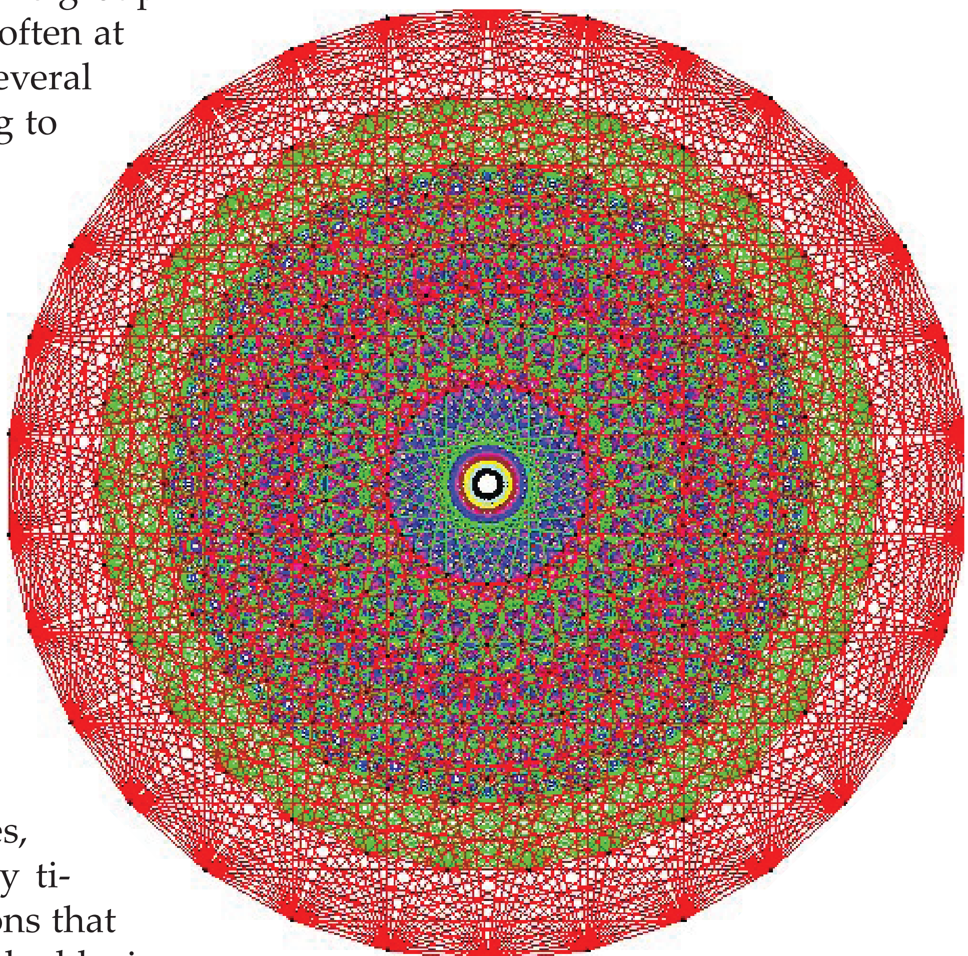
Lie groups were invented by the 19th century Norwegian mathematician Sophus Lie to study symmetry. Underlying any symmetrical object is a Lie group. Spheres, cylinders, or cones are familiar examples of symmetrical three-dimensional objects. Mathematicians study symmetries in higher dimensions.

The Lie group E8 has 248 dimensions and is the symmetry group of a 57-dimensional geometric space. "E8 was discovered over a century ago, in 1887, and until now, no one thought the structure could ever be understood," said Jeffrey Adams, Project Leader and Professor of Mathematics at the University of Maryland.

The magnitude and nature of the E8 calculation invite comparison with the Human Genome Project. The human genome, which contains all the genetic information of a cell, is less than a gigabyte in size. The result of the E8 calculation, which contains all the information about E8 and its representations, is 60 gigabytes in size. This is enough space to store 45 days of continuous music in MP3 format. If written out on paper, the result would cover an area the size of Manhattan. The computation required sophisticated new mathematical techniques and computing power not available even a few years ago. Whereas many scientific projects involve processing large amounts of input data, the E8 calculation is unusual, as the size of the input is comparatively small, but the answer itself is enormous, and very dense.

"This is an impressive achievement," said Hermann Nicolai, Director of the Albert Einstein Institute in Potsdam, Germany. "While mathematicians have known for a long time about the beauty and the uniqueness of E8, we physicists have come to appreciate its exceptional role only more recently. Understanding the inner workings of E8 is not only a great advance for pure mathematics, but may also help physicists in their quest for a unified theory."

AIM's role in the E8 breakthrough began in 2003, when AIM ignited the research by funding a meeting for the initial small group of investigators whose goal was not only to formulate a plan for the study of the Lie groups, but also to have AIM help them secure funding from the National Science Foundation for a multi-year project. The first efforts for NSF funding were unsuccessful, but with some foresight AIM brought a slightly larger group back to Palo Alto for another meeting the following year so that the project would not die and to again help the researchers seek additional funding. In 2005, the group received a Focused Research Grant (FRG) from NSF and their research efforts have flourished since then. The group has met several times since (often at AIM), and there have been several additional sources of funding to members of the Atlas team.



The mapping of E8 was announced by Atlas team member David Vogan at a colloquium at MIT, March 19, 2007. Leading up to this announcement, AIM worked closely with the Atlas team to develop their research breakthrough into a news story that would be accessible to the public. While preparing the E8 story, we learned about "hooks," press releases, finding good pictures, catchy titles, and a host of other lessons that have proved to be very valuable in explaining and promoting mathematics to the non-mathematician. We were initially hoping for coverage in science and technology magazines, but in the final days before Vogan's announcement a transition occurred and the story was picked up by the popular media. In the end, the E8 story was covered in hundreds of newspapers, dozens of radio stations, and on local TV; it even made national news on NPR's "All Things Considered" and ABC's "Good Morning America." Representative Jerry McNerney (D-Calif) delivered a statement to Congress about the result, saying, "The participants are to be commended for their work that has expanded the limits of human knowledge and brings hitherto unknown beauty and power to grace our human condition."

Computing the First Transcendental *L*-Function of Degree 3

The breakthrough discovery of an example of a transcendental third-degree *L*-function was announced at an AIM workshop in March of 2008 by Andrew Booker and Ce Bian. The most famous *L*-function is the Riemann zeta function which encodes how the prime numbers are distributed. All *L*-functions are believed to have deep connections to number theory and geometry. The previous known examples were of a less complicated nature and included *L*-functions of first and second degree and an algebraic type of third degree. (By way of analogy, the square root of two is algebraic and pi is transcendental.) More complicated *L*-functions were known to exist, but no one had computed them. The construction was made possible by some theoretical advances and approximately 10,000 hours of computer time to get initial results.

"This discovery is analogous to finding planets in remote solar systems. We know they are out there, but the problem is to detect them and determine what they look like. It gives us a glimpse of new worlds."
—Dorian Goldfeld

It was quite appropriate for the *L*-function announcement to be made at AIM since much of the inspiration, interest, and support for the discovery came from AIM-related projects. In July of 2007, *L*-functions experts gathered at AIM to participate in the workshop "*L*-functions and Modular Forms." At the workshop it became clear that new examples of transcendental *L*-functions were needed to make advances in the field. The experts were committed to push harder to find examples and applied for funding from the National Science Foundation with the idea of creating a database to systematically chart *L*-functions.

Eventually, in the spirit of friendly competition, four teams of researchers set out to construct the transcendental third-degree *L*-functions example using different approaches. The hope was to find the new *L*-function before the group was scheduled to meet again at another AIM workshop in March of 2008. It was agreed that the teams would not reveal results while they were working, but that if no one had constructed a new *L*-function, then the methods would be shared at the March workshop. The Booker and Bian team came in first, although one other team using a different approach had a solution about a week later. Since the announcement, many more *L*-functions of higher degree have been found. "The techniques developed by Bian and Booker open up whole new possibilities for experimenting with these powerful and mysterious functions and are a key step towards making our group project a success," remarks Michael Rubinstein, a participant in the March workshop.

The researchers will continue to work together in a Focused Research Grant funded by the National Science Foundation.

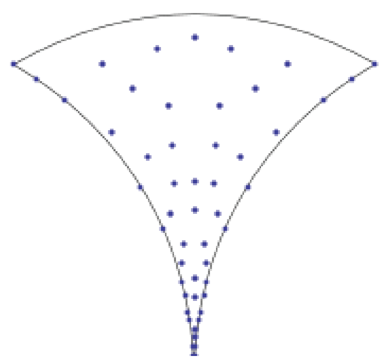
Quantum Unique Ergodicity

In a seminar that was held in September 2008 and co-organized by AIM and Stanford University, K. Soundararajan announced that he and Roman Holowinsky had proved a significant version of the Quantum Unique Ergodicity (QUE) Conjecture. "This is one of the best theorems of the year," said Peter Sarnak, a mathematician from Princeton who along with Zeev Rudnick from the University of Tel Aviv formulated the conjecture fifteen years ago in an effort to understand the connections between classical and quantum physics.

The motivation behind the problem is to understand how waves are influenced by the geometry of their enclosure. Imagine sound waves in a concert hall. In a well-designed concert hall you can hear every note from every seat. The sound waves spread out uniformly and evenly. At the opposite extreme are "whispering galleries" where sound concentrates in a small area.

"This is one of the best theorems of the year."
—Peter Sarnak

The mathematical world is populated by all kinds of shapes, some of which are easy to picture, like spheres and donuts, and others that are constructed from abstract mathematics. All of these shapes have waves associated with them. Soundararajan and Holowinsky showed that for certain shapes that come from number theory, the waves always spread out evenly. According to Lev Kaplan, a physicist at Tulane University, "This is a good example of mathematical work inspired by an interesting physical problem."



Uniformly distributed points in a fundamental domain for SL(2,Z)
–Image courtesy of Fredrik Stromberg

The QUE result is a direct consequence of how AIM has identified and supported promising and outstanding young mathematicians. Soundararajan was the first recipient of an AIM Five-Year Fellowship in 1998. Since that time, he has produced many important results in number theory and related fields. In 2006, he became a Professor at Stanford University after previously being on the University of Michigan faculty. His position at Stanford was jointly funded for two years by Stanford and AIM in an effort to advance the field of number theory.

Selected AIM Publications

In AIM's first 10 years more than 400 papers were written as a result of AIM projects and workshops. So far 260 of those papers have appeared in print—23 of them in the three most prestigious journals: *Annals of Mathematics*, *Inventiones Mathematicae*, and the *Journal of the American Mathematical Society*.[1]

The following is a list of these 23 papers that represent some of AIM's very best work:

Calegari, Frank; & Emerton, Matthew (to appear). Bounds for multiplicities of unitary representations of cohomological type in spaces of cusp forms. *Annals of Mathematics*.

Goldston, Daniel A.; Pintz, János; & Yildirim, Cem Yalçin (to appear). Primes in tuples. I. *Annals of Mathematics*.

Soundararajan, K. (to appear). Moments of the Riemann zeta-function. *Annals of Mathematics*.

Cautis, Sabin; & Kamnitzer, Joel (2008). Knot homology via derived categories of coherent sheaves. II. $\mathfrak{sl}_m$ case. *Inventiones Mathematicae, 174*(1), 165–232.

Hassett, Brendan; & Tschinkel, Yuri (2008). Log Fano varieties over function fields of curves. *Inventiones Mathematicae, 173*(1), 7–21.

Madsen, Ib; & Weiss, Michael (2007). The stable moduli space of Riemann surfaces: Mumford's conjecture. *Annals of Mathematics, 165*(3), 843–941.

Chudnovsky, Maria; Robertson, Neil; Seymour, Paul; & Thomas, Robin (2006). The strong perfect graph theorem. *Annals of Mathematics, 164*(1), 51–229.

Ellenberg, Jordan S.; & Venkatesh, Akshay (2006). The number of extensions of a number field with fixed degree and bounded discriminant. *Annals of Mathematics*, *163*(2), 723–741.

Calegari, Frank; & Emerton, Matthew (2005). On the ramification of Hecke algebras at Eisenstein primes. *Inventiones Mathematicae, 160*(1), 97–144.

Cohn, Henry; & Elkies, Noam (2003). New upper bounds on sphere packings. I. *Annals of Mathematics, 157*(2), 689–714.

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1 It takes an average of two years from the time a paper is submitted until it is published in one of the more than 200 different journals devoted to mathematics.

Kaloshin, V. (2003). The existential Hilbert 16th problem and an estimate for cyclicity of elementary polycycles. *Inventiones Mathematicae, 151*(3), 451–512.

Conrey, J. B. & Soundararajan, K. (2002). Real zeros of quadratic Dirichlet *L*-functions. *Inventiones Mathematicae, 150*(1), 1–44.

Cordoba, Diego; & Fefferman, Charles (2002). Growth of solutions for QG and 2D Euler equations. *Journal of the American Mathematical Society, 15*(3), 665–670.

Etnyre, John B.; & Honda, Ko (2002). Tight contact structures with no symplectic fillings. *Inventiones Mathematicae, 148*(3), 609–626.

Ulmer, Douglas (2002). Elliptic curves with large rank over function fields. *Annals of Mathematics, 155*(1), 295–315.

Cohn, Henry; Kenyon, Richard; & Propp, James (2001). A variational principle for domino tilings. *Journal of the American Mathematical Society, 14*(2), 297–346.

Constantin, Peter (2001). An Eulerian-Lagrangian approach for incompressible fluids: Local theory. *Journal of the American Mathematical Society, 14*(2), 263–278.

Granville, Andrew; & Soundararajan, K. (2001). Large character sums. *Journal of the American Mathematical Society, 14*(2), 365–397.

Granville, Andrew; & Soundararajan, K. (2001). The spectrum of multiplicative functions. *Annals of Mathematics, 153*(2), 407–470.

Conrey, J. B.; & Iwaniec, H. (2000). The cubic moment of central values of automorphic *L*-functions. *Annals of Mathematics, 151*(3), 1175–1216.

Giroux, Emmanuel (2000). Structures de contact en dimension trois et bifurcations des feuilletages de surfaces. *Inventiones Mathematicae, 141*(3), 615–689.

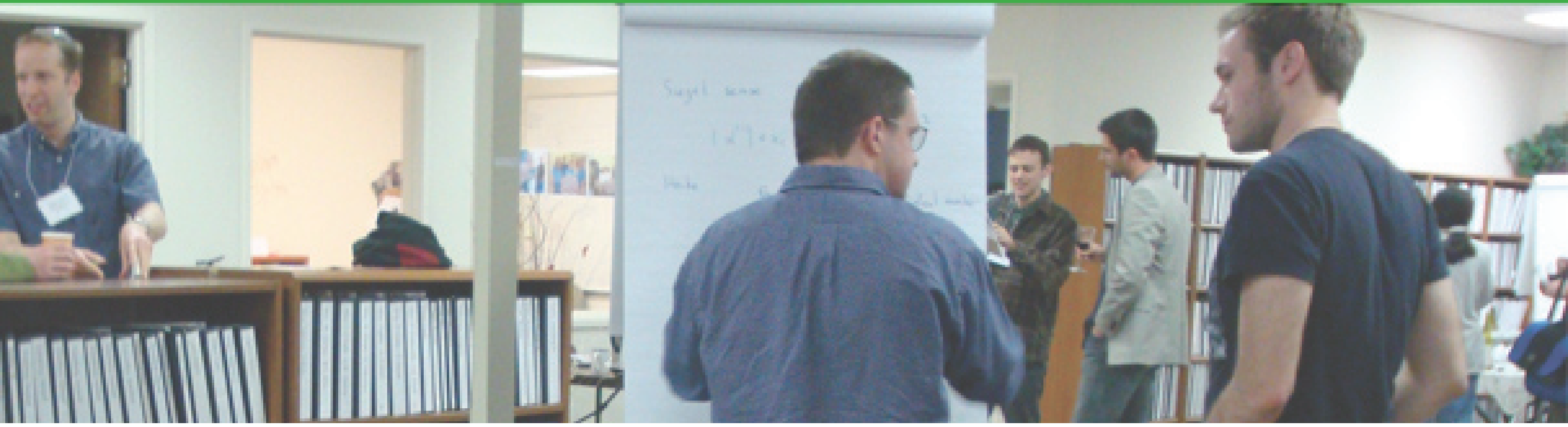
Greenberg, Ralph; & Vatsal, Vinayak (2000). On the Iwasawa invariants of elliptic curves. *Inventiones Mathematicae, 142*(1), 17–63.

Soundararajan, K. (2000). Nonvanishing of quadratic Dirichlet *L*-functions at s=1/2. *Annals of Mathematics, 152*(2), 447–488.

The AIM-Style Workshop

The AIM Research Conference Center (ARCC) hosts focused workshops in all areas of the mathematical sciences. ARCC focused workshops are distinguished by their emphasis on a specific mathematical goal, such as making progress on a significant unsolved problem, understanding the proof of an important new result, or examining the convergence of two distinct areas of mathematics.

ARCC focused workshops provide an ideal forum for a team of researchers to map out strategies, set priorities, work toward a solution, and set in place a framework for progress on important mathematical problems. The leaders in each field are involved in the planning of the workshops, and younger scientists and graduate students are active participants. Special attention is devoted to facilitate collaborations that include women, minorities, and researchers at primarily undergraduate institutions.



Since the first workshop in 2002, ARCC has hosted over 100 workshops in a variety of fields illustrating the rich and diverse character of mathematics. Some of these workshops have been about solving very practical problems and others have had much more of a pure mathematics emphasis. Often our workshops bring together both pure and applied mathematicians so that differing points of view can shed light on problems.

Recently AIM hosted one group of mathematicians and scientists investigating the rhythms of the pituitary gland and another group that was seeking solutions to the saltwater intrusion problems on the island of Crete. AIM also hosted a workshop that focused on the size of the gaps between prime numbers and another that was concerned with the topological study of knots. Other workshops, such as "How to Run a Math Teachers' Circle," illustrate AIM's commitment to making mathematics enjoyable and challenging for teachers and students.

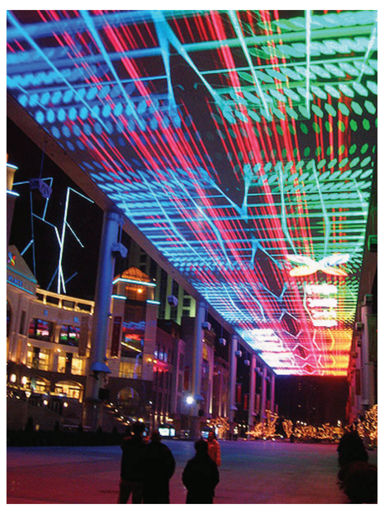
All our workshops, from the very practical to the very pure, are conducted "AIM-style." That is, they are structured to be as conducive as possible to focused collaborative research. Formal talks are kept to a minimum, whereas interactive problem sessions and group work sessions are encouraged. Because the workshops are small, with a maximum of 32 participants, there are ample opportunities for meaningful collaboration. AIM staff members interact frequently with workshop organizers before, during, and after each workshop, to help define strategies and priorities and set in place a plan for future research. On the following pages are some highlights from seven AIM workshops that illustrate the scope and success of the program.

Featured Workshops

Ferroelectric Phenomena in Soft Matter Systems

This workshop was exceptional because of its potential for applications. The goal was to overcome present obstacles in the modeling and simulation of liquid crystal systems and other ferroelectric phenomena. The interest in liquid crystals is due partly to their exceptional responsiveness to excitation, whether from external electric fields or variations in temperature. This responsiveness allows for their use as switches or valves which are at the heart of many technological applications. Examples include the electronics behind liquid crystal displays (LCDs) in watches, calculators, TV screens, and other visual display monitors. The promise that ferromagnetic materials hold for these new applications is a result of the strong polarization effects produced by electric fields. However, it is exactly this characteristic that makes them difficult to model.

A cross-disciplinary group of experimental and theoretical physicists worked with analytical and computational mathematicians to explore new techniques for modeling these unusual systems. During the week, an exciting breakthrough was made when a team of researchers developed a system of differential equations that closely models experimentally observed phenomena. This is a very important step in the modeling and analysis of ferroelectric liquid crystals, and it constitutes a significant achievement after ten years of effort.



LCD Screens are examples of an application of Ferroelectric Phenomena in Soft Matter Systems. Pictured is the world's largest LCD screen (photo used with permission of Newlaunches.com).

"It was very useful for me. Such close work with people both from physics and math was very beneficial for the field and for the participants."
(excerpt from workshop participant survey)

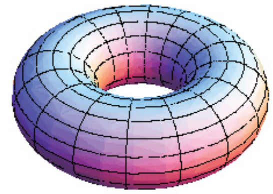
Topology and Geometry of the Moduli Space of Curves

A topologist is a mathematician who thinks about shapes like circles, spheres, or lines, and higher-dimensional analogues of these basic shapes. One way to classify such shapes is by the number of holes in the shape. A sphere has no holes, but a donut shape has one hole. Algebraic geometers also think about shapes, but use algebraic methods to describe the shape. A topologist might describe a circle as the set of points equidistant from a given point, but an algebraic geometer would say that a circle is the set of points satisfying a certain algebraic equation.

"This workshop exceeded all my expectations. It was an absolutely wonderful experience of joint interaction between topologists and algebraic geometers."
(excerpt from workshop participant survey)

This workshop brought together topologists and algebraic geometers to study moduli spaces of curves and to work toward understanding each other's terminology and approaches. Each point in a moduli space represents a kind of geometric structure for another space. Understanding these spaces is important in mathematics and physics, especially in the areas of string and quantum field theory.

This workshop developed a plethora of results and resources for the mathematical community, including an extensive glossary and a list of nineteen interesting questions and open problems.



Problems in Geometric Group Theory

This workshop was interesting and unusual because it was devoted entirely to producing a problem list, in this case in the area of geometric group theory. A group is a mathematical structure that consists of a set along with an operation on the set that satisfies certain rules. An example is the set of integers with the operation of addition. Geometric groups are those that arise from geometric properties of an object.

The participants were instructed to try to agree on a relatively short list of problems that should be regarded as key problems in geometric group theory, and whose solutions would lead to significant progress. One of the results of the workshop was a wiki page, which is a dynamic web page where the participants can continue to share ideas, results, and solutions to the fundamental problems in the area. Over 24 separate problem areas have been identified, each with multiple questions and results.

"An essential workshop. Very good for researchers in all levels and will assist other people in the area in the years to come." *(excerpt from workshop participant survey)*

Pólya-Schur-Lax Problems: Hyperbolicity and Stability Preservers

This was a truly remarkable workshop that on the surface was about algebra problems. One of the problems considered was if we know something about the set of solutions to a polynomial equation, can we prove that the same is true if we change the polynomial in a prescribed way? Here is an example. Suppose we know that the equation $ax^3 + bx^2 + cx + d = 0$ has real solutions (it is assumed that the numbers a, b, c are real). Then it is known that the polynomial $3ax^2 + 2bx + c = 0$ also has only real solutions. The workshop produced an extensive problem list with 47 interesting open questions related to the above question about roots of polynomials. At last count, more than twelve papers had been written by the participants of the workshop and more were still underway. Of the twelve papers several were in the most prestigious journals, including the *Annals of Mathematics* and the *Duke Mathematical Journal*.

"Perfect idea of joining people from different areas to look at specific topics from completely different points of view!"

(excerpt from workshop participant survey)

The Modeling of Cancer Progression and Immunotherapy

This unique interdisciplinary workshop represented a significant step toward building bridges of cooperation between mathematicians and clinical cancer researchers. Experts from widely divergent fields came from all over the world to talk about the problems of tumor immune responses, mathematical modeling of tumor growth, and physiological mechanisms that are useful in treating advanced stages of cancer.

One focus group generated a model of differential equations to describe tumor versus immune growth. Another focus group discussed ways to use a database of genetic profiles of patients with breast cancer, including treatments administered and the outcomes of these treatments. Two participants began a collaboration to develop a mathematical model of a certain kind of cancer vaccine. Workshop participants were so enthusiastic about the AIM experience that they expressed a strong desire to see this meeting become an annual event.

"I got inspiration and new ideas for using mathematics to improve cancer diagnosis and treatment. I had the opportunity to get to know and to work with biologists and physicians that I would not have had otherwise."

(excerpt from workshop participant survey)

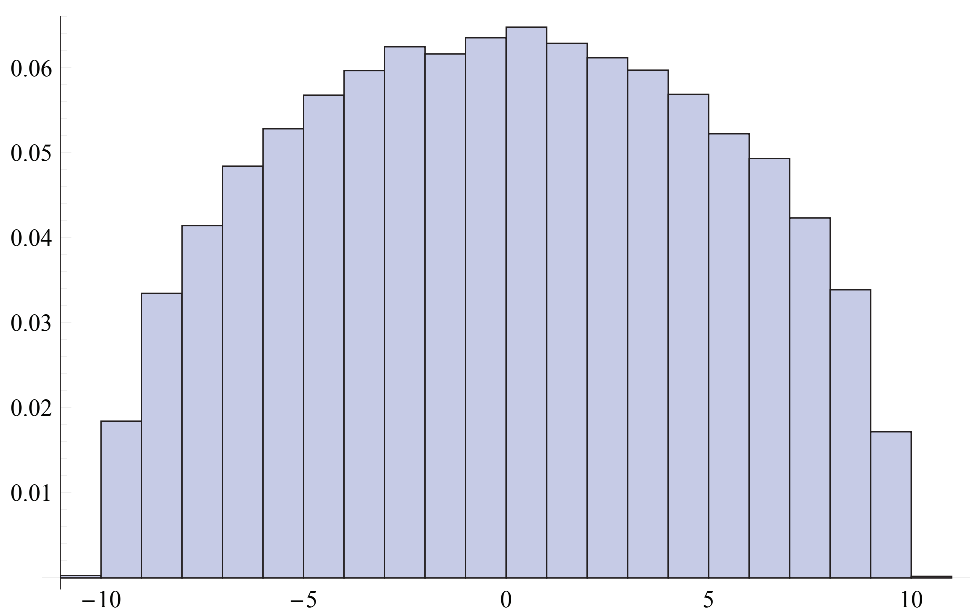
Random Matrices and Higher Dimensional Inference

The world is full of random data. For example, tax returns and medical records generate random data that should be carefully analyzed. In recent years, the mathematical world has seen an explosion of advances in the theory of random matrices, along with new tools to help analyze random data. One can use the theory to check if data seems to come from a standard model, which can be used for interpolation purposes when the data are sparse. Random Matrix Theory also has applications to wireless communication, climate and weather models, and many other areas.

"Well organized, yet informal atmosphere fosters close collaboration and brainstorming new ideas."

(excerpt from workshop participant survey)

The workshop at AIM was jointly sponsored by AIM and the Statistical and Applied Mathematics Institute in North Carolina (SAMSI). Many of the workshop participants had met at SAMSI and had been working for much of the previous year on these problems. The workshop at AIM began by summarizing and assessing the SAMSI activities and then moved toward synthesizing the key findings and outlining directions and problems for ongoing research.



The graph is an illustratration of the famous Wigner semi-circle law and represents the density of eigenvalues of 50-by-50 random Hermitian matrices formed from sampling 400 of the matrices. The theory predicts that most of the eigenvalues should fall between -10 and 10.

Quotes from Workshop Participants

"The AIM Workshop I attended was truly one of the most stimulating meetings that I have been to in over 25 years."

"Within a period of two years, I have attended two workshops at AIM—one as an organizer, and one as a participant. I will soon attend a third one. Both meetings were very productive: informative, optimally structured, well focused and stimulating. From both I returned home with a huge amount of new information, a better insight into the specific fields, and with many new potential collaborators."

"I think that this is the most efficient way of dealing with a problem or area that is stuck: get a bunch of people from heterogeneous backgrounds together to brainstorm and try all possible directions, eventually one will go somewhere."

"I was fortunate to have the chance to participate in one of the AIM workshops (The Modeling of Cancer Progression and Immunotherapy) in December 2005, and I would say it has been one of the best events of the kind I took part in. The organization was great, both scientifically and administratively. Truly exceptional conditions have been provided by AIM for the workshop participants."

"I've been to one workshop at AIM and found it extremely helpful, and the whole atmosphere highly suitable for an exchange of ideas and joint work. In fact, this was probably the most useful and pleasant conference I have ever been to. Three papers of which I was co-author have been started there."

Complete List of Workshops

2008

- Legendrian and transverse knots
- The Isoperimetric Inequality for $SL(n, Z)$
- Frames for the finite world: Sampling, coding and quantization
- Research experiences in linear algebra and number theory for undergraduate faculty
- Rhythms in the Hypothalamus and Pituitary
- Generalizing theta correspondences
- Geometry and representation theory of tensors for computer science, statistics and other areas
- How to run a Math Teachers' Circle (Wash. DC)
- How to run a Math Teachers' Circle (AIM)
- Ferroelectric phenomena in soft matter systems
- Percolation on transitive graphs
- Applications of universal algebra and logic to the constraint satisfaction problem
- Nonlinear PDEs of mixed type arising in mechanics and geometry
- Computing arithmetic spectra
- The uniform boundedness conjecture in arithmetic dynamics

2007

- Triangulations, Heegaard splittings and hyperbolic geometry
- Rigidity and polyhedral combinatorics
- Algorithmic Convex Geometry
- The practice and theory of stochastic simulation
- Dichotomy Amenable/Nonamenable in Combinatorial Group Theory
- Towards Relative Symplectic Field Theory
- Manifolds with nonnegative sectional curvature
- High-order methods for computational wave propagation and scattering
- Fourier analytic methods in convex geometry
- Generic Case Complexity
- Enhancing the problem authoring capabilities of WeBWorK
- L-functions and modular forms
- The Tate conjecture
- Cohomology and representation theory for finite Lie groups
- How to run a math teachers' circle
- Arithmetic harmonic analysis on character and quiver varieties
- Pólya-Schur-Lax problems: hyperbolicity and stability preservers
- Rational curves on algebraic varieties
- Problems in Geometric Group Theory
- Random Matrices and Higher Dimensional Inference
- Buildings and combinatorial representation theory
- Representations of surface groups

2006

- Integral Closure, Multiplier Ideals and Cores
- Finding and Keeping Graduate Students in the Mathematical Sciences
- Spectra of families of matrices described by graphs, digraphs, and sign patterns
- Subconvexity bounds for L-functions
- Short-term Cardiovascular-Respiratory Control Mechanisms
- The Kadison-Singer Problem
- Model Theory of Metric Structures
- Complexity of mappings in CR geometry
- Phase Transitions
- The Teachers' Circle
- Effective Randomness
- Numerical invariants of singularities and higher-dimensional algebraic varieties
- Classification theory for abstract elementary classes
- Calibrations
- Free Analysis

- Self-similar groups and conformal dynamics
- Low eigenvalues of Laplace and Schrödinger operators
- The computational complexity of polynomial factorization
- Extreme forms of real algebraic varieties
- p-adic representations, modularity, and beyond
- Mathematical and Geophysical Fluid Dynamics
- The Caccetta-Häggkvist conjecture
- The property of rapid decay
- Random analytic functions
- Moduli spaces of knots

2005

- The Modeling of Cancer Progression and Immunotherapy
- Gaps between primes
- Numerical Methods for Optimal Control in High Dimensions
- Eisenstein Series and Applications
- Theory and Algorithms of Linear Matrix Inequalities
- Generalized Kostka Polynomials
- Gravitational Lensing in the Kerr Spacetime Geometry
- Boundaries in Geometric Group Theory
- Moduli Spaces of Properly Embedded Minimal Surfaces
- Stability Criteria for Multi-Dimensional Waves and Patterns
- Statistical Inferences on Shape Manifolds
- Stiff Sources and Numerical Methods for Conservation Laws
- Topology and geometry of the moduli space of curves
- Extensions of Hilbert's Tenth Problem
- Deterministic and stochastic Navier-Stokes equations
- Braid Groups, Clusters, and Free Probability

2004

- Sharp Thresholds for Mixing Times
- Recent Advances in Core Model Theory
- Compact moduli spaces and birational geometry
- Time-reversal communications in richly scattering environments
- Recent Trends in Additive Combinatorics
- Sphere Packings, Lattices, and Infinite Dimensional Algebra
- Moment maps and surjectivity in various geometries
- Tensor decompositions
- Emerging applications of measure rigidity
- Theory of motives, homotopy theory of varieties, and dessins d'enfants
- L^2 harmonic forms in geometry and string theory
- Thompson's group at 40 years

2003

- Computational Algebraic Statistics
- Ricci Flow and Geometrization of 3-Manifolds
- Numerical probabilistic methods for high-dimensional problems in finance
- Amoebas and tropical geometry
- Inference and prediction in neocortical circuits
- Topological phases in condensed matter physics
- Conformal structure in geometry, analysis, and physics
- Holomorphic curves in contact geometry
- New connections between dynamical systems and PDEs
- Variational Methods in Celestial Mechanics
- Geometric models of biological phenomena
- Future directions in algorithmic number theory

2002

- Rational and integral points on higher dimensional varieties
- The Perfect Graph Conjecture

The SQuaREs Program

To complement the focused research workshops, AIM started a new program in the fall of 2007 called SQuaREs (Structured Quartet Research Ensembles). The purpose of a SQuaRE is to allow a dedicated group of four to eight mathematicians to spend one to two weeks at the AIM headquarters in Palo Alto, California, working on a focused research problem. A SQuaRE could arise as a follow-up to an AIM workshop, or it could be a freestanding activity.

AIM has hosted seven different SQuaREs so far and has several planned in the future. While this program is very new, there are indications that it will be highly successful in helping to foster significant first-rate mathematics. The program allows for weeklong investigations without interruptions, and it provides an opportunity for new unproven collaborations to develop with participation from both junior and senior researchers. Here are some highlights from two of the first-year SQuaREs.

Featured SQuaREs

The **"Kadison-Singer Problem" SQuaRE** grew out of an earlier AIM workshop of the same title held in 2006. This SQuaRE focused on an old and difficult problem that originated from quantum mechanics. One of the surprising outcomes of both the AIM workshop and this SQuaRE was to realize that the original problem was equivalent to many other fundamental, unsolved problems in a dozen areas of research in pure mathematics, applied mathematics, and engineering. The Kadison-Singer SQuaRE made significant progress in exploring the many facets of this problem.

The **"Algebraic Topology and Physics" SQuaRE** was focused on the connections between certain fundamental geometric structures and string theory. This group had an impressive list of accomplishments, many of which occurred during the actual week that the SQuaRE met at AIM. Four papers have already resulted from the first weeklong meeting of this SQuaRE, with four more in progress. The organizer report notes, "It seems that every paper benefited from extensive discussions with several participants, in such a way that each participant influenced one or more of the papers."

"It seems that every paper benefited from extensive discussions with several participants, in such a way that each participant influenced one or more of the papers."
(excerpt from the organizer report)

Complete List of SQuaREs

Hausdorff geometry of complex polynomials, positive charge distributions and normal operators
July 7 - 11, 2008

Atlas of Lie groups VI
July 7-11, 2008

Combinatorics and the Langlands program
May 26 - 30, 2008

Algebraic topology and physics
May 19 - 23, 2008

The Kadison-Singer Problem
April 14 - 18, 2008

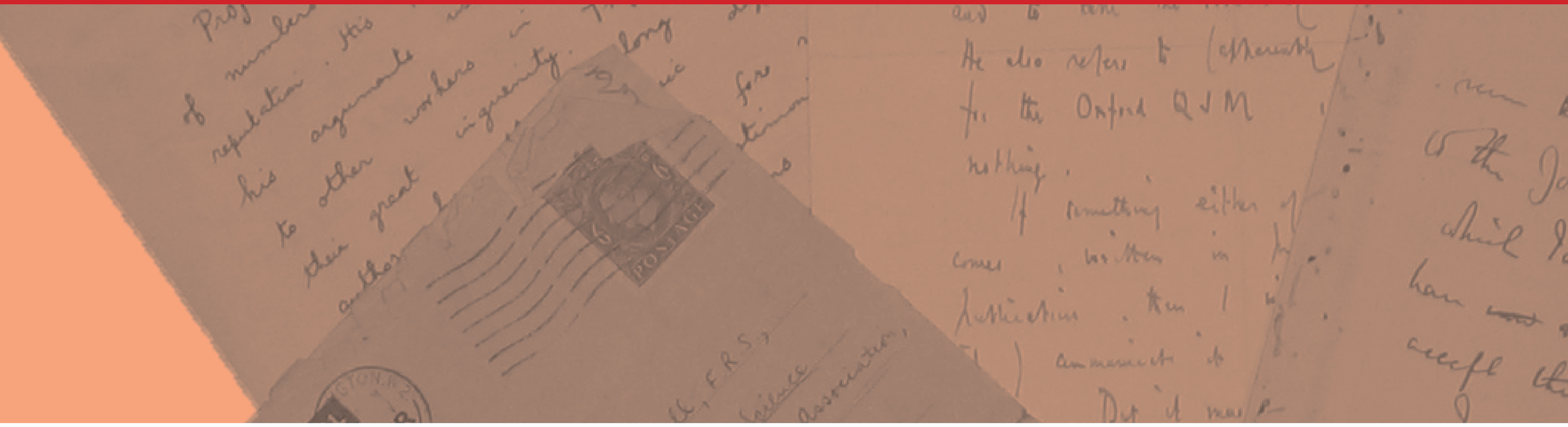
Minimum rank of symmetric matrices described by a graph
February 25 - 29, 2008

Triangulations of 3-manifolds II
November 16 - 19, 2007

Triangulations of 3-manifolds I
September 21 - 24, 2007

Five-Year Fellows

As part of AIM's commitment to the education of outstanding young mathematicians, we offer the AIM Five-Year Fellowship. This award is intended for an absolutely first-rate new PhD—someone with the potential to leave a lasting mark on mathematics.



The Five-Year Fellow program at AIM was started in 1998 with the selection of Soundararajan as the first Fellow. Since that time nearly 1000 new PhDs have applied for the 11 awards that have been made. Each new Fellow receives five years of full-time research support, which affords the freedom to develop a singularly distinctive research program. It is hoped that these Fellows will develop into the leaders of their generation of mathematicians.

K. Soundararajan
(1998)

Kannan Soundararajan completed 15 papers during his time as an AIM Five-Year Fellow. He taught at Princeton, served as a member of the Institute for Advanced Study (Princeton), and spent the last two years of his fellowship as an Associate Professor at the University of Michigan. He has worked with several collaborators, including Andrew Granville and Brian Conrey, and reveals that one of his favorite papers is "Real zeros of quadratic dirichlet *L*-functions," featured in AIM's Selected Publications (p. 10). In the future, Soundararajan plans to write a book on the analytic theory of zeta and *L*-functions. He comments: "The AIM Fellowship made it very easy for me to focus just on research for the first five years after my Ph.D. After having just completed a quarter with many teaching responsibilities, I appreciate even more how valuable that was!"

Currently a Professor of Mathematics at Stanford Univesity, Soundararajan has solved a major conjecture called the Quantum Unique Ergodicity Conjecture, featured in the "Major Research Achievements" section (p. 18).

Vadim Kaloshin
(2000)

Currently the Michael Brin Chair in Mathematics at the University of Maryland at College Park, Vadim Kaloshin is also the informal head of the Maryland group in dynamical systems. Kaloshin dreams that this group will produce many experts in dynamical systems and related fields and also hopes to inspire young mathematicians to become involved in research as well. As an AIM Five-Year Fellow, Kaloshin had the opportunity to meet professors with diverse research backgrounds and believes that the fellowship enriched the scope of his research. "I really benefited from it. First, I managed to stay in 3 different places during my postdoc time, and since I did not have to teach, I managed to specialize in a deep topic, different from my PhD," he says. During his tenure as an AIM fellow, Kaloshim studied Aubry-Mather theory at Courant, gave a graduate course in dynamical systems at MIT, and produced his favorite result, joint with Brian Hunt, which involved an original method of studying prevalent dynamical systems.

Vadim Kaloshin is the Michael Brin (named for the father of Google co-founder Sergey Brin) Professor of Mathematics at the University of Maryland.

Henry Cohn
(2000)

Receiving his S.B. in mathematics from MIT in 1995, Henry Cohn finished his PhD under the direction of Noam Elkies. His thesis was entitled "New bounds on sphere packings." In his thesis, Henry developed new techniques that improve upper estimates on the packing density of spheres in Euclidean spaces of dimensions 4 through 36. His bounds in dimensions 8 and 24 are only 0.0001% and 0.07% higher than the densities of known packings (E8 and the Leech lattice). Henry has already published several papers in combinatorics and number theory. Notable are his work with N. Elkies and J. Propp, "Local statistics for random domino tilings of the Aztec diamond," which appeared in the *Duke Mathematical Journal* (1996), and his paper with R. Kenyon and J. Propp entitled "A variational principle for domino tilings," which appeared in the *Journal of the American Mathematical Society* and is included in AIM's Selected Publications (p. 10). Cohn is also interested in the question of the irrationality of the Riemann zeta-function for arguments which are odd integers that are 5 or more.

Henry Cohn is a senior researcher in Microsoft's research group.

Lenhard Ng
(2001)

During his time as an AIM Fellow, Lenny Ng wrote eleven papers and gave one of the first known applications of the Khovanov homology theory, relating it to certain properties of Legendrian Knots. For Ng, the main advantage of being an AIM Fellow was flexibility. "I was able to concentrate solely on research as well as travel freely and engage in an assortment of collaborations," he states. During his time as a Fellow, he took extended visits to MIT, Princeton, the Institute for Advanced Study, Columbia, Penn, Georgia Tech, and USC, and co-authored papers with several collaborators. Currently, he holds a tenure-track Assistant Professor position at Duke University that involves primarily research.

In recent work, Lenny Ng authored a significant development between algebra and geometry, showing that the closed string invariants of symplectic manifolds can be realized algebraically in terms of cyclic homology. His breakthrough will be the subject of an AIM workshop in 2009 and part of a special semester at the Mathematical Sciences Research Institute.

Frank Calegari (2002)

Frank Calegari spent most of his time as an AIM Fellow traveling across the United States and overseas to work with collaborators. "I have worked on what I like to think of as a diverse range of problems," he says, speaking of his collaborative work with Kevin Buzzard on the Coleman-Mazur eigencurve, and also his work with Nathan Dunfield on the Langlands program to answer an open question in low-dimensional topology. Calegari credits the length of the fellowship with encouraging him to take on ambitious research projects, and also states, "The most significant impact has been on the freedom the fellowship provided me from the obligations of teaching." Now a tenure-track Assistant Professor at Northwestern, Calegari says, "I'm honored to count myself as an 'alumnus' of the AIM Fellowship program, which includes some very strong mathematicians. AIM is great. I am grateful for all of the opportunities that they provided for me."

Frank Calegari's joint paper with Matt Emerton, "Bounds for multiplicities of unitary representations of cohomological type in spaces of cusp forms," which will appear in the *Annals of Mathematics* and was featured in Selected AIM Publications (p. 9), was one of the four featured topics in this year's current events session at the Joint Mathematical Meetings in Washington, DC, a professional meeting attended by more than 5000 mathematicians.

Mike Develin (2003)

Currently a quantitative analyst for the hedge fund D.E. Shaw & Co., Mike Develin spent the majority of his time as an AIM Fellow working on tropical geometry and random combinatorial problems. He has worked with Professor Victor Reiner at the University of Minnesota, Professor Bernd Sturmfels at the University of California-Berkeley, and Professor Dave Bayer at Columbia University. For Develin, the mobility that the AIM Fellowship afforded him has been greatly influential to his work: "Having an infinite amount of locational and vocational flexibility has been fantastic—the Fellowship greatly improved my mathematical lifestyle."

Michael Develin is now working for the hedge fund company D. E. Shaw, which is a company noted for hiring high-profile geniuses.

Jacob Lurie (2004)

Jacob Lurie's research as an AIM Fellow involved work on higher category theory, the study of elliptic cohomology, and the classification of topological quantum field theories. An Associate Professor at MIT, Lurie feels that the freedom the Fellowship gave him from teaching responsibilities had the biggest influence on his work. When asked to describe his favorite result, Lurie responds, "It's a version of the cobordism hypothesis conjectured by Baez and Dolan. It proves a classification of extended topological quantum field theories (TQFT). The cobordism hypothesis asserts that an extended TQFT can be recovered from the invariant that it assigns to a point."

Jacob Lurie's new work on homotopy-theoretic foundations of algebraic geometry work was prominently featured in the Institute for Advanced Study's special year on Representation Theory (2007-2008).

Joel Kamnitzer (2005)

For Joel Kamnitzer, some of the biggest benefits of the AIM Five-Year Fellowship include being able to collaborate with various mathematicians, having funds for travel, and having more time to focus on his research. "Having the fellowship has allowed me to tackle a broader range of topics than I would otherwise. Since I did not have much pressure to produce results immediately, I was able to learn a lot of homological algebra and algebraic geometry in my first year of the fellowship," he says. During his tenure as an AIM Fellow, Kamnitzer has worked in three areas: knot homology via derived categories of coherent sheaves with Sabin Cautis and Anthony Licata, crystal commutor with Peter Tingley, and work that is related to MV cycles and polytopes. He has held positions at Berkeley and MIT, and is now an Assistant Professor at the University of Toronto where he is teaching one course per year for the last two years of his fellowship.

One portion of Joel Kamnitzer's work has been centered around the question, "Can one see the shape of a space?" The catch is that the shapes he studies are infinite dimensional. Kamnitzer's work provides the first real pictures of the fundamental space called the "loop Grassmannian," a key space in an area of study known as the Langlands program.

Elizabeth Meckes
(2006)

As an AIM Fellow, Elizabeth Meckes has spent time at Cornell University elaborating on work that stems from her thesis. She has written two papers that are en route to being published and reveals that her favorite result is Stein's theorem. "This isn't so much for the stand-alone elegance of the theorem itself (though it could be described that way), but for the fact that this simple observation turns out to be such a powerful technique for proving other results," says Meckes. She also feels that the AIM Fellowship has had a great impact for her research as it has enabled her to travel. "These trips have generally been very useful, both for attending talks and for the opportunity to talk to other mathematicians from around the world."

Meckes is currently an Assistant Professor at Case Western Reserve University.

Yi Ni
(2007)

Since becoming an AIM Five-Year Fellow, Yi Ni has had more time to elaborate on his thesis, "Knot Floer homology detects fibred knots." "It is a result in three-dimensional topology. It says that some algebraic properties of the Floer homology of a knot imply a certain geometric property," he says. Ni has also recently contributed to a theorem in Seiberg-Witten theory. He has held positions at Columbia and MIT, and his future plans include finding a tenure-track position, continuing his research on Heegaard Floer homology, and eventually, expanding his research to other fields.

Ni currently holds a position as a C. L. E. Moore Instructor at MIT.

Travis Schedler (2008)

Travis received his A.B. from Harvard *"summa cum laude"* in 2002 and spent a year of his graduate studies at the Ecole Normale Supérieure in Paris as a visiting student. He received his PhD from the University of Chicago in 2008 under the direction of Professor Victor Ginzburg. His area of specialization is noncummutative algebraic geometry. In his thesis, Travis defines and applies a new formalism of differential operators for associative algebras. In other work, he computes Hochschild and cyclic homology of algebras associated to quivers. He has already written or co-authored 11 papers, including one that appeared in the *Journal of the American Mathematical Society* and another in the *Duke Mathematical Journal*.

Schedler is currently a C. L. E. Moore Instructor at MIT.

AIM is proud to have provided support for such an outstanding group of mathematicians!

Quotes from Our Five-Year Fellows

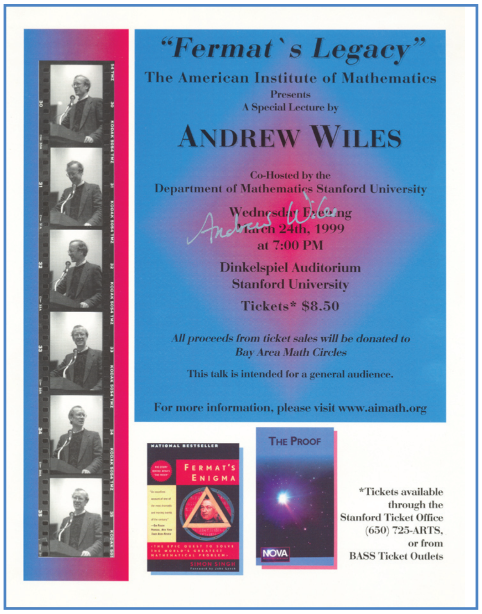
"The AIM Fellowship made it very easy for me to focus just on research for the first five years after my PhD. After having just completed a quarter with many teaching responsibilities, I appreciate even more just how valuable that was! I completed about 15 papers while on the fellowship, and began several other projects during that time."

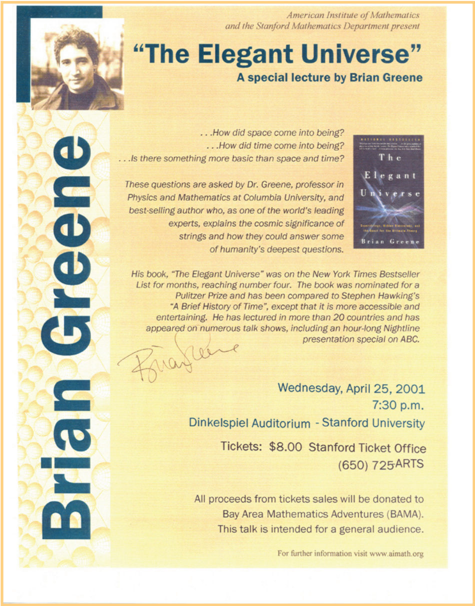
"The AIM Fellowship afforded me the opportunity to concentrate solely on my mathematics."

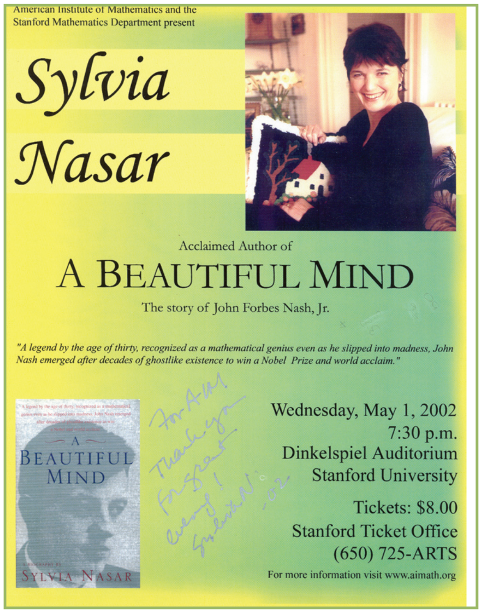
"The flexibility afforded by the Fellowship had an enormous positive influence on my research."

Outreach

- Public Lectures
- The Math Teachers' Circle Network
- Math Mardi Gras
- Math Activities for Students



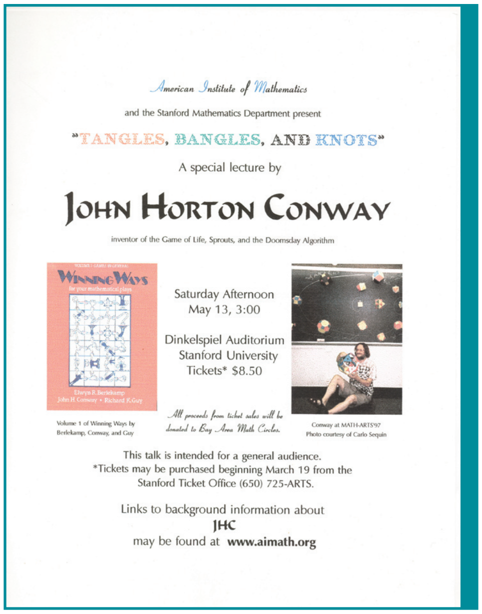


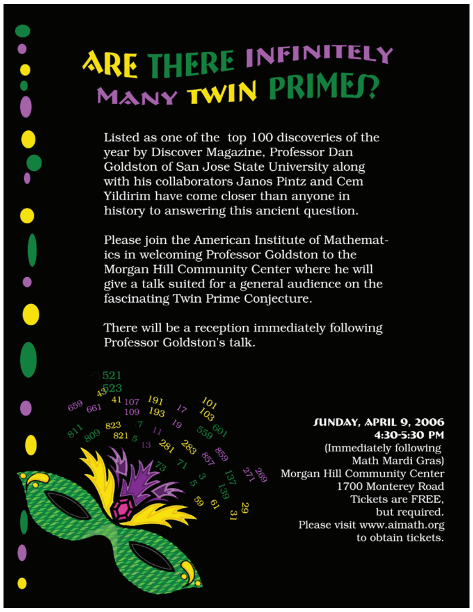


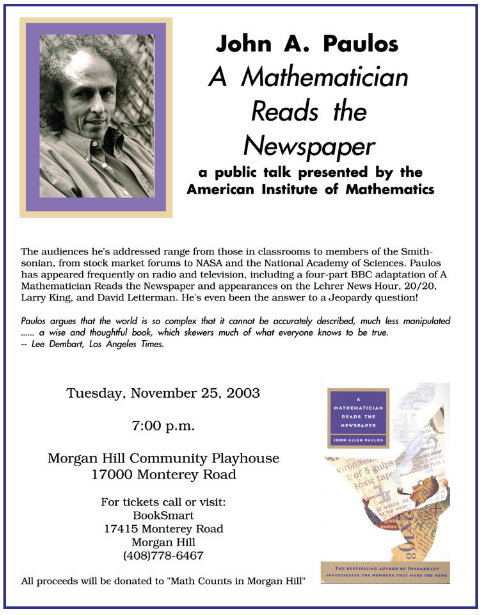
PUBLIC LECTURES

AIM sponsors general-interest public talks on mathematical topics given by nationally known mathematicians and authors. Some of the talks have been co-sponsored by Stanford University and held in their Dinkelspiel Auditorium, while others have been given at the Community and Cultural Center in Morgan Hill. All talks were publicized widely in the Bay Area. The following are the speakers and titles:

1999	Andrew Wiles	Fermat's Legacy
2000	John Horton Conway	Tangles, Bangles, and Knots
2001	Brian Greene	The Elegant Universe
2002	Sylvia Nasar	A Beautiful Mind
2003	Hendrik Lenstra	Escher and the Dröste Effect
2003	John A. Paulos	A Mathematician Reads the Newspaper
2006	Daniel Goldston	Are There Infinitely Many Twin Primes?







The Math Teachers' Circle Network

"The beauty of the program is that by exposing one teacher to the kind of open-ended problem solving you encounter in a Math Teachers' Circle, you can potentially affect thousands of students over the course of that teacher's career," explains AIM Executive Director Brian Conrey. "By the time we have 100 Math Teachers' Circles around the country, the program will have an impact on up to five percent of all U.S. middle school students every year."

In 2006, AIM worked with local educator Mary Fay-Zenk and San Jose State University mathematician Tatiana Shubin to hold a workshop for middle school math teachers in the Bay Area who wanted to learn more about mathematical problem solving. AIM's national Math Teachers' Circle Network, directed at middle school math teachers across the United States, grew out of the successes of that original workshop. The program has a mission of enriching middle school math teachers' experiences of mathematical problem solving and enabling them to tackle open-ended problems with confidence. Through their participation in a Math Teachers' Circle, teachers engage in an ongoing dialogue about math with colleagues and professional mathematicians and also gain access to support and resources that empower them to promote open-ended problem solving in their classrooms.

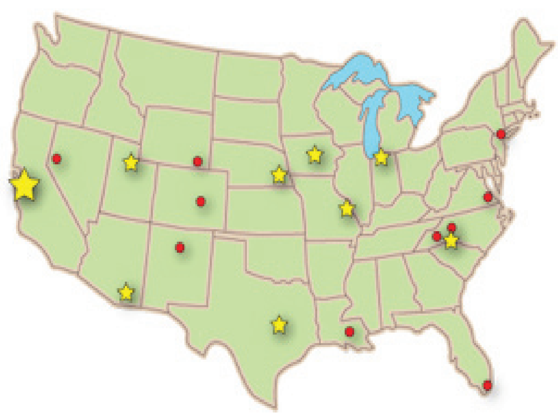
Each Math Teachers' Circle is a group of 20 to 25 middle school math teachers who meet regularly with mathematicians to engage in open-ended problem solving. Math Teachers' Circle sessions are based on the highly successful Eastern European model of student math circles, which emphasize participant-centered, mathematician-led collaborative problem solving.

Math Teachers' Circles around the country have two primary components. First, teachers participate in an immersion workshop, during which they get to know other local teachers and mathematicians and spend time doing math in a relaxed, supportive atmosphere. After the immersion workshop, teachers become members of their local Math Teachers' Circle, which meets once a month during the academic year to provide support as they work to incorporate a new, interactive style of teaching focused on problem solving into their classrooms.

"When I was taught basic arithmetic, geometry, and algebra, I was never taught the underlying math inherent to these ideas. My understanding has been enhanced, and therefore my teaching has improved."

(comment from a participating teacher)

Beginning in 2007, and with the help of the Mathematical Association of America, AIM has held a series of three workshops to inform teams of middle school math teachers, school administrators, and research mathematicians from around the country about the program and equip them to begin Math Teachers' Circles of their own. Called "How to Run a Math Teachers' Circle," these workshops help Member Circles develop their goals and plans, including finding a venue, recruiting teachers and mathematicians, evaluating their program, and fund-raising at the local or state level. As a result of these workshops, we anticipate that by Summer 2009, the Math Teachers' Circle Network will include Member Circles from 19 communities in 17 states!

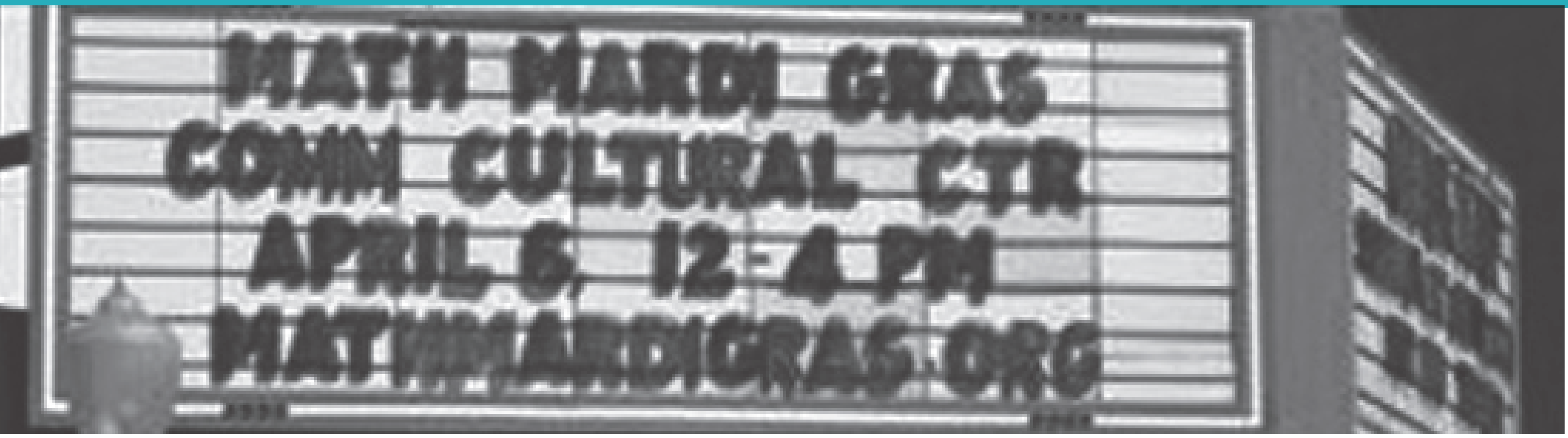


"We've been exposed to exciting methods of doing mathematics. We want the students and teachers to share in the aesthetic beauty of this process."–Circle Leader

More information on Math Teachers' Circles is available at www.mathteacherscircle.org

Math Mardi Gras

Each year the Community Center in Morgan Hill bustles with activity during the AIM Math Mardi Gras. Local students ranging from grades 2 through 12 and their families, along with other community members, participate in a day of fun math activities and friendly competitions.



Q. Where can you find more than 300 students, parents, and volunteers spending an afternoon actively engaged in solving math puzzles and having fun?

A. At AIM's annual Math Mardi Gras in Morgan Hill!

This annual event has been a great success since it first began in 2006. Highlights include a game of Math Jeopardy, a Rubik's Cube competition, and a SET tournament. There are also several carnival-style booths with math and logic problems for anyone to try, along with "How To" tables to help figure out the puzzles.

The sponsorship of Math Mardi Gras is one of AIM's outreach efforts to increase mathematical interest and awareness among the public, and it is also an important part of AIM's efforts to develop community support and goodwill for AIM in the Morgan Hill area.

In 2008, players of Math Jeopardy were able to face their peers in this fast-paced, buzzer-hitting game on a new "game show" set designed by AIM's former Executive Assistant, Meghan Criswell.

Morgan Hill Mayor Steve Tate at Math Jeopardy

Intense games of SET alternated between silence and shouts.

Math Activities for Students

- Morgan Hill Math
- Bay Area Mathematical Adventures (BAMA)
- San Jose Math Circle

Morgan Hill Math

Morgan Hill Math collectively describes the many AIM-sponsored activities for young people in the local Morgan Hill community. Its goal is to spread the enjoyment and appreciation for mathematics, in all its many forms, and to challenge students through extracurricular activities. Events for students at various levels take place throughout the year. In addition, leaders for each group prepare their students for regional and national math contests—with proven success. The following is a sample of these activities.

Mathletics is a new program started in the fall of 2008 that is designed for students enrolled in 4th and 5th grades. It consists of a 10-week program, held after school at Gavilan College's Morgan Hill site located in the Morgan Hill Community Center. Mathletics introduces problem solving to young students and is designed to enhance the standard school curriculum while also preparing students for the future with more advanced mathematical concepts.

MATHCOUNTS, a national program, is designed to expose students from 6th to 8th grade to multi-step word problems. Several MATHCOUNTS groups meet weekly from October through January. Recent topics have included logic, counting, probability, statistics, and number theory. MATHCOUNTS students are encouraged to compete in the American Mathematics Competition AMC-8, a nationwide math test, and also in the regional MATHCOUNTS contest. In March of 2008, Mark Holmstrom (7th grade) progressed to the MATHCOUNTS State Competition for Northern California, held at UC Davis, and placed 18th out of 152 participants!

AIM Executive Director Brian Conrey with Murphy Middle School MATHCOUNTS team

Britton Middle School MATHCOUNTS Team with Coach Elizabeth Mandel

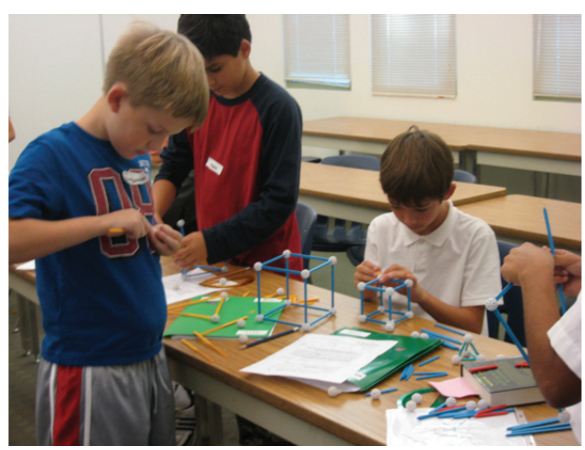
High School Math Clubs are active at both Sobrato High School and Live Oak High School. Former MATHCOUNTS student Joshua Yip leads the biweekly meetings at Sobrato High, while AIM Executive Director Brian Conrey coaches the Live Oak High School Math Club. Meetings often involve discussing and exploring challenging mathematical problems, and preparing students for the Math League Competition and the American Mathematics Competition AMC-10. In 2008, Bryant Gamboa, a ninth grader, placed in the top 1% in the nation and progressed to the American Invitational Mathematics Exam.

Students from the high school math club also play an integral role in the success of the Math Mardi Gras, running the SET competition, assisting with Math Jeopardy, and running the "Win the Mardi Gras Lottery" booth.

Congratulations to Bryant Gamboa from Live Oak High School Principal Nick Boden.

Director's Circle was developed for outstanding students from our 6th-12th grade Morgan Hill Math programs. Coached by AIM Executive Director Brian Conrey, students embark on more formal aspects of the discipline of mathematics. Some sessions introduce the concept of "proof" and discuss the elements of proof-writing in a very practical manner. Other meetings involve exploring specific problem-solving techniques and concepts such as the "Pigeon Hole Principle." Students also prepare for the Bay Area Mathematical Olympiad contest.

Mathletes



Each summer, members of the Director's Circle are invited to participate in SMART (Summer Mathematically Advanced Research Team). This multi-day experience introduces students to more substantial problems requiring time for experimentation and investigation. They are introduced to Mathematica, a powerful computer algebra system that is widely used by professional mathematicians.

In 2008, the students studied random sequences. For instance, they considered the following problem : Show that there exists a power of 2 that ends in one thousand 1s and 2s. The quantity of '1000' can be replaced by any number and, in fact, an understanding of this problem reveals a unique infinite sequence of 1s and 2s for which the sequence of length 1000 above is just the initial part. This leads naturally to the following question: Does this infinite sequence appear to be random? The students were set the task of figuring out how to generate the sequence and to then perform various tests to determine whether the sequence is random. Joshua Yip and Peter Mains are continuing to work on this project and plan to prepare a submission to the science fair.

Bay Area Mathematical Adventures & San Jose Math Circle

AIM has been an active sponsor and participant in both the **Bay Area Mathematical Adventures (BAMA)** and the **San Jose Math Circle (SJMC).**

The primary goal of the lecture series **BAMA** is to challenge and motivate students to think mathematically. Speakers present real mathematics and share with the audience modern views of mathematics. Some talks provide students with related problems or enable teachers to expand later on the topics with their students.

The **San Jose Math Circle (SJMC)** is a weekly math meeting for middle school and high school students. Over 30 students come each week to confront difficult, original, and always fun mathematical puzzles.

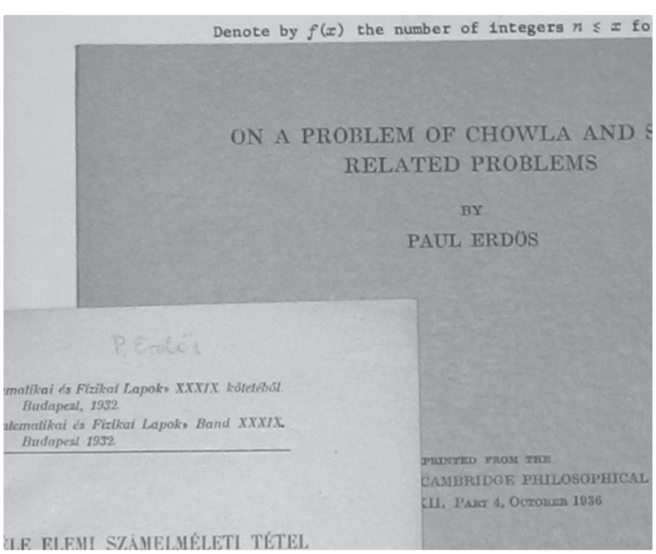
Library

The Library at AIM grew out of the premise that the practice of mathematics depends on a close relationship with its past scholarly literature. Our library thus has two essential goals: to advance the study of mathematics and to preserve the history of mathematics. To these ends, AIM acquires and conserves original materials, makes them accessible to staff and visitors via cataloguing and collection management, supports research, and educates with displays and exhibitions.

"The library is the mathematician's laboratory."
—Paul Halmos

In its 10 years, the AIM Library has developed its holdings at a rapid rate, both by donation and by purchase. Our collections fall into four categories: the general printed collection (i.e. the working library), rare books, reprints/journals, and archives. The working library currently numbers 12,000 books, while the rare books collection, housed in a separate location, showcases items from the 15th through 20th centuries. Perhaps our strongest asset is the reprint collection, now representing several thousand mathematicians in 100,000+ offprints and preprints. AIM actively solicits the reprints of mathematicians the world over, knowing this material to be an enormously rich resource, worthy of preservation. We are unique among libraries in assembling a comprehensive reprint repository. Similarly, AIM believes that the study of collateral, non-printed materials—drafts, manuscripts, lecture notes, correspondence, etc.—is key to the understanding of a mathematician's oeuvre. We therefore seek to add archives to our collections whenever possible.

The core of the AIM Library is the Gian-Carlo Rota collection, purchased from Rota's estate in 2000. To this initial acquisition we have added approximately 8,000 books in the last eight years, many of them supplied from the backlists of the major mathematical publishers and the remainder donated by individual mathematicians, mathematics departments and libraries, visitors, and workshop participants. Donations represent an increasingly important part of our acquisitions; nowhere is this more evident than in the archives and in the reprint collection, built entirely from the generous contributions of supporters. From donors to staff to the generation of student assistants responsible for processing the materials, the AIM Library is a fully collaborative venture, reflecting the philosophy of the Institute itself.



AIM's online catalog is available at http://www.aimath.org/library/

AIM Staff

Brian Conrey, Executive Director

Brian Conrey is the founding Executive Director of the American Institute of Mathematics. He received his PhD from the University of Michigan in 1980 and has written 65 papers and given more than 100 invited talks in number theory, his research specialty. He was Head of Mathematics at Oklahoma State University from 1991–1997 and has been Executive Director of AIM since 1997. He was a member of the Institute for Advanced Study in 1982 -1983, 1987–1988, and 1990–1991. He received an Alfred P. Sloan Fellowship in 1987 and the Levi Conant Prize from the American Mathematical Society in 2008.

David Farmer, Director of Programming

David Farmer is a founding member of the AIM Research Conference Center (ARCC). He received his PhD from Oklahoma State University and his research interests are in *L*-functions and modular forms. He actively involves undergraduates in his research and is also working on developing Web-based tools for research mathematics.

Wei Kang, Director of International and Business Collaborations

Wei Kang is responsible for developing collaborations between AIM and other organizations, both regional and international. He received his PhD from the University of California, Davis. His research interests lie in the field of control theory and its applications. He served as an associate editor of *Automatica* and *IEEE Transactions on Automatic Control*. He is a Fellow of IEEE and has been a plenary speaker at two international conferences of SIAM and IFAC. He is also a professor of applied mathematics at the Naval Postgraduate School.

Estelle Basor, Deputy Director

Estelle Basor received her PhD from the University of California at Santa Cruz. She recently retired from California Polytechnic State University in San Luis Obispo and has held visiting positions at UC Santa Cruz and Bryn Mawr College. Her research interests are in the areas of operator theory and random matrix theory.

Leslie Hogben, Associate Director for Program Diversity

Leslie Hogben is a professor of mathematics at Iowa State University. She received her PhD in 1978 from Yale University. Originally working in nonassociative algebra, she shifted her research focus to linear algebra, especially combinatorial matrix theory. She particularly enjoys doing research with graduate and undergraduate students. Hogben is an associate editor of *Linear Algebra and Its Applications*, editor of *Handbook of Linear Algebra*, and the Secretary/Treasurer of the International Linear Algebra Society.

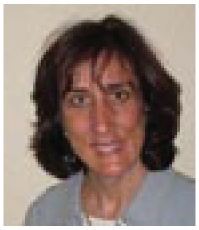
Brianna Donaldson, Director of Special Projects

Brianna Donaldson received her PhD from Indiana University and has research interests in mathematical models of perceptual decision-making. Her role at AIM includes managing the Math Teachers' Circle Network (see pp. 31-32) and coordinating AIM's contributions to GEMSTONES, a project to increase the recruitment and retention of U.S. women and underrepresented minorities in graduate-level mathematics.

AIM Staff

Ellen Heffelfinger, Librarian

Ellen Heffelfinger supervises AIM's historical mathematics collection and its working library. She holds a B.A. from Yale University and a M.S. from Columbia University. She spent 15 years in the rare book business, specializing in science, before joining AIM. She is currently a board member of the Friends of the San Francisco Public Library.



Lori Mains, Outreach Coordinator

Lori Mains oversees AIM's outreach programs for the Morgan Hill community and talented math students in grades 4-12. Lori has a B.S. in Computer Science from Union College in Schenectady, NY. A former IBM employee, Lori has spent the past ten years working with school-aged children and math, through both school-based programs and one-on-one tutoring. The current programs which she administers include the Math Mardi Gras, Mathletics, MATHCOUNTS, and Mu Alpha Theta.

Hannah Brodie, Financial Officer

Hannah Brodie has worked for AIM since 1999. She handles Human Resources, covering the full range of HR Administration activities. She has a background in finance and administration and is currently working on her Grants Specialist certification.

Shaquana Mitchell, Executive Assistant

Shaquana Mitchell handles a range of administrative duties. She holds a B.A. from Louisiana State University and a M.F.A. from San Jose State University.

Harpreet Kaur, Administrative Assistant

Harpreet Kaur grew up in India where she received her undergraduate degree from Punjab University and where she also did graduate work in economics. She moved to the United States in 1986 and began working for AIM in 2003. At AIM she handles a multitude of activities for the workshops and SQuaREs programs and is also the administrative assistant to the Deputy Director.

Previous Staff Members

Meghan Criswell,
Executive Assistant 2000 - 2008

Steven Krantz,
Deputy Director 2006 - 2008

Helen Moore,
Associate Director 2002 - 2006

Rachel Kuske,
Associate Director for Program Diversity 2006 - 2007

Governance

AIM is governed by a Board of Trustees overseeing all AIM activities.

AIM's yearly planning is done under the direction of an Advisory Board. The selection of specific scientific projects occurs under the direction of the Scientific Board.

The Human Resources Board is charged with promoting diversity in the activities of AIM.

The day-to-day activities of AIM are overseen by Executive Director Brian Conrey.

Board of Trustees

Prof. Gerald Alexanderson, Chairman

Professor Alexanderson was formerly Chair of the Department of Mathematics and Computer Science at Santa Clara University and is a former President of the Mathematical Association of America.

Prof. Gunnar Carlsson

Professor Carlsson is a Professor of Mathematics at Stanford University. He has served as Chair of the Stanford Mathematics Department, and has been on the faculty of the University of Chicago, University of California (San Diego), and Princeton University.

Stephen Sorenson, President

Mr. Sorenson is also a Director at Fry's Electronics. He previously worked in R&D at Advanced Micro Devices, and has managed a non-profit research institute.

Dr. Harry J. Saal

Dr. Saal was chosen by the US Department of Justice to lead the Technical Committee charged with monitoring and enforcing the Microsoft Antitrust case. He was also the founder and CEO of Network General Corporation, and he is active in philanthropy and community affairs.

John Fry, Secretary

Mr. Fry is also founder and CEO of Fry's Electronics.

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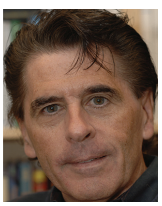

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Harvard University
(passed away in Fall of 2008)

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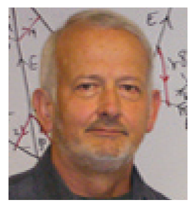

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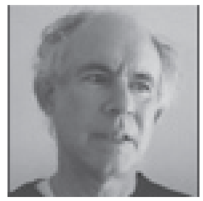

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Financial Statements

Statement of Financial Position

Assets	2007	2006	2005	2004	2003	2002
Current Assets:						
Cash and cash equivalents	0	0	204,681	8,931	24,890	35,130
Investments, at fair value	0	0	202,900	422,007	0	0
Grants Receivable	76,252	71,572	8,428	88,665	118,201	64,176
Other Receivables	944	914	13,672	13,672	0	0
Pledges Receivable	0	0	0	0	525,000	0
Prepaid Expenses	36,116	0	0	0	1,791	4,238
Total Current Assets	113,312	72,486	429,681	533,275	669,882	103,544
Property and Equipment						
Furniture and Fixtures	24,549	23,731	32,186			
Computers and Equipment	72,323	57,432	79,057			
Library Books	3,706	3,000	3,000			
	100,578	84,163	114,243			
Less accumulated depreciation and amortization	(63,871)	(55,869)	(84,713)			
Total property and equipment	36,707	28,294	29,530	314,772	185,779	76,211
Other assets	15,300	15,300	15,300	15,300	15,300	3,300
Total assets	165,319	116,080	474,511	863,347	870,961	183,055

Liabilities and Net Assets	2007	2006	2005	2004	2003	2002
Current Liabilities:						
Bank overdraft	96,275	23,044	0	0	0	0
Accounts payable	90,040	139,626	148,540	148,423	98,478	44,957
Accrued expenses	38,142	174,856	191,847	207,197	89,517	45,187
Total current liabilities	224,457	337,526	340,387	355,620	187,995	90,144
Net assets:						
Unrestricted	(59,138)	(221,446)	134,124	507,727	682,966	92,911
Total net assets (accumulated deficit)	(59,138)	(221,446)	134,124	507,727	682,966	92,911
Total liabilities and net assets	165,319	116,080	474,511	863,347	870,961	183,055

Statement of Activities and Changes in Net Assets

	2007	2006	2005	2004	2003	2002
Support and revenues:						
Government Grants	1,924,335	2,299,922	1,882,666	1,309,554	1,048,746	631,051
Private grants and contributions	1,450,819	772,063	869,727	1,027,642	1,711,045	844,961
Investment revenue	34	2,065	6,173	5,683	74	335
Other revenue	19,185	1,764	0	0	0	0
Net assets released from restriction	0	0	390,950	0	0	0
Total support and revenues	3,394,373	3,075,814	3,149,516	2,342,879	2,759,865	1,476,347
Expenses						
Program Services	2,722,015	3,186,508	2,892,281	2,250,893	1,911,383	1,342,675
Management and administration	510,050	244,876	239,888	267,225	258,427	174,908
Total expenses	3,232,065	3,431,384	3,132,169	2,518,118	2,169,810	1,517,583
Change in net assets	162,308	(355,570)	17,347	(175,239)	590,055	(41,236)
Net assets, beginning of year	(221,446)	134,124	116,777	682,966	92,911	134,147
Net assets, end of year	(59,138)	(221,446)	134,124	507,727	682,966	92,911

Statement of Cash Flows

	2007	2006	2005	2004	2003	2002
Cash flows from operating activities						
Change in net assets	162,308	(355,570)	(373,603)	(175,239)	590,055	(41,236)
Adjustments to reconcile change in assets to net cash from operating activities:						
Depreciation and amortization	8,002	14,524	11,120	9,650	15,455	14,384
Interest Income from certificate of deposit	0	0	(6,065)	(5,638)	0	
Loss on deposal of fixed asset	0	0	0	0	1,841	
Net effect of changes in:						
Government grants receivable	(4,680)	(63,144)	80,237	29,536	(54,025)	(48,451)
Pledges receivable	0	0	0	525,000	(525,000)	0
Other receivable	(30)	12,758	0	0	0	8,424
Employee advance	0	0	0	0	0	5,959
Prepaid expenses	(36,116)	0	0	(11,881)	2,447	3,860
Deposits	0	0	0	0	3,300	0
Accounts payable	(49,586)	(8,914)	117	49,945	53,521	44,957
Accrued expenses	(136,714)	(16,991)	(15,350)	117,680	44,330	(6,527)
Net cash from operating activities	(56,816)	(417,337)	(303,544)	539,053	131,924	(18,630)
Cash flows from investing activities:						
Net change in investments	0	202,900	0	0	0	0
Purchases of certificates of deposit	0	0	(275,553)	(920,892)	0	0
Purchases of collection item	0	0	0	0	(15,300)	0
Proceeds received from certificates of deposit	0	0	500,725	504,523	0	0
Proceeds from sale of property and equipment	0	0	315,852	0	0	0
Acquisition of property and equipment	(16,415)	(13,288)	(41,730)	(138,643)	(126,864)	(39,136)
Net cash from investing activities	(16,415)	189,612	499,294	(555,012)	(142,164)	(39,136)
Change in cash	(73,231)	(227,725)	195,750	(15,959)	(10,240)	(57,766)
Cash, beginning of year	(23,044)	204,681	8,931	24,890	35,130	92,896
Cash, end of year	(96,275)	(23,044)	204,681	8,931	24,890	35,130

Statement of Functional Expenses

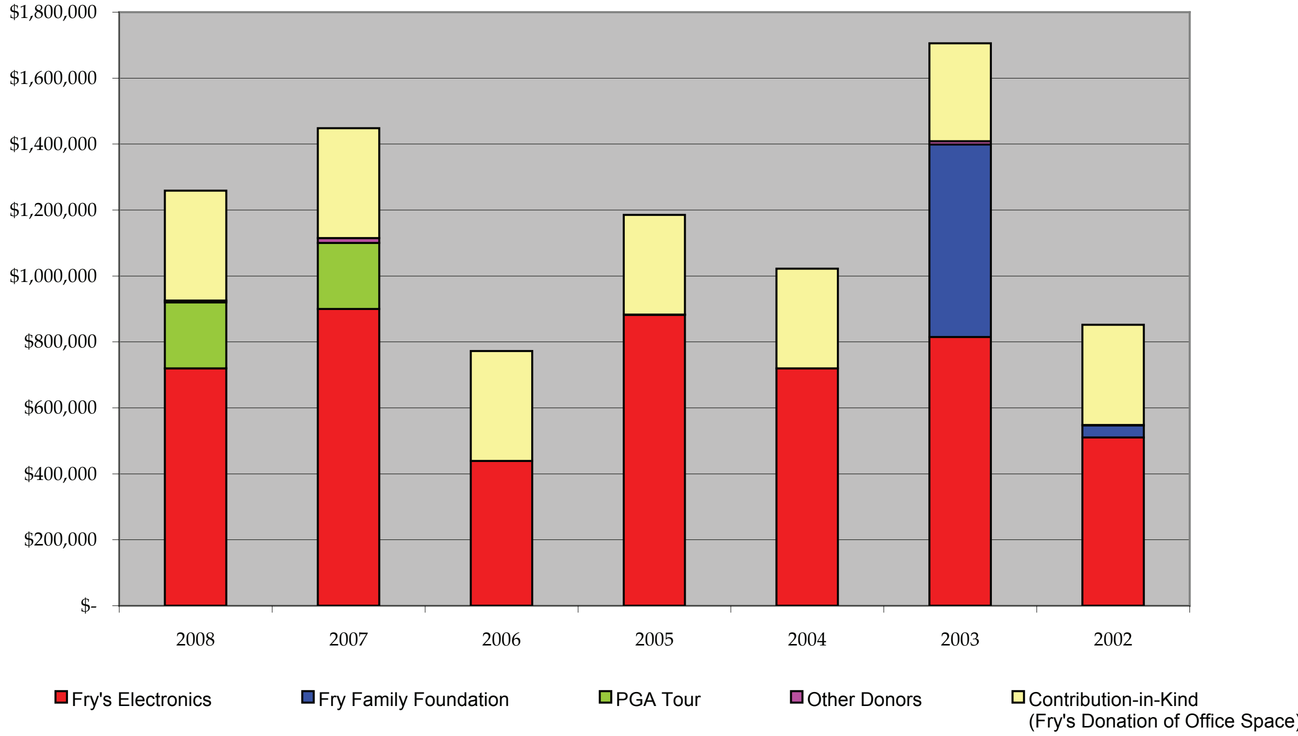
	Year Ended December 31, 2007			Year Ended December 31, 2006		
	Program Services	Management & General	Total	Program Services	Management & General	Total
Compensation and grants paid	990,777	167,993	1,158,770	1,258,184	94,000	1,352,184
Payroll taxes	56,998	9,950	66,948	62,166	7,175	69,341
Accounting and professional fees	18,692	133,503	152,195	35,310	1,755	37,065
Insurance	0	6,625	6,625	31,954	56,354	88,308
Conferences, travel and meetings	1,286,899	37,534	1,324,433	1,347,655	29,203	1,376,858
Supplies	4,248	10,264	14,512	30,802	2,607	33,409
Telephone	11,722	9,334	21,056	20,354	2,985	23,339
Postage	3,925	4,602	8,527	1,657	2,153	3,810
Maintenance	5,137	12,285	17,422	11,852	0	11,852
Miscellaneous expense	10,617	27,463	38,080	38,503	10,911	49,414
Rent	333,000	81,540	414,540	333,547	37,061	370,608
Utilities	0	302	302	0	0	0
Taxes	0	653	653	0	672	672
Total expenses before depreciation	2,722,015	502,048	3,224,063	3,171,984	244,876	3,416,860
Depreciation	0	8,002	8,002	14,524	0	14,524
Total expenses	2,722,015	510,050	3,232,065	3,186,508	244,876	3,431,384

	Year Ended December 31, 2005			Year Ended December 31, 2004		
	Program Services	Management & General	Total	Program Services	Management & General	Total
Compensation and grants paid	1,260,267	87,000	1,347,267	864,310	84,667	948,977
Payroll taxes	59,934	6,661	66,595	46,260	7,051	53,311
Accounting and professional fees	19,171	21,789	40,960	18,231	14,487	32,718
Insurance	18,174	39,040	57,214	29,579	39,959	69,538
Conferences, travel and meetings	1,004,679	20,786	1,025,465	663,401	43,552	706,953
Supplies	136,907	5,386	142,293	230,680	17,913	248,593
Telephone	16,792	1,790	18,582	13,256	844	14,100
Postage	937	3,362	4,299	1,102	4,375	5,477
Maintenance	11,868	0	11,868	5,340	0	5,340
Miscellaneous expense	9,201	15,678	24,879	38,116	8,769	46,885
Rent	309,960	34,440	344,400	310,393	34,488	344,881
Utilities	33,271	0	33,271	24,120	7,018	31,138
Taxes	0	3,956	3,956	0	557	557
Total expenses before depreciation	2,881,161	239,888	3,121,049	2,244,788	263,680	2,508,468
Depreciation	11,120	0	11,120	6,105	3,545	9,650
Total expenses	2,892,281	239,888	3,132,169	2,250,893	267,225	2,518,118

Statement of Functional Expenses

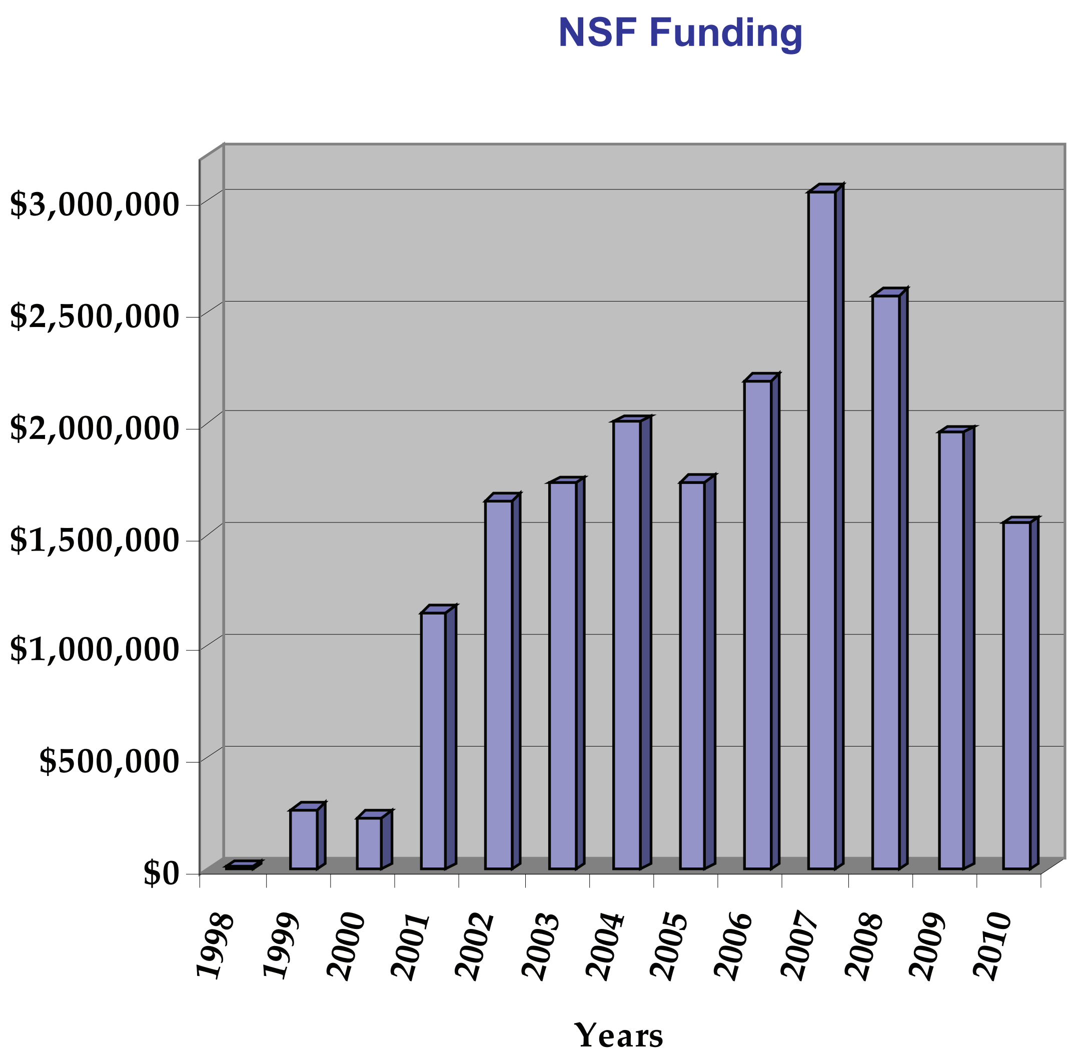
	Year Ended December 31, 2003			Year Ended December 31, 2002		
	Program Services	Management & General	Total	Program Services	Management & General	Total
Compensation and grants paid	621,439	81,500	702,939	519,243	63,318	582,561
Payroll taxes	46,978	6,627	53,605	35,077	5,222	40,299
Accounting and professional fees	17,500	12,163	29,663	19,963	15,095	35,058
Insurance	12,756	18,394	31,150	11,353	10,007	21,360
Conferences, travel and meetings	776,837	58,728	835,565	427,529	6,355	433,884
Supplies	64,245	18,299	82,544	5,722	13,247	18,969
Telephone	11,345	1,289	12,634	4,779	531	5,310
Postage	1,293	2,901	4,194	2,316	1,055	3,371
Maintenance	3,596	688	4,284	0	3,923	3,923
Miscellaneous expense	17,291	12,282	29,573	1,892	15,870	17,762
Rent	325,242	36,138	361,380	303,351	33,706	337,057
Advertising	2,236	2,734	4,970	1,152	2,444	3,596
Taxes	0	13	13	0	49	49
Loss on disposal of fixed assets	0	1,841	1,841	0	0	0
Total expenses before depreciation	1,900,758	253,597	2,154,355	1,332,377	170,822	1,503,199
Depreciation	10,625	4,830	15,455	10,298	4,086	14,384
Total expenses	1,911,383	258,427	2,169,810	1,342,675	174,908	1,517,583

Donations to AIM



National Science Foundation awards to AIM

Title	Year	Amount
New Developments in Algebraic K-Theory	1999	$ 5,000
L-Functions	1999	15,000
Essential Surfaces in Knot Exteriors: The Lopez Conjecture	2000	37,340
Equivariant Stable Homotopy Theory and *K*-Theory	2000	7,500
Biholomorphic Mappings	2000	20,000
Low-Dimensional Contact Geometry	2000	70,000
FRG: *L*-functions: Symmetry and Zeros	2000	500,000
The Mumford Standard Class Conjecture	2001	10,000
Analytic Theory of *L*-functions and Modular Forms	2001	57,701
General Relativity	2002	40,000
d-Bar Estimates and Their Applications	2002	30,000
L-functions: Zeros and Values	2002	69,000
A National Conference Center	2002	5,219,807
A Concentration Year in Dynamical Systems	2002	21,000
Computational Opportunuties in Algebra, Number Theory, and Combinatorics	2002	19,760
Automorphic Forms Workshop	2003	15,000
FRG: Random Matrix Models, Zeros of *L*-functions, and Arithmetic	2003	989,823
Arithmetical Geometry and Number Theory - A conference in honor of N. Katz	2003	25,000
FRG: Holomorphic Curves in Low Dimensional Topology	2003	828,000
Graduate Opportunities in Number Theory and Random Matrix Theory	2004	16,244
FRG: Minimal Surfaces, Moduli Spaces and Computation	2004	110,371
Atlas of Lie Groups and Representations	2005	229,957
Integrable Systems, Random Matrices, and Applications	2006	50,000
FRG: Atlas of Lie Groups and Representations	2006	813,471
SM: Geometry and Topology of Moduli Spaces and Applications	2006	448,800
FRG: Affine Schubert Calculus	2007	671,270
Focused Collaborative Research at ARCC	2007	7,751,329
How to Run a Teachers' Circle	2008	12,000
Canadian Number Theory Association Meeting	2008	15,000
Analytic Theory of *L*-functions	2008	35,093
FRG: *L*-functions and Modular Forms	2008	1,205,332
CDI: Simulation of Ultrasonic-Wave Propagation with Application to Cancer Therapy	2008	31,500
CDI: Bibliographic Knowledge Network	2008	759,656
TOTAL		**$ 20,129,954**


NSF Funding
$3,000,000
$2,500,000
$2,000,000
$1,500,000
$1,000,000
$500,000
$0
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
Years

The Future

Recognizing the advantage of doing innovative mathematical work in a quiet, beautiful place, John Fry chose Morgan Hill as the setting in which to create his vision for AIM. After purchasing a 190-acre plot of land in the rolling foothills of south Santa Clara Valley in 1994, he set about making his dream come true. Since his purchase, the natural landscape has been enhanced by the planting of some 40,000 trees and the creation of four extensive gardens embedded into the greenery of a magnificent private golf course.

Ground has been broken for the construction of AIM's permanent home, an architecturally distinctive 16,500 square meter building that will be perched on a hill with panoramic views of Santa Clara Valley. The "math castle," as it is affectionately known, will open in the near future. AIM currently resides in Palo Alto while awaiting the completion of its new facilities.

Groundbreaking Ceremony
May 31, 2007

Inner
Courtyard

Panoramic view of the "math castle"

AIM in 1998

AIM in 2008

Future vision for AIM

American Institute
of Mathematics

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