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.
Welcome from the Executive Director

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
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

The AIM-Style Workshop
Featured Workshops
Complete List of Workshops
The SQuaREs Program
Featured SQuaREs
Complete List of SQuaREs

1998: K. Soundararajan
2000: Henry Cohn and Vadim Kaloshin
2001: Lenhard Ng
2002: Frank Calegari
2003: Mike Develin
2004: Jacob Lurie
2005: Joel Kamnitzer
2006: Elizabeth Meckes
2007: Yi Ni
2008: Travis Schedler

Public Lectures
The Math Teachers’ Circle Network
Math Mardi Gras
Math Activities for Students
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.

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.

“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
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.

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."

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:


\(^1\) 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.


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.

“"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)
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)

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.

“The 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)
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.

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.

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

(excerpt from workshop participant survey)

The graph is an illustration 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 $SL(n, \mathbb{Z})$
- 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
- 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

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
- 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.
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)

**Featured SQuaREs**

The “Kadison-Singer Problem” SQuaRE April 14 - 18, 2008

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

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

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

**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 I September 21 - 24, 2007

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

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.

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.

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

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.
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 noncommutative 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
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 fundraising 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.

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!

**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.

**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.
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.
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/
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.
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
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.

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.

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.

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 Anti-trust 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.
Advisory Board

Donald J. Albers
Mathematical Association of America

Fernando Gouvêa
Colby College

Thomas F. Banchoff
Brown University

Ronald Graham
University of California, San Diego

Keith Dennis
Cornell University

William Jaco
Oklahoma State University

Keith J. Devlin
Stanford University

Douglas Lind
University of Washington

Wade Ellis, Jr.
West Valley College

Doris Schattschneider
Moravian College

Andrew Gleason
Harvard University
(passed away in Fall of 2008)

Sanford Segal
University of Rochester
Scientific Board

Gerard Ben Arous
New York University

David Gabai
Princeton University

Mladen Bestvina
University of Utah

Victor Guillemin
Massachusetts Institute of Technology

Robert Calderbank
Princeton University

Alexander Kechris
Caltech

Fan Chung Graham
University of California, San Diego

Sándor Kovács
University of Washington

Robbert Dijkgraaf
University of Amsterdam

Joyce R. McLaughlin
Rensselaer Polytechnic Institute

Yakov Eliashberg
Stanford University

Yuval Peres
University of California, Berkeley and Microsoft Research

Charles Fefferman
Princeton University

Paul Rabinowitz
University of Wisconsin
Pauline van den Driessche
University of Victoria

Dan-Virgil Voiculescu
University of California, Berkeley

Efim Zelmanov
University of California, San Diego

Peter Sarnak (Chair)
Princeton University

David Siegmund
Stanford University

Jean Taylor
Rutgers University

Human Resources Board

Indira Chatterji
Ohio State University

Tamara G. Kolda
Sandia National Labs

Nathaniel Dean
Texas State University

Rachel Kuske
University of British Columbia

Stephan Ramon Garcia
Pomona College

Ellen Maycock
DePauw University and AMS

Raymond Johnson
University of Maryland

Abdul-Aziz Yakubu
Howard University
# Financial Statements

## Statement of Financial Position

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

**Liabilities and Net Assets**

| Liabilities and Net Assets | | | | | | |
| **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:**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Unrestricted</td>
<td>(59,138)</td>
<td>(221,446)</td>
<td>134,124</td>
<td>507,727</td>
<td>682,966</td>
<td>92,911</td>
</tr>
<tr>
<td><strong>Total net assets (accumulated deficit)</strong></td>
<td>(59,138)</td>
<td>(221,446)</td>
<td>134,124</td>
<td>507,727</td>
<td>682,966</td>
<td>92,911</td>
</tr>
</tbody>
</table>

**Total liabilities and net assets**

| 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

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

### Statement of Cash Flows

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Change in net assets</td>
<td>162,308</td>
<td>(355,570)</td>
<td>(373,603)</td>
<td>(175,239)</td>
<td>590,055</td>
<td>(41,236)</td>
</tr>
<tr>
<td><strong>Adjustments to reconcile change in assets</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Depreciation and amortization</td>
<td>8,002</td>
<td>14,524</td>
<td>11,120</td>
<td>9,650</td>
<td>15,455</td>
<td>14,384</td>
</tr>
<tr>
<td>Interest Income from certificate of deposit</td>
<td>0</td>
<td>0</td>
<td>(6,065)</td>
<td>(5,638)</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Loss on disposal of fixed asset</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1,841</td>
<td></td>
</tr>
<tr>
<td><strong>Net effect of changes in:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Government grants receivable</td>
<td>(4,680)</td>
<td>(63,144)</td>
<td>80,237</td>
<td>29,536</td>
<td>(54,025)</td>
<td>(48,451)</td>
</tr>
<tr>
<td>Pledges receivable</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>525,000</td>
<td>525,000</td>
<td>0</td>
</tr>
<tr>
<td>Other receivable</td>
<td>(30)</td>
<td>12,758</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>8,424</td>
</tr>
<tr>
<td>Employee advance</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>5,959</td>
</tr>
<tr>
<td>Prepaid expenses</td>
<td>(36,116)</td>
<td>0</td>
<td>0</td>
<td>(11,881)</td>
<td>2,447</td>
<td>3,860</td>
</tr>
<tr>
<td>Deposits</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>3,300</td>
<td>0</td>
</tr>
<tr>
<td>Accounts payable</td>
<td>(49,586)</td>
<td>(8,914)</td>
<td>117</td>
<td>49,945</td>
<td>53,521</td>
<td>44,957</td>
</tr>
<tr>
<td>Accrued expenses</td>
<td>(136,714)</td>
<td>(16,991)</td>
<td>(15,350)</td>
<td>117,680</td>
<td>44,330</td>
<td>(6,527)</td>
</tr>
<tr>
<td><strong>Net cash from operating activities</strong></td>
<td>(56,816)</td>
<td>(417,337)</td>
<td>(303,544)</td>
<td>539,053</td>
<td>131,924</td>
<td>(18,630)</td>
</tr>
<tr>
<td>Change in cash</td>
<td>(73,231)</td>
<td>(227,725)</td>
<td>195,750</td>
<td>(15,959)</td>
<td>(10,240)</td>
<td>(57,766)</td>
</tr>
<tr>
<td>Cash, beginning of year</td>
<td>(23,044)</td>
<td>204,681</td>
<td>8,931</td>
<td>24,890</td>
<td>35,130</td>
<td>92,896</td>
</tr>
<tr>
<td>Cash, end of year</td>
<td>(96,275)</td>
<td>(23,044)</td>
<td>204,681</td>
<td>8,931</td>
<td>24,890</td>
<td>35,130</td>
</tr>
</tbody>
</table>
## Statement of Functional Expenses

<table>
<thead>
<tr>
<th></th>
<th>Year Ended December 31, 2007</th>
<th>Year Ended December 31, 2006</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Program Services</td>
<td>Management &amp; General</td>
</tr>
<tr>
<td>Compensation and grants paid</td>
<td>990,777</td>
<td>167,993</td>
</tr>
<tr>
<td>Payroll taxes</td>
<td>56,998</td>
<td>9,950</td>
</tr>
<tr>
<td>Accounting and professional fees</td>
<td>18,692</td>
<td>133,503</td>
</tr>
<tr>
<td>Insurance</td>
<td>0</td>
<td>6,625</td>
</tr>
<tr>
<td>Conferences, travel and meetings</td>
<td>1,286,899</td>
<td>37,534</td>
</tr>
<tr>
<td>Supplies</td>
<td>4,248</td>
<td>10,264</td>
</tr>
<tr>
<td>Telephone</td>
<td>11,722</td>
<td>9,334</td>
</tr>
<tr>
<td>Postage</td>
<td>3,925</td>
<td>4,602</td>
</tr>
<tr>
<td>Maintenance</td>
<td>5,137</td>
<td>12,285</td>
</tr>
<tr>
<td>Miscellaneous expense</td>
<td>10,617</td>
<td>27,463</td>
</tr>
<tr>
<td>Rent</td>
<td>333,000</td>
<td>81,540</td>
</tr>
<tr>
<td>Utilities</td>
<td>0</td>
<td>302</td>
</tr>
<tr>
<td>Taxes</td>
<td>0</td>
<td>653</td>
</tr>
<tr>
<td><strong>Total expenses before depreciation</strong></td>
<td>2,722,015</td>
<td>502,048</td>
</tr>
<tr>
<td><strong>Depreciation</strong></td>
<td>0</td>
<td>8,002</td>
</tr>
<tr>
<td><strong>Total expenses</strong></td>
<td>2,722,015</td>
<td>510,050</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Year Ended December 31, 2005</th>
<th>Year Ended December 31, 2004</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Program Services</td>
<td>Management &amp; General</td>
</tr>
<tr>
<td>Compensation and grants paid</td>
<td>1,260,267</td>
<td>87,000</td>
</tr>
<tr>
<td>Payroll taxes</td>
<td>59,934</td>
<td>6,661</td>
</tr>
<tr>
<td>Accounting and professional fees</td>
<td>19,171</td>
<td>21,789</td>
</tr>
<tr>
<td>Insurance</td>
<td>18,174</td>
<td>39,040</td>
</tr>
<tr>
<td>Conferences, travel and meetings</td>
<td>1,004,679</td>
<td>20,786</td>
</tr>
<tr>
<td>Supplies</td>
<td>136,907</td>
<td>5,386</td>
</tr>
<tr>
<td>Telephone</td>
<td>16,792</td>
<td>1,790</td>
</tr>
<tr>
<td>Postage</td>
<td>937</td>
<td>3,362</td>
</tr>
<tr>
<td>Maintenance</td>
<td>11,868</td>
<td>0</td>
</tr>
<tr>
<td>Miscellaneous expense</td>
<td>9,201</td>
<td>15,678</td>
</tr>
<tr>
<td>Rent</td>
<td>309,960</td>
<td>34,440</td>
</tr>
<tr>
<td>Utilities</td>
<td>33,271</td>
<td>0</td>
</tr>
<tr>
<td>Taxes</td>
<td>0</td>
<td>3,956</td>
</tr>
<tr>
<td><strong>Total expenses before depreciation</strong></td>
<td>2,881,161</td>
<td>239,888</td>
</tr>
<tr>
<td><strong>Depreciation</strong></td>
<td>11,120</td>
<td>0</td>
</tr>
<tr>
<td><strong>Total expenses</strong></td>
<td>2,892,281</td>
<td>239,888</td>
</tr>
</tbody>
</table>
## Statement of Functional Expenses

### Year Ended December 31, 2003

<table>
<thead>
<tr>
<th>Category</th>
<th>Program Services</th>
<th>Management &amp; General</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compensation and grants paid</td>
<td>621,439</td>
<td>81,500</td>
<td>702,939</td>
</tr>
<tr>
<td>Payroll taxes</td>
<td>46,978</td>
<td>6,627</td>
<td>53,605</td>
</tr>
<tr>
<td>Accounting and professional fees</td>
<td>17,500</td>
<td>12,163</td>
<td>29,663</td>
</tr>
<tr>
<td>Insurance</td>
<td>12,756</td>
<td>18,394</td>
<td>31,150</td>
</tr>
<tr>
<td>Conferences, travel and meetings</td>
<td>776,837</td>
<td>58,728</td>
<td>835,565</td>
</tr>
<tr>
<td>Supplies</td>
<td>64,245</td>
<td>18,299</td>
<td>82,544</td>
</tr>
<tr>
<td>Telephone</td>
<td>11,345</td>
<td>1,289</td>
<td>12,634</td>
</tr>
<tr>
<td>Postage</td>
<td>1,293</td>
<td>2,901</td>
<td>4,194</td>
</tr>
<tr>
<td>Maintenance</td>
<td>3,596</td>
<td>688</td>
<td>4,284</td>
</tr>
<tr>
<td>Miscellaneous expense</td>
<td>17,291</td>
<td>12,282</td>
<td>29,573</td>
</tr>
<tr>
<td>Rent</td>
<td>325,242</td>
<td>36,138</td>
<td>361,380</td>
</tr>
<tr>
<td>Advertising</td>
<td>2,236</td>
<td>2,734</td>
<td>4,970</td>
</tr>
<tr>
<td>Taxes</td>
<td>0</td>
<td>13</td>
<td>13</td>
</tr>
<tr>
<td>Loss on disposal of fixed assets</td>
<td>0</td>
<td>1,841</td>
<td>1,841</td>
</tr>
<tr>
<td><strong>Total expenses before depreciation</strong></td>
<td>1,900,758</td>
<td>253,597</td>
<td>2,154,355</td>
</tr>
<tr>
<td><strong>Depreciation</strong></td>
<td>10,625</td>
<td>4,830</td>
<td>15,455</td>
</tr>
<tr>
<td><strong>Total expenses</strong></td>
<td>1,911,383</td>
<td>258,427</td>
<td>2,169,810</td>
</tr>
</tbody>
</table>

### Year Ended December 31, 2002

<table>
<thead>
<tr>
<th>Category</th>
<th>Program Services</th>
<th>Management &amp; General</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compensation and grants paid</td>
<td>519,243</td>
<td>63,318</td>
<td>582,561</td>
</tr>
<tr>
<td>Payroll taxes</td>
<td>35,077</td>
<td>5,222</td>
<td>40,299</td>
</tr>
<tr>
<td>Accounting and professional fees</td>
<td>19,963</td>
<td>15,095</td>
<td>35,058</td>
</tr>
<tr>
<td>Insurance</td>
<td>11,353</td>
<td>10,007</td>
<td>21,360</td>
</tr>
<tr>
<td>Conferences, travel and meetings</td>
<td>427,529</td>
<td>6,355</td>
<td>433,884</td>
</tr>
<tr>
<td>Supplies</td>
<td>5,722</td>
<td>13,247</td>
<td>18,969</td>
</tr>
<tr>
<td>Telephone</td>
<td>4,779</td>
<td>531</td>
<td>5,310</td>
</tr>
<tr>
<td>Postage</td>
<td>2,316</td>
<td>1,055</td>
<td>3,371</td>
</tr>
<tr>
<td>Maintenance</td>
<td>0</td>
<td>3,923</td>
<td>3,923</td>
</tr>
<tr>
<td>Miscellaneous expense</td>
<td>1,892</td>
<td>15,870</td>
<td>17,762</td>
</tr>
<tr>
<td>Rent</td>
<td>303,351</td>
<td>33,706</td>
<td>337,057</td>
</tr>
<tr>
<td>Advertising</td>
<td>1,152</td>
<td>2,444</td>
<td>3,596</td>
</tr>
<tr>
<td>Taxes</td>
<td>0</td>
<td>49</td>
<td>49</td>
</tr>
<tr>
<td>Loss on disposal of fixed assets</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><strong>Total expenses before depreciation</strong></td>
<td>1,332,377</td>
<td>170,822</td>
<td>1,503,199</td>
</tr>
<tr>
<td><strong>Depreciation</strong></td>
<td>10,298</td>
<td>4,086</td>
<td>14,384</td>
</tr>
<tr>
<td><strong>Total expenses</strong></td>
<td>1,342,675</td>
<td>174,908</td>
<td>1,517,583</td>
</tr>
</tbody>
</table>

### Donations to AIM

- **Fry’s Electronics**
- **Fry Family Foundation**
- **PGA Tour**
- **Other Donors**
- **Contribution-in-Kind**
  (Fry’s Donation of Office Space)
National Science Foundation awards to AIM

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