

**SIAG Algebraic Geometry (AG)**  
**Charter Renewal Application**

This CHARTER RENEWAL APPLICATION applies to the SIAM Activity Group on Algebraic Geometry (SIAG/AG). The SIAM Activity Group (or SIAG/AG) to which this renewal applies was originally formed under the aegis of SIAM on July 2009 by the SIAM Council and by the SIAM Board of Trustees with its initial operating period beginning January 1, 2010 and ending December 31, 2011. This charter was renewed by the Council and Board six times with the sixth term ending 12/31/21. As of 12/31/20 this SIAG had 409 members, including 192 student members.

According to its Rules of Procedure, the objective of the SIAG is to provide a research community gathering point for research in applications of algebra and geometry. The activity group will welcome participation from both theoretical mathematical areas and application areas not on this list which fall under these broadly interpreted notions of algebraic geometry and its applications.

Its proposed functions were:

- (1) Organize minisymposia at the SIAM Annual Meeting in years where there is no SIAG Conference.
  
- (2) At least once every seven years either organize a track of at least six minisymposia at the SIAM Annual Meeting or have an activity group meeting held jointly with the annual meeting. The VP for Programs and th VP at Large will coordinate the scheduling with the SIAG chair.
  
- (3) Organize a biennial SIAM Conference on Algebraic Geometry. The SIAG will consider dovetailing specialized workshops and conferences with the SIAM Annual meeting or other SIAG conferences. The chair of the conference organizing committee shall be either the program director or the chairperson of the SIAG or their designee. The organizing committee must be approved by the VP for Programs at least 16 months before the conference.
  
- (4) With the approval of the SIAM Program Committee, the SIAG may organize special sessions at SIAM meetings, and conduct special one- or two-day meetings immediately before or after a regular SIAM meeting. Other SIAG meetings may be organized only with the approval of the SIAM president and vice president for programs.

The SIAG has complemented SIAM's activities and supported its proposed functions. The answers to the questions below indicate how this was accomplished and what the officers propose as the future directions for the SIAG.

**SIAG Algebraic Geometry (AG)**  
**Charter Renewal Application**

Current officers of the activity group:

Chair, Sandra Di Rocco

Vice Chair, Bernard Mourrain

Program Director, Josephine Yu

Secretary, Kaie Kubjas

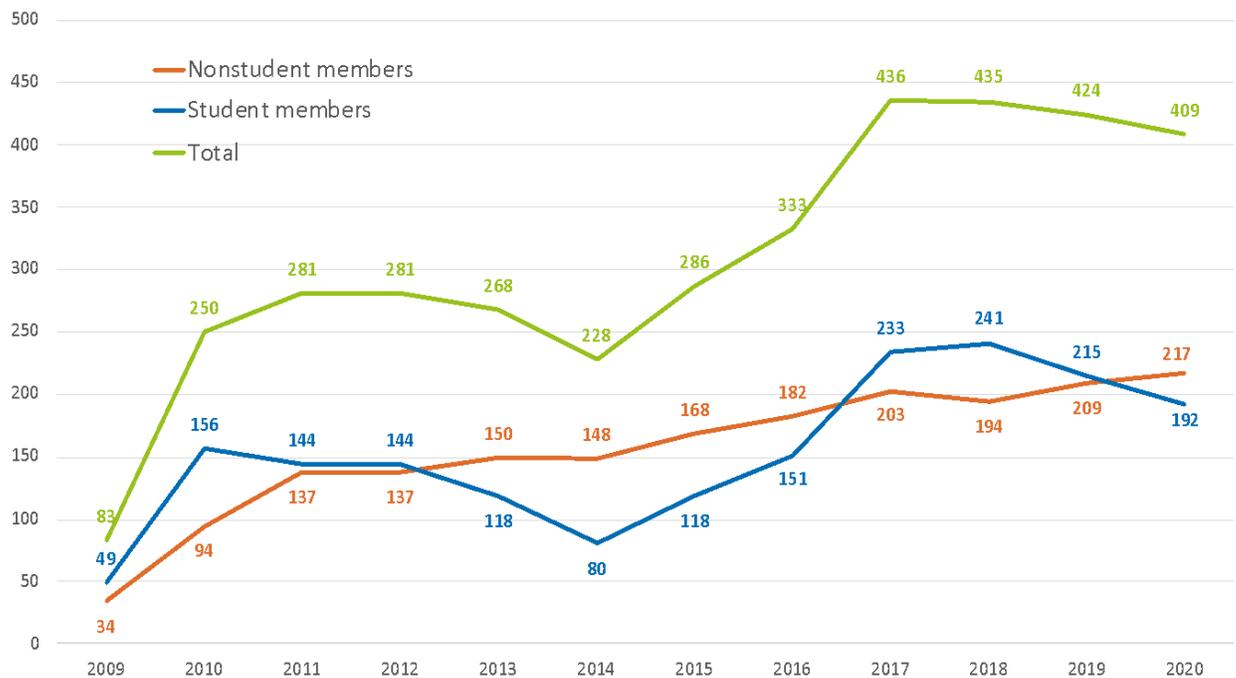
1. *How is the field covered by the activity group doing? Is it growing, is the focus shifting? What have been the significant advances over the last two years?*

The SIAG in Algebraic Geometry (AG) will be often denoted by  $SI(AG)^2$ .

The field has witnessed a rapid expansion, partially due to the growing need for a mathematical foundation for expanding fields such as statistical analysis, data analysis, and AI. The activity group covers a broad spectrum of research areas within Applied Algebra and Geometry. This is reflected, in particular, by the variety of topics of the numerous minisymposia at the biennial SIAM conference of Applied Algebraic Geometry. For the next venue in August 2021, we observe well-visible evolutions on subjects like convex algebraic geometry, polynomial optimization, and real algebraic geometry, algebra, and geometry of tensors, algebraic geometry of data analysis and machine learning, homological methods for topological data analysis, and algebra for differential equations and dynamical systems.

Among notable results from the past two years, let us mention the work of Manivel, Michałek, Monin, Seynnaeve, and Vodička, which expresses the ML degree of linear Gaussian models in terms of Schubert calculus, thereby solving an open problem posed by Sturmfels and Uhler. Another notable highlight is the work of Lairez, Sertoz, and others on the exact computation of volumes of semialgebraic sets, using D-modules and moment methods. Among all the high impact results published on SIAGA, we mention the proof of the conjectured formula for the ED degree of the multiview variety in computer vision by Maxim, Rodriguez, and Wang *SIAM J. Appl. Algebra Geometry* 4-1 (2020), pp. 28-48. With their proof, they lay to rest the problem that started the entire Euclidean Distance degree story.

A significant milestone for the field in the last two years is also the book “Invitation to Nonlinear Algebra” by Mateusz Michałek and Bernd Sturmfels, which was published at the beginning of 2021. The book gives a broad overview of the topics covered in applied algebra and geometry and provides an excellent introduction to the field.



2. *How is the activity group doing? Is it remaining vibrant? Is the size of the SIAG stable or increasing? How is the SIAG keeping up with the changes in the field? How are the broader interests of SIAM reflected in the activities of the SIAG?*

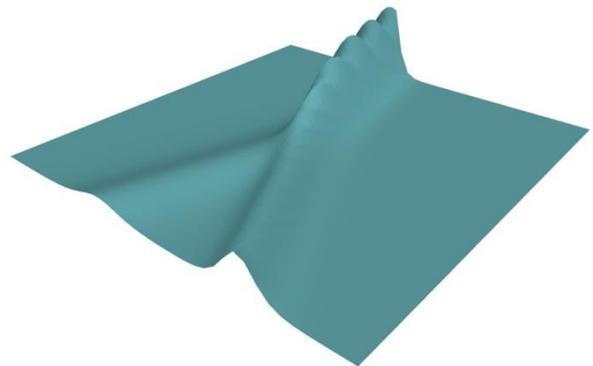
The COVID-19 pandemic has greatly limited the group activity during 2020 and 2021. As for many other groups and communities, even our activity group has witnessed an explosion of online activities; after the first months of uncertainty and confusion. We are impressed by the energy and sense of community that the group has shown during this difficult period. We start by mentioning the newly launched SAGA, the SIAM web Seminar in Applied Geometry and Algebra <http://wiki.siam.org/siagag/index.php/Webinar>. The seminar has attracted as many as 100 listeners from the community at most of its talks. A list of all upcoming and past seminars and conferences within the community is collected at the Wiki page [http://wiki.siam.org/siag-ag/index.php/Virtual\\_seminars](http://wiki.siam.org/siag-ag/index.php/Virtual_seminars).

The activity group is very vibrant. Among its activities we mention (more details can be found later in the text):

- The SAGA (web) Seminar;
- A high number of minisymposia sessions at the SIAM Conference on Algebraic Geometry;
- The SIAM Journal on Applied Algebra and Geometry associated with the activity group;
- Regular submissions to the monthly newsletter.

Although there has been a slight decrease in the total membership in the last three years with the total membership of 409 in 2020, the activity group has experienced a steady increase in its non-student membership from 94 in 2010 to 217 in 2020. The decrease in the total membership is caused by the decrease of student members. The trend is inexplicable considering the fact that student membership is free and that the expectation is that the research group of every new member should contain a number of graduate students. We will start an advertising campaign on all our social channels, including ENGAGE.

The broader interests of SIAM are reflected in the variety of backgrounds of the activity group members (employer, gender and geography) and the diversity in the applications covered by the SIAM Activity Group on Algebraic Geometry. The recent preprint “Nonlinear Algebra and Applications” <https://arxiv.org/abs/2103.16300> features among the authors Paul Breeding, receiver of the 2021 Early Career Prize, and is a good illustration of the wide spectrum of areas and applications represented by the group. From its abstract: “[...] we showcase applications of nonlinear algebra in the sciences and engineering. Our survey is organized into eight themes: polynomial optimization, partial differential equations, algebraic statistics, integrable systems, configuration spaces of frameworks, biochemical reaction networks, algebraic vision, and tensor decompositions. Conversely, developments on these topics inspire new questions and algorithms for algebraic geometry.”



- Please list conferences/workshops the activity group has sponsored or co-sponsored over the past three years, and give a brief (one sentence or phrase) indication of the success or problems with each.*

SI(AG)<sup>2</sup> sponsors the biennial SIAM Conference on Algebraic Geometry:

**SIAM Conference on Applied Algebraic Geometry (AG19)**, University of Bern, Bern, Switzerland, July 9-13, 2019. This conference had 756 participants, 163 minisymposia sessions, 4 sessions for contributed presentations, and poster sessions. The conference was a satellite conference to the International Congress of Industrial and Applied Mathematics (ICIAM) that took place a week later in Valencia, Spain. The conference AG19 was highly successful with the number of participants increasing from 443 to 756 and the number of minisymposia sessions increasing from 106 to 163 compared to AG17.

**SIAM Conference on Applied Algebraic Geometry (AG21)**, Texas A&M University, College Station, TX, USA, August 16-20, 2021. The conference will take place fully virtually and will have 109 minisymposia sessions consisting of 545 talks, two contributed sessions consisting of 11 talks, and a poster session. The registration for the conference will start in May 2021.

Additionally, members of the SI(AG)<sup>2</sup> activity group have actively organized conferences, workshops and summer schools. A full list of current and past events in the field can be found at [http://wiki.siam.org/siag-ag/index.php/Current\\_events](http://wiki.siam.org/siag-ag/index.php/Current_events).

4. *Please indicate the number of minisymposia directly organized by the activity group at the last two SIAM annual meetings. When did the SIAG last organize a track at an annual meeting or meet jointly with the SIAM Annual Meeting?*

There have been no minisymposia directly organized by the activity group at the last two SIAM annual meetings. In 2018, SI(AG)<sup>2</sup> organized a track of 10 minisymposia at the 2018 SIAM Annual Meeting (AN18).

5. *Please indicate other activities sponsored by the activity group, to include newsletters, prizes and web sites. Have each of these been active and successful?*

The SI(AG)<sup>2</sup> activity group sponsors the following activities:

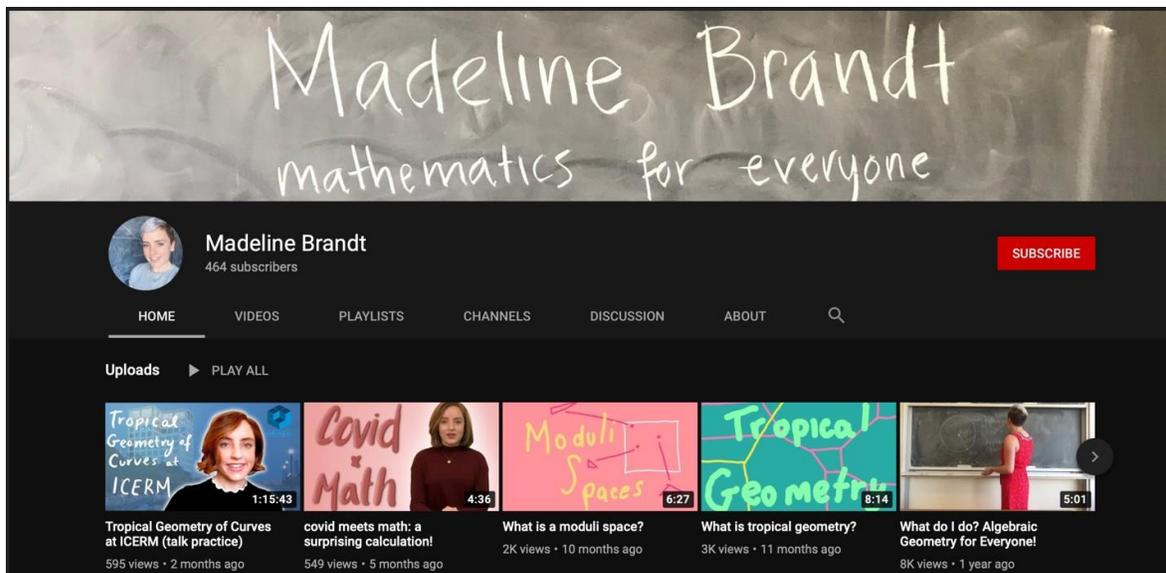
- The SI(AG)<sup>2</sup> Early Career Prize, which is awarded to an outstanding early career researcher in the field of algebraic geometry and its applications, for distinguished contributions to the field in the three calendar years prior to the year of the award. The prize was established in 2016 and is awarded every two years. Input from the prize committee indicates high quality and good gender balance in the nominations.
- SAGA - Seminar on Applied Geometry and Algebra. The online seminar series started in November 2020 and since then there has been a talk every second Tuesday of every month. The list of upcoming and past talks can be found at <http://wiki.siam.org/siag-ag/index.php/Webinar>. The seminar has attracted as many as 100 listeners from the community at most of its talks.
- Newsletter, delivered every month via SIAM Engage.
- Wiki page [http://wiki.siam.org/siag-ag/index.php/Main\\_Page](http://wiki.siam.org/siag-ag/index.php/Main_Page) with a full overview of upcoming conferences, virtual seminars and job deadlines in the field.
- A Facebook group with nearly 900 members that posts conferences, jobs, news articles, prizes and other relevant items related to applied algebraic geometry:  
[https://www.facebook.com/groups/181166842299433/?multi\\_permaLinks=1262196214196485&notif\\_id=1620903678257857&notif\\_t=group\\_activity&ref=notif](https://www.facebook.com/groups/181166842299433/?multi_permaLinks=1262196214196485&notif_id=1620903678257857&notif_t=group_activity&ref=notif)

The SIAM Journal on Applied Algebra and Geometry (SIAGA) is the SIAM journal best associated with the SI(AG)<sup>2</sup>. The SIAGA journal has gained outstanding reputation in the community and is able to attract most of the significant advances in the field. The second three-year term of Editor-in-Chief

Bernd Sturmfels ends in December 2021, and SIAM will appoint a successor shortly. In his end-of-term report, Sturmfels writes: “The journal is doing very well. We have a small but relatively steady stream of submissions, and the quality of those submissions is generally really high. The word has gotten out that SIAGA has very high standards, and there is noticeable self-selection. My vision is to consolidate that good start and to branch out into more communities while maintaining the focus on algebra and geometry, and while staying closely connected to the core of the SIAM community.”

Members of the applied algebraic geometry community constantly engage in a range of outreach activities. Here are some examples:

- Eliana Duarte and Thomas Kahle taught a graduate course on tensors and produced a podcast with five interviews available at <https://tensorvoices.de> and <https://podcasts.apple.com/us/podcast/tensor-voices/id1560947792>.
- Madeline Brandt and Maddie Weinstein have contributed to a series of YouTube videos popularizing concepts in algebraic geometry and demystifying math research. Brandt has a YouTube channel with a combined view count of over 15k on various mathematical topics, and Weinstein has partnered with STEM outreach organizations to make videos aimed at middle school girls. <https://www.youtube.com/channel/UCSLI88C1v7xJHrgp-1dd68g>
- *Picture this maths* is a maths blog that describes mathematical concepts via pictures, run by Anna Seigal at the University of Oxford and Rachael Boyd at the Max-Planck-Institut für Mathematik. Many of the posts are inspired by research directions in applied algebraic geometry. For example, a recent series has been about the algebraic and geometric structure behind correlation. The blog has had 40,000 visitors from more than 160 countries. <https://picturethismaths.wordpress.com/author/annaseigal/>



Madeline Brandt  
mathematics for everyone

Madeline Brandt  
464 subscribers

SUBSCRIBE

HOME VIDEOS PLAYLISTS CHANNELS DISCUSSION ABOUT

Uploads ▶ PLAY ALL

Tropical Geometry of Curves at ICERM (talk practice)  
1:15:43  
595 views · 2 months ago

covid meets math: a surprising calculation!  
4:36  
549 views · 5 months ago

What is a moduli space?  
6:27  
2K views · 10 months ago

What is tropical geometry?  
8:14  
3K views · 11 months ago

What do I do? Algebraic Geometry for Everyone!  
5:01  
8K views · 1 year ago

6. *What activities are planned and proposed for the next period of the charter? Please describe scheduled and suggested future activities in detail.*

The following activities are proposed for the next period of the charter:

- SIAM Conference on Applied Algebraic Geometry (AG23). Since AG21 takes place in the US, we expect AG23 to be held outside the US.
- Soliciting nominations for the SI(AG)<sup>2</sup> Early Career Prize, which will be awarded at AG23.
- SAGA - Seminar on Applied Geometry and Algebra, taking place virtually on the 2nd Tuesday of every month.
- A monthly newsletter distributed via SIAM Engage.
- Maintain an up-to-date wiki page with a complete overview of upcoming conferences, virtual seminars, and job deadlines in applied algebra and geometry.
- Organize minisymposia at the 2022 SIAM Annual Meeting.

7. How can SIAM help the activity group achieve its goals?

SIAM has been very supportive of the SI(AG)<sup>2</sup> activity group. Last year SI(AG)<sup>2</sup> member Alicia Dickenstein was elected to be a member of the SIAM's Council during 1/1/2021-31/12/2022. SIAM can help by supporting further increase of the presence of the SI(AG)<sup>2</sup> members in SIAM governance. This will encourage representing the interests of the activity group in SIAM and closer cooperation with other activity groups.

8. How can the activity group help SIAM in its general role of promoting applied mathematics and computational science?

SI(AG)<sup>2</sup> is helping SIAM by increasing visibility via high quality publications in the SIAM Journal on Applied Algebra and Geometry (SIAGA) as well as other SIAM publications such as SIAM Journal on Discrete Mathematics (SIDMA), SIAM Journal on Matrix Analysis and Applications (SIMAX), SIAM Journal on Numerical Analysis (SINUM), SIAM Journal on Mathematics of Data Science (SIMODS), and SIAM Journal on Optimization (SIOPT).

SI(AG)<sup>2</sup> also contributes to the cross-interactions between different communities in applied mathematics and computer science, participating in conferences such as SIAM Conference on Optimization and the SIAM conference on Computational Geometric Design.

The focus of SIAM/AG is on mathematical foundations in applications, with emphasis in Algebra and Geometry. Our aim is to provide a mathematical theory of the fundamental building blocks of relevant societal challenges such as AI, Digitalisation, Data Analysis.

This SIAG requests that the SIAM Council and Board of Trustees renew its charter for a two year operating period beginning January 1, 2022-December 31, 2023.

A handwritten signature in black ink, reading "Sandra Di Rocco". The signature is written in a cursive style with a large initial 'S' and 'D'.

Sandra Di Rocco, Chair of the SIAG on Algebraic Geometry

May 13 2021