

REPORT DOCUMENTATION PAGE			Form Approved OMB NO. 0704-0188		
<p>The public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington VA, 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to any penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number. PLEASE DO NOT RETURN YOUR FORM TO THE ABOVE ADDRESS.</p>					
1. REPORT DATE (DD-MM-YYYY) 12-04-2023		2. REPORT TYPE Final Report		3. DATES COVERED (From - To) 15-Aug-2022 - 14-Feb-2023	
4. TITLE AND SUBTITLE Final Report: 2022 Plasma Processing Science Gordon Research Conference and Gordon Research Seminar			5a. CONTRACT NUMBER W911NF-22-1-0141		
			5b. GRANT NUMBER		
			5c. PROGRAM ELEMENT NUMBER 611102		
6. AUTHORS			5d. PROJECT NUMBER		
			5e. TASK NUMBER		
			5f. WORK UNIT NUMBER		
7. PERFORMING ORGANIZATION NAMES AND ADDRESSES Gordon Research Conferences, Inc. 512 Liberty Lane West Kingston, RI 02892 -1502			8. PERFORMING ORGANIZATION REPORT NUMBER		
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS (ES) U.S. Army Research Office P.O. Box 12211 Research Triangle Park, NC 27709-2211			10. SPONSOR/MONITOR'S ACRONYM(S) ARO		
			11. SPONSOR/MONITOR'S REPORT NUMBER(S) 80601-ES-CF.1		
12. DISTRIBUTION AVAILABILITY STATEMENT Approved for public release; distribution is unlimited.					
13. SUPPLEMENTARY NOTES The views, opinions and/or findings contained in this report are those of the author(s) and should not be construed as an official Department of the Army position, policy or decision, unless so designated by other documentation.					
14. ABSTRACT					
15. SUBJECT TERMS					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT UU	15. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON Lorenzo Mangolini
a. REPORT UU	b. ABSTRACT UU	c. THIS PAGE UU			19b. TELEPHONE NUMBER 951-827-5872

RPPR Final Report

as of 25-Apr-2023

Agency Code: 21XD

Proposal Number: 80601ESCF

Agreement Number: W911NF-22-1-0141

INVESTIGATOR(S):

Name: Ph.D. Lorenzo Mangolini

Email: lmangolini@enr.ucr.edu

Phone Number: 9518275872

Principal: Y

Organization: **Gordon Research Conferences, Inc.**

Address: 512 Liberty Lane, West Kingston, RI 028921502

Country: USA

DUNS Number: 075712877

EIN: 050300482

Report Date: 14-May-2023

Date Received: 12-Apr-2023

Final Report for Period Beginning 15-Aug-2022 and Ending 14-Feb-2023

Title: 2022 Plasma Processing Science Gordon Research Conference and Gordon Research Seminar

Begin Performance Period: 15-Aug-2022

End Performance Period: 14-Feb-2023

Report Term: 0-Other

Submitted By: Ph.D. Nancy Gray

Email: grants@grc.org

Phone: (401) 783-4011

Distribution Statement: 1-Approved for public release; distribution is unlimited.

STEM Degrees:

STEM Participants:

Major Goals: This award will provide financial support for young researchers (graduate students and post-doctoral researchers) so that they can attend the 2022 Gordon Research Conference on Plasma Processing Science, to be held July 24-29, 2022, at the Proctor Academy in Andover NH. This conference series has been exceptionally successful at bringing together, over the years, experts in all areas related to plasma processing science, including theory, experiments and advanced characterization. The 2022 conference will be titled "Plasmas and Their Interaction with Matter" to highlight the common thread among the many scientific issues and potential applications currently investigated by the community. Plasmas are now being placed in contact of inorganic materials, polymers, organic tissues, liquids, aerosols, catalysts beds, creating unique processing environments and representing an area of both need and opportunity for fundamental scientific advances. Areas of particular interest to the Army Research Office include plasma catalysis and plasma-liquid interaction, recognized by the plasma community as exciting growth areas. The Gordon Research Conference will serve as a meeting point in this highly interdisciplinary and cross-disciplinary field, bringing together researchers at all career stages, from leaders in the field to junior investigators and graduate students. This conference encourages the presenters to share and discuss their most recent results, and provides ample time for constructive discussions among the participants. The Gordon Research Seminar will take place immediately before the conference. This day-long meeting, titled "Investigating Multiphase and Multiscale Plasma-Material Interactions", will be fully organized by students and postdocs, and will include a mentoring session designed to provide different career perspectives to the participants.

Statement of objective:

The objective of the GRC-PPS and of the related Gordon Research Seminar is to advance the broad field of plasma processing science by providing both an optimal environment for scientific discussion and unique opportunities for scientific growth to its participants, at all career stages.

Accomplishments: Much of the richness and value of plasma processing science arises from the interactions of the plasma with solid and liquid materials: surfaces undergoing functionalization, etching, or coating; catalysts; biological materials; liquids; electrodes; and so on. The importance of these interactions leads to the highly interdisciplinary nature of plasma processing science, spanning chemistry, physics, materials science, biology and engineering. Moreover, almost all of the many industrial applications of plasmas arise from their interactions with matter.

The program of the 2022 Gordon Research Conference on Plasma Processing highlighted both advances in fundamental understanding of processing plasmas and their interactions with matter, and the importance of these interactions in emerging and existing applications.

RPPR Final Report as of 25-Apr-2023

The conference brought together leaders in the field with junior investigators and graduate students. In addition to the invited presentations, selected contributions from attendees were included in the program. The associated Gordon Research Seminar also provided an exciting venue for junior researchers to present and discuss their research. The special format of the Gordon Conferences, with programmed discussion sessions and ample time for informal gatherings in the afternoons and evenings, provided for a fertile atmosphere of brainstorming and creative thinking among the attendees.

The Gordon Research Seminar on Plasma Processing Science was a unique forum for graduate students, post-docs, and other scientists with comparable levels of experience and education to present and exchange new data and cutting-edge ideas.

The focus of this seminar was on plasma interaction with materials/condensed matter as it is present in most of the plasma-related technological applications such as in medicine, agriculture, surface processing and nanofabrication. The meeting highlighted recent progress in the investigation of the different phases involved in plasma-material interactions addressing the large span of time and size scales. To approach these challenges, both experimental and computational methods were discussed.

Participants were encouraged to present their unpublished, cutting-edge research, discuss scientific results with experienced leaders in the field and build networks with peers during ample time provided for socializing and informal discussions. To support this atmosphere, the whole meeting was strictly off-the-record with no abstracts published online and a no-photo policy during the scientific sessions. The mentorship component in the 2022 GRS addressed the challenges in choosing a promising plasma research topic for their career. A leading plasma physicist as well as early stages researchers participated in a panel discussion.

Training Opportunities: Speakers, discussion leaders, poster presenters and attendees simultaneously contributed to and benefited from the collective skills and experience shared throughout the conference.

Results Dissemination: The final program has been posted on the GRC website.

Honors and Awards: Nothing to Report

Protocol Activity Status:

Technology Transfer: Nothing to Report

PARTICIPANTS:

Participant Type: PD/PI

Participant: Lorenzo Mongolini PhD

Person Months Worked: 1.00

Project Contribution:

National Academy Member: N

Funding Support:

RPPR Final Report
as of 25-Apr-2023

Partners

,

I certify that the information in the report is complete and accurate:

Signature: Bethany Mancuso

Signature Date: 4/12/23 3:54PM



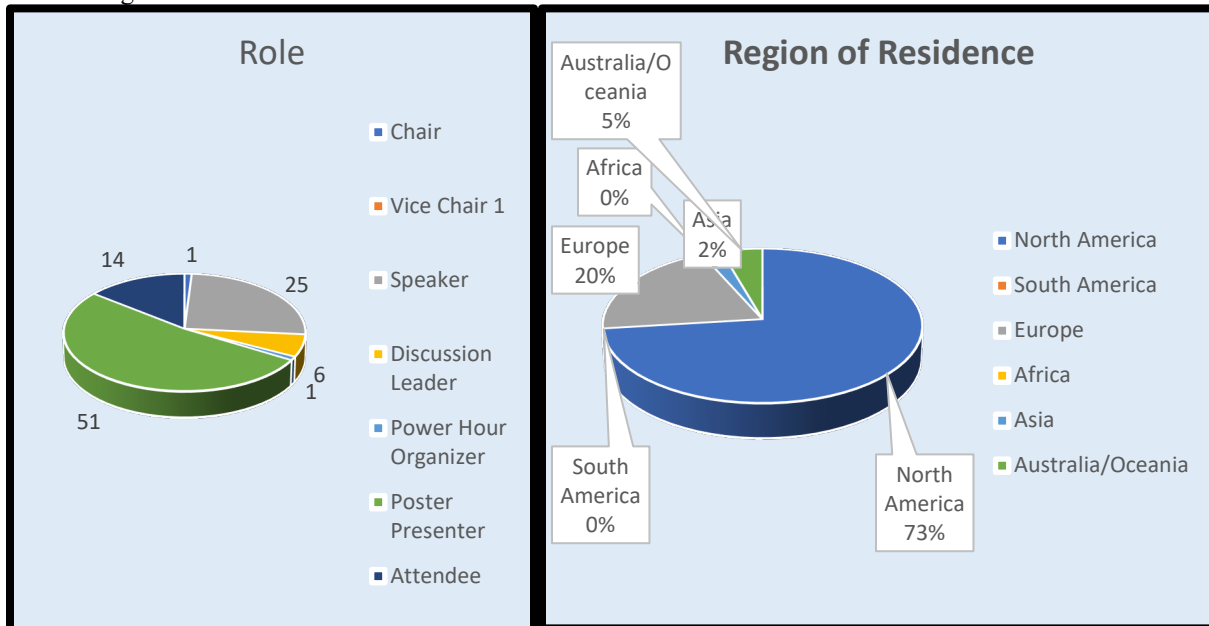
**GORDON RESEARCH CONFERENCES
FINAL PROGRESS REPORT
Army Research Office (ARO)
Grant Number W911NF2210141
2022 Plasma Processing Science GRC/GRS
July 24-29, 2022**

Operational Summary

The Gordon Research Conference (GRC) and Gordon Research Seminar (GRS) on Plasma Processing Science were held at the Proctor Academy in Andover, New Hampshire from Jul 23-24, 2022. The meeting covered a variety of scientific topics and the content presented was highly rated by participants.

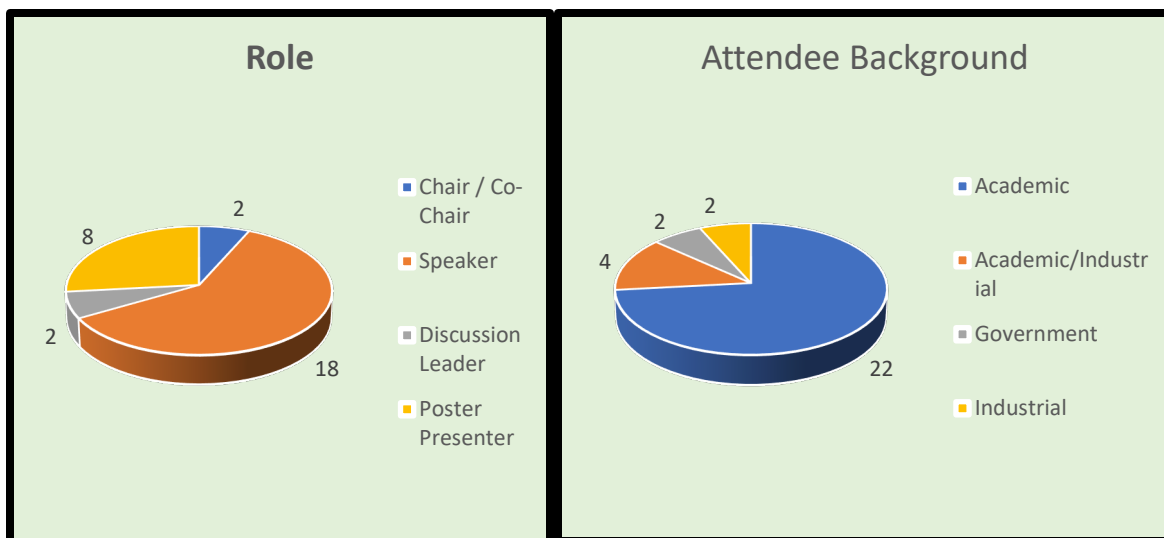
GRC Conference Participants

The Conference was well-attended with 99 participants. Scientists from academia represented 80% of the participants while attendees from government accounted for 5%, attendees from industry totaled 4% and those from academic/industrial accounted for 11%. The meeting also attracted a strong mix of young investigators and senior scientists. Students and post-docs accounted for 44% of all attendees. Approximately 25% of the participants at the 2022 meeting were women.



Seminar Participants

The Seminar was well-attended with 30 participants. Students and post docs combined accounted for 67% of all attendees. The remaining participants served as mentors at the seminar. Out of attendees, 43% were female.



Conference Program

Much of the richness and value of plasma processing science arises from the interactions of the plasma with solid and liquid materials: surfaces undergoing functionalization, etching, or coating; catalysts; biological materials; liquids; electrodes; and so on. The importance of these interactions leads to the highly interdisciplinary nature of plasma processing science, spanning chemistry, physics, materials science, biology and engineering. Moreover, almost all of the many industrial applications of plasmas arise from their interactions with matter.

The program of the 2022 Gordon Research Conference on Plasma Processing highlighted both advances in fundamental understanding of processing plasmas and their interactions with matter, and the importance of these interactions in emerging and existing applications.

The conference brought together leaders in the field with junior investigators and graduate students. In addition to the invited presentations, selected contributions from attendees were included in the program. The associated Gordon Research Seminar also provided an exciting venue for junior researchers to present and discuss their research. The special format of the Gordon Conferences, with programmed discussion sessions and ample time for informal gatherings in the afternoons and evenings, provided for a fertile atmosphere of brainstorming and creative thinking among the attendees.

The Gordon Research Seminar on Plasma Processing Science was a unique forum for graduate students, post-docs, and other scientists with comparable levels of experience and education to present and exchange new data and cutting-edge ideas.

The focus of this seminar was on plasma interaction with materials/condensed matter as it is present in most of the plasma-related technological applications such as in medicine, agriculture, surface processing and nanofabrication. The meeting highlighted recent progress in the investigation of the different phases involved in plasma-material interactions addressing the large span of time and size scales. To approach these challenges, both experimental and computational methods were discussed.

Participants were encouraged to present their unpublished, cutting-edge research, discuss scientific results with experienced leaders in the field and build networks with peers during ample time provided for socializing and informal discussions. To support this atmosphere, the whole meeting was strictly off-the-record with no abstracts published online and a no-photo policy during the scientific sessions. The mentorship component in the 2022 GRS addressed the challenges in choosing a promising plasma research topic for their career. A leading plasma physicist as well as early stages researchers participated in a panel discussion.

Conference Budget

Funding provided by the ARO supported partial registration for 12 graduate students, 1 post-docs, 1 Research Scientist/Engineer, and 2 assistant professors at the GRC. The funds supported 1 Research Scientist/Engineer, 8 students and 2 post-docs at the GRS.

ARO GRC Disbursement List

Abe, Shota <i>Post Doc, Attendee</i>	Princeton Plasma Physics Laboratory (United States)	\$750.00
Boutrouche, Valentin <i>Graduate Student, Attendee</i>	University of Massachusetts Lowell (United States)	\$750.00
Carreon, Maria <i>Assistant Professor, Discussion Leader</i>	University of Massachusetts Lowell (United States)	\$900.00
Herrmann, Antoine <i>Graduate Student, Attendee</i>	Université de Montréal (Canada)	\$50.00
Hizon, Kimberly <i>Research Scientist/Engineer, Attendee</i>	University of California, Riverside/Department of Mechanical Engineering (United States)	\$100.00
Husmann, Eric <i>Graduate Student, Attendee</i>	Washington University in St. Louis (United States)	\$750.00
Kaye, Andrew <i>Graduate Student, Attendee</i>	Colorado School of Mines (United States)	\$750.00
Kim, Minseok <i>Graduate Student, Attendee</i>	UC Riverside (United States)	\$50.00
Konina, Kseniia <i>Graduate Student, Attendee</i>	University of Michigan, The Department of Nuclear Engineering & Radiological Sciences (United States)	\$100.00
Krüger, Florian <i>Graduate Student, Attendee</i>	University of Michigan (United States)	\$750.00
Litch, Evan <i>Graduate Student, Attendee</i>	University of Michigan (United States)	\$750.00
Modérie, Charles <i>Graduate Student, Attendee</i>	Université de Montréal (Canada)	\$750.00
Remigy, Alice <i>Graduate Student, Attendee</i>	Laboratoire des Sciences des Procédés et des Matériaux (LSPM), Université Sorbonne Paris Nord, CNRS (France)	\$900.00
Schwan, Joseph <i>Graduate Student, Attendee</i>	University of California at Riverside (United States)	\$50.00
Simasiku, Ephraim <i>Graduate Student, Attendee</i>	University of Massachusetts Lowell (United States)	\$750.00
Underwood, Thomas <i>Assistant Professor, Attendee</i>	University of Texas at Austin (United States)	\$750.00
Conferees: 16		\$8,900.00

ARO GRS Disbursement List

Filice, Dante <i>Graduate Student, Speaker</i>	McGill University (Canada)	\$100.00
Gorky, FNU <i>Graduate Student, Attendee</i>	South Dakota school of mines and Technology (United States)	\$100.00
He, Jinjie <i>Graduate Student, Speaker</i>	Drexel University (United States)	\$100.00
Held, Julian <i>Post Doc, Speaker</i>	University of Minnesota (United States)	\$100.00
Hizon, Kimberly <i>Research Scientist/Engineer, Speaker</i>	University of California, Riverside/Department of Mechanical Engineering (United States)	\$100.00
Kim, Minseok <i>Graduate Student, Attendee</i>	UC Riverside (United States)	\$100.00

Konina, Kseniia <i>Graduate Student, Attendee</i>	University of Michigan, The Department of Nuclear Engineering & Radiological Sciences (United States)	\$100.00
Meyer, Mackenzie <i>Graduate Student, Attendee</i>	University of Michigan (United States)	\$100.00
Pillai, Naveen <i>Post Doc, Speaker</i>	North Carolina State University (United States)	\$100.00
Polito, Jordyn <i>Graduate Student, Attendee</i>	University of Michigan (United States)	\$100.00
Veng, Visal <i>Graduate Student, Speaker</i>	University of Massachusetts Lowell (United States)	\$100.00
Conferees: 11		\$1,100.00

Conference Feedback

Participants had an opportunity to provide feedback at the end of the Conference. The feedback collected from the meeting was extremely positive. Evaluations included numerous positive remarks regarding the networking opportunities, the high quality talks and diverse information presented as well as the diverse and friendly environment. The GRS meeting also received positive feedback highlighting the ample opportunities for networking, discussion and the welcoming and friendly environment that allowed for open discussion with senior mentors.

GRC would like to thank the ARO for its continued support of the meetings. The contributions received from the ARO have been critical to the success of the conferences and are having a measurable impact in advancing the frontiers of science worldwide.

Dr. Anthony Murphy, GRC Chair
CSIRO, Australia

Dr. Lorenzo Mangolini, GRC Chair
University of California, Riverside, USA

Dr. Judith Golda, GRS Chair
Ruhr-University Bochum, Germany

Dr. Marien Simeni Simeni, GRS Chair
University of Minnesota, United States

Dr. Nancy Ryan Gray
President and Chief Executive Officer
Gordon Research Conferences

**Plasma Processing Science
Gordon Research Conference**

**Plasmas and Their Interactions with Matter
July 24 - 29, 2022**

Chair Anthony B. Murphy

Vice Chair Lorenzo Mangolini

Proctor Academy

204 Main Street

Andover, NH, United States

Conference Description

Much of the richness and value of plasma processing science arises from the interactions of the plasma with solid and liquid materials: surfaces undergoing functionalization, etching, or coating; catalysts; biological materials; liquids; electrodes; and so on. The importance of these interactions leads to the highly interdisciplinary nature of plasma processing science, spanning chemistry, physics, materials science, biology and engineering. Moreover, almost all of the many industrial applications of plasmas arise from their interactions with matter.

The program of the 2022 Gordon Research Conference on Plasma Processing will highlight both advances in fundamental understanding of processing plasmas and their interactions with matter, and the importance of these interactions in emerging and existing applications.

The conference will bring together leaders in the field with junior investigators and graduate students. In addition to the invited presentations, selected contributions from attendees will be included in the program. The associated Gordon Research Seminar also provides an exciting venue for junior researchers to present and discuss their research. The special format of the Gordon Conferences, with programmed discussion sessions and ample time for informal gatherings in the afternoons and evenings, will provide for a fertile atmosphere of brainstorming and creative thinking among the attendees.

Conference Program

Sunday

2:00 pm - 9:00 pm Arrival and Check-in

6:00 pm - 7:00 pm Dinner

7:30 pm - 7:40 pm Introductory Comments by GRC Site Staff / Welcome from the GRC Chair

7:40 pm - 9:30 pm **Complex Chemical Synthesis Using Plasmas**
Discussion Leader: **Lenka Zajickova** (Brno University of Technology, Czech Republic)

7:40 pm - 7:50 pm Opening Remarks

7:50 pm - 8:20 pm **Julia Bandow** (Ruhr University Bochum, Germany)
"Plasma-driven Biocatalysis – Concept, Challenges and Prospects"

8:20 pm - 8:40 pm Discussion

8:40 pm - 9:10 pm **Elijah Thimsen** (Washington University in St. Louis, United States)
"Understanding Complex Chemical Reactions in Nonequilibrium Plasma using Concepts from Thermodynamics"

9:10 pm - 9:30 pm Discussion

Monday

7:30 am - 8:30 am Breakfast

9:00 am - 12:30 pm **The Plasma-Liquid Interface**
Discussion Leader: **Peter Bruggeman** (University of Minnesota, United States)

9:00 am - 9:15 am Introduction by Discussion Leader

9:15 am - 9:45 am **Zdenko Machala** (Comenius University Bratislava, Slovakia)
"Plasma-liquid Interactions: Transport of Reactive Species and Effects of Plasma-activated Water"

9:45 am - 10:05 am Discussion

10:05 am - 10:35 am Coffee Break

10:35 am - 11:05 am **Fumiyoshi Tochikubo** (Tokyo Metropolitan University, Japan)
"Numerical Analysis of Plasma-Liquid Interaction in Glow-like Discharge"

11:05 am - 11:25 am Discussion

11:25 am - 11:55 am **Ester Marotta** (University of Padova, Italy)
"Chemical Tools for Probing Plasma-Liquid Interfaces"

11:55 am - 12:15 pm Discussion

12:15 pm - 12:25 pm **Judith Golda** (Ruhr-University Bochum, Germany)
"State-Enhanced Actinometry in Atmospheric Pressure Discharges"

12:25 pm - 12:30 pm Discussion

12:30 pm - 1:30 pm Lunch

1:30 pm - 4:00 pm Free Time

3:00 pm - 4:00 pm **The GRC Power Hour™**
The GRC Power Hour™ is designed to address diversity and inclusion in the scientific

workplace by providing a safe environment for informal and meaningful conversations amongst colleagues of all career stages. The program supports the professional growth of all members of our communities, including ethnicity, race and/or gender identity by providing an open forum for discussion and mentoring.

Organizers: **Rebecca Anthony** (Michigan State University, United States) and **Judith Golda** (Ruhr-University Bochum, Germany)

4:00 pm - 6:00 pm

Poster Session

6:00 pm - 7:00 pm

Dinner

7:30 pm - 9:30 pm

Measuring the Interplay Between Plasma and Matter

Discussion Leader: **David Staack** (Texas A&M University, United States)

7:30 pm - 7:50 pm

Introduction by Discussion Leader

7:50 pm - 8:20 pm

Sedina Tsikata (CNRS, France)

"Connecting Large and Small Scale Physics in Partially Magnetized Plasmas"

8:20 pm - 8:40 pm

Discussion

8:40 pm - 9:10 pm

David Pai (CNRS Laboratoire de Physique des Plasmas, Ecole Polytechnique, France)

"Dynamic Interfaces in Contact with Atmospheric-Pressure Plasmas: Laser Diagnostics and Interactions"

9:10 pm - 9:30 pm

Discussion

Tuesday

7:30 am - 8:30 am

Breakfast

8:30 am - 9:00 am

Group Photo

9:00 am - 12:30 pm

Plasma Interactions with Biological Materials

Discussion Leader: **Greg Fridman** (AAPlasma LLC, United States)

9:00 am - 9:15 am

Introduction by Discussion Leader

9:15 am - 9:45 am

Marcela Bilek (University of Sydney, Australia)

"Development of Plasma Processes Enabling the Facile Creation of Tailorable Biosignalling Interfaces for Biomedical Applications"

9:45 am - 10:05 am

Discussion

10:05 am - 10:35 am

Coffee Break

10:35 am - 11:05 am

David Staack (Texas A&M University, United States)

"Pulsed and AC Plasma Jets and their Interaction with Biological Tissues"

11:05 am - 11:25 am

Discussion

11:25 am - 11:55 am

Emilia Jacofsky (Kulaga) (Plasmology4 Inc., United States)

"Clinical Trials of Plasma Jets for Wound Treatment"

11:55 am - 12:15 pm

Discussion

12:15 pm - 12:25 pm	Marién Simeni Simeni (University of Minnesota, United States) "Tin Droplets Laser-Produced Plasmas for Microchips Manufacturing through EUV Lithography"
12:25 pm - 12:30 pm	Discussion
12:30 pm - 1:30 pm	Lunch
1:30 pm - 4:00 pm	Free Time
4:00 pm - 6:00 pm	Poster Session
6:00 pm - 7:00 pm	Dinner
7:30 pm - 9:30 pm	Plasmas for the Environment Discussion Leader: Sylvain Coulombe (McGill University, Canada)
7:30 pm - 7:50 pm	Introduction by Discussion Leader
7:50 pm - 8:20 pm	Mariadriana Creatore (Eindhoven University of Technology, The Netherlands) "Plasma for Next-Generation Energy Devices"
8:20 pm - 8:40 pm	Discussion
8:40 pm - 9:10 pm	Volker Hessel (University of Adelaide, Australia) "Sustainability of Plasma Fixation of Nitrogen"
9:10 pm - 9:30 pm	Discussion
Wednesday	
7:30 am - 8:30 am	Breakfast
9:00 am - 12:30 pm	Plasmas and Catalysts Discussion Leader: Maria Carreon (University of Massachusetts Lowell, United States)
9:00 am - 9:15 am	Introduction by Discussion Leader
9:15 am - 9:45 am	William Schneider (University of Notre Dame, United States) "Models and Opportunities in Plasma-Catalytic Chemical Transformations"
9:45 am - 10:05 am	Discussion
10:05 am - 10:35 am	Coffee Break
10:35 am - 11:05 am	Sankaran Sundaresan (Princeton University, United States) "Plasma-assisted Catalysis of Ammonia Synthesis: Effectiveness and Energy Consumption"
11:05 am - 11:25 am	Discussion
11:25 am - 11:55 am	Alexander Fridman (Drexel University, United States) "Plasma-as-Catalyst vs Plasma-and-Catalyst in Chemistry, Medicine, and Food Processing"

11:55 am - 12:15 pm Discussion

12:15 pm - 12:25 pm **Julian Held** (University of Minnesota, United States)
"Wave-synchronized Langmuir Probe Measurements in Magnetron Sputtering Discharges"

12:25 pm - 12:30 pm Discussion

12:30 pm - 1:30 pm Lunch

1:30 pm - 4:00 pm Free Time

4:00 pm - 6:00 pm **Poster Session**

6:00 pm - 7:00 pm Dinner

7:00 pm - 7:30 pm **Business Meeting**
Nominations for the Next Vice Chair(s); Complete the GRC Evaluation Forms; Discuss Future Dates and Venue; Election of the Next Vice Chair(s)

7:30 pm - 9:30 pm **Plasma Surface Modification and Deposition**
Discussion Leader: **Michael Gordon** (UC Santa Barbara, United States)

7:30 pm - 7:50 pm Introduction by Discussion Leader

7:50 pm - 8:20 pm **Sumit Agarwal** (Colorado School of Mines, United States)
"Surface Modification as a Route to Material Selective Plasma-Assisted Atomic Layer Processing"

8:20 pm - 8:40 pm Discussion

8:40 pm - 9:10 pm **Lenka Zajickova** (Brno University of Technology, Czech Republic)
"Multifunctional Amine Plasma Polymers as Bioactive Surfaces"

9:10 pm - 9:30 pm Discussion

Thursday

7:30 am - 8:30 am Breakfast

9:00 am - 12:30 pm **Plasma Synthesis of Novel Materials**
Discussion Leader: **Elijah Thimsen** (Washington University in St. Louis, United States)

9:00 am - 9:15 am Introduction by Discussion Leader

9:15 am - 9:45 am **Scott Walton** (U.S. Naval Research Laboratory, United States)
"The Role of Plasma in Plasma-Enhanced Atomic Layer Deposition"

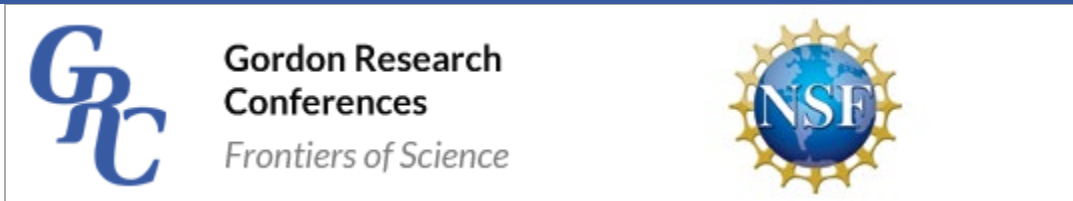
9:45 am - 10:05 am Discussion

10:05 am - 10:35 am Coffee Break

10:35 am - 11:05 am **Boris Feigelson** (US Naval Research Laboratory, United States)
"From Nanoparticles to Novel Metastable Solids"

11:05 am - 11:25 am	Discussion
11:25 am - 11:55 am	Rebecca Anthony (Michigan State University, United States) "Flow-Through Low-Temperature Plasma Synthesis of Nanomaterials"
11:55 am - 12:15 pm	Discussion
12:15 pm - 12:25 pm	Rahel Buschhaus (Ruhr-University Bochum, Germany) "Ion-Induced Secondary Electron Emission of Nickel and Copper and Their Oxides"
12:25 pm - 12:30 pm	Discussion
12:30 pm - 1:30 pm	Lunch
1:30 pm - 4:00 pm	Free Time
4:00 pm - 6:00 pm	Poster Session
6:00 pm - 7:00 pm	Dinner
7:30 pm - 9:30 pm	Linking Plasma Processing and Fusion Plasmas Discussion Leader: Juan Trelles (University of Massachusetts Lowell, United States)
7:30 pm - 7:50 pm	Introduction by Discussion Leader
7:50 pm - 8:20 pm	David Ruzic (University of Illinois at Urbana-Champaign, United States) "Lithium – The Way to Make Fusion Affordable – Latest Results"
8:20 pm - 8:40 pm	Discussion
8:40 pm - 9:10 pm	Michael Campanell (Lawrence Livermore National Laboratory, United States) "Electron-Emitting Surface Phenomena in Low-Temperature Plasma Devices and Tokamaks"
9:10 pm - 9:30 pm	Discussion
Friday	
7:30 am - 8:30 am	Breakfast
9:00 am	Departure

Contributors



[Lam Research Corporation](http://www.lam-research.com)



This material is based upon work supported by the U.S. Department of Energy, Office of Science, Fusion Energy Science, under Award Number DE- SC 0023094. This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

Plasma Processing Science (GRS)
Gordon Research Seminar

Investigating Multiphase and Multiscale Plasma-Material Interactions
July 23 - 24, 2022

Chairs Judith Golda and Marien Simeni Simeni

Proctor Academy

204 Main Street

Andover, NH, United States

Conference Description

The Gordon Research Seminar on Plasma Processing Science is a unique forum for graduate students, post-docs, and other scientists with comparable levels of experience and education to present and exchange new data and cutting edge ideas.

The focus of this meeting is on plasma interaction with materials/condensed matter as it is present in most of the plasma-related technological applications such as in medicine, agriculture, surface processing and nanofabrication. The meeting will highlight recent progress in the investigation of the different phases involved in plasma-material interactions addressing the large span of time and size scales. To approach these challenges, both experimental and computational methods will be discussed.

Participants are encouraged to present their unpublished, cutting-edge research, discuss scientific results with experienced leaders in the field and build networks with peers during ample time provided for socializing and informal discussions. To support this atmosphere, the whole meeting is strictly off-the-record with no abstracts published online and a no-photo policy during the scientific sessions. The mentorship component in the 2022 GRS will address the challenges in choosing a promising plasma research topic for their career. A leading plasma physicist as well as early stages researchers will participate in a panel discussion.

Conference Program

Saturday

1:00 pm - 5:00 pm	Arrival and Check-in
3:30 pm - 3:45 pm	Introductory Comments by GRC Site Staff / Welcome from the GRS Chair
3:45 pm - 4:30 pm	Plasma Biomedical Applications Discussion Leader: Kristof Bal (University of Antwerp, Belgium)

3:45 pm - 3:50 pm	Introduction by Discussion Leader
3:50 pm - 4:05 pm	Saeed Keshani Langroodi (AAPlasma LLC, United States) "Air Disinfection in Public Transportation Vehicles and Facilities by UV and Plasma Technology"
4:05 pm - 4:10 pm	Discussion
4:10 pm - 4:25 pm	Jinjie He (Drexel University, United States) "Application of Non-thermal Plasma on Produce Safety"
4:25 pm - 4:30 pm	Discussion
4:30 pm - 6:00 pm	Poster Session
6:00 pm - 7:00 pm	Dinner
7:30 pm - 9:30 pm	Plasma Diagnostics and Modeling Discussion Leader: Zakari Eckert (Sandia National Laboratories, United States)
7:30 pm - 7:45 pm	Jente Wubs (Leibniz Institute for Plasma Science and Technology (INP), Germany) "Terahertz Spectroscopy for Measurements of Atomic Oxygen Densities"
7:45 pm - 7:50 pm	Discussion
7:50 pm - 8:05 pm	Naveen Pillai (North Carolina State University, United States) "Interdisciplinary Multiphysics: Using Interface-Resolved Direct Numerical Simulation to Inform Plasma Streamer Modeling"
8:05 pm - 8:10 pm	Discussion
8:10 pm - 8:25 pm	Rahel Buschhaus (Ruhr-University Bochum, Germany) "Ion-Induced Secondary Electron Emission of Nickel and Copper and Their Oxides"
8:25 pm - 8:30 pm	Discussion
8:30 pm - 8:45 pm	Julian Held (University of Minnesota, United States) "Wave-synchronized Langmuir Probe Measurements in Magnetron Sputtering Discharges"
8:45 pm - 8:50 pm	Discussion
8:50 pm - 9:05 pm	Nirbhav Chopra (Princeton University, United States) "Characterization of Low-Pressure E-Beam Generated ExB Plasmas in Nitrogen and Air"
9:05 pm - 9:10 pm	Discussion
9:10 pm - 9:25 pm	Yuanfu Yue (University of Minnesota, United States) "Quantification of Plasma Produced OH and Electron Flux at the Liquid Anode and their Roles in Liquid Phase Redox Chemistry"
9:25 pm - 9:30 pm	Discussion

Sunday

7:30 am - 8:30 am	Breakfast
9:00 am - 11:00 am	Plasma Material Synthesis, Plasma Catalysis and Energy Conversion Discussion Leader: Judith Golda (Ruhr-University Bochum, Germany)
9:00 am - 9:15 am	Alice Remigy (Laboratoire des Sciences des Procédés et des Matériaux (LSPM), Université Sorbonne Paris Nord, CNRS, France) "Optimization of Hexagonal Boron Nitride Deposition by Micro Hollow Cathode Discharge"
9:15 am - 9:20 am	Discussion
9:20 am - 9:35 am	Kimberly Hizon (University of California, Riverside/Department of Mechanical Engineering, United States) "Analysis of Graphitic Carbon Coated Silicon Mesoparticles for Lithium-Ion Battery Applications"
9:35 am - 9:40 am	Discussion
9:40 am - 9:55 am	Lynn Hein (McGill University, Canada) "Nitrogen Grafting on Multi-Walled Carbon Nanotubes by Continuous and Pulsed Low-Pressure Ammonia RF Plasma"
9:55 am - 10:00 am	Discussion
10:00 am - 10:15 am	Dante Filice (McGill University, Canada) "Preliminary Characterization of Combined High-Voltage Pulse and Radiofrequency Excitation for Atmospheric Pressure Non-Thermal Plasma Generation"
10:15 am - 10:20 am	Discussion
10:20 am - 10:35 am	Shota Abe (Princeton Plasma Physics Laboratory, United States) "Model Analysis and Experimental Investigation of the Penning Excitation by Noble Gas Metastable for Plasma-Assisted Catalysis of Ammonia"
10:35 am - 10:40 am	Discussion
10:40 am - 10:55 am	Visal Veng (University of Massachusetts Lowell, United States) "Nitrate Synthesis with a Digitally-Manufactured Air Plasma-on-Water Reactor"
10:55 am - 11:00 am	Discussion
11:00 am - 12:30 pm	Poster Session <i>Coffee will be served in the poster area from 11:00 am - 11:30 am</i>
12:30 pm - 1:30 pm	Lunch
1:30 pm - 2:30 pm	Mentorship Component: The Future for Early Career Scientists in Low Temperature Plasma Physics: Personal and Scientific Challenges in the Field Discussion Leader: Marien Simeni Simeni (University of Minnesota, United States)
1:30 pm - 2:20 pm	Panel Discussion <i>Career Panel</i> <ul style="list-style-type: none"> • Rebecca Anthony (Michigan State University, United States)

- **Matthew Hopkins** (Sandia National Laboratories, United States)
- **Saravanapriyan Sriraman** (Lam Research Corporation, United States)
- **Mingmei Wang** (TEL Technology Center, America, LLC, United States)

2:20 pm - 2:30 pm General Discussion

2:30 pm - 3:00 pm **Evaluation Period**
Complete the GRS Evaluation Forms; Election of Future Chair(s)

3:00 pm Seminar Concludes

Contributors



GRC Attendee List

The list of attendees appears below, sorted by the role recorded in their registration record.

Name	Affiliation	Participation	Gender
Murphy, Anthony B	Commonwealth Scientific and Industrial Research Organisation (CSIRO)	Chair	Male
Mangolini, Lorenzo	University of California, Riverside	Vice Chair	Male
Agarwal, Sumit	Colorado School of Mines	Speaker	Male
Anthony, Rebecca	Michigan State University	Speaker	Female
Bandow, Julia E	Ruhr University Bochum	Speaker	Female
Bilek, Marcela	University of Sydney	Speaker	Female
Buschhaus, Rahel	Ruhr-University Bochum	Speaker	Female
Campanell, Michael	Lawrence Livermore National Laboratory	Speaker	Male
Creatore, Mariadriana	Eindhoven University of Technology	Speaker	Female
Feigelson, Boris N	US Naval Research Laboratory	Speaker	Male
Fridman, Alexander	Drexel University	Speaker	Male
Held, Julian	University of Minnesota	Speaker	Male
Hessel, Volker	University of Adelaide	Speaker	Male
Jacofsky (Kulaga), Emilia	Plasmology4 Inc.	Speaker	Female
Machala, Zdenko	Comenius University Bratislava	Speaker	Male
Marotta, Ester	University of Padova	Speaker	Female
Pai, David	CNRS Laboratoire de Physique des Plasmas, Ecole Polytechnique	Speaker	Male
Ruzic, David N	University of Illinois at Urbana-Champaign	Speaker	Male
Schneider, William F	University of Notre Dame	Speaker	Male
Simeni Simeni, Marien	University of Minnesota	Speaker	Male
Staack, David A	Texas A&M University	Speaker	Male
Sundaresan, Sankaran	Princeton University	Speaker	Male
Thimsen, Elijah	Washington University in St. Louis	Speaker	Male
Tochikubo, Fumiyoshi	Tokyo Metropolitan University	Speaker	Male
Tsikata, Sedina	CNRS	Speaker	Female
Walton, Scott	U.S. Naval Research Laboratory	Speaker	Male
Zajickova, Lenka	Brno University of Technology	Speaker	Female
Bruggeman, Peter	University of Minnesota	Discussion Leader	Male
Carreon, Maria	University of Massachusetts Lowell	Discussion Leader	Female
Coulombe, Sylvain	McGill University	Discussion Leader	Male
Fridman, Greg	AAPlasma LLC	Discussion Leader	Male
Gordon, Michael J	UC Santa Barbara	Discussion Leader	Male
Trelles, Juan Pablo	University of Massachusetts Lowell	Discussion Leader	Male
Golda, Judith	Ruhr-University Bochum	Power Hour Organizer	Female
Abe, Shota	Princeton Plasma Physics Laboratory	Poster Presenter	Male
Akhter, Mirza	Texas A&M University	Poster Presenter	Male

Name	Affiliation	Participation	Gender
Bal, Kristof	University of Antwerp	Poster Presenter	Male
Belamkar, Aishwarya	University of California, Riverside	Poster Presenter	Female
BERROSPE-RODRIGUEZ, CARLA	UNIVERSITY OF CALIFORNIA RIVERSIDE	Poster Presenter	Female
Boutrouche, Valentin	University of Massachusetts Lowell	Poster Presenter	Male
CACOT, Laura	University of montreal	Poster Presenter	Female
Camata, Renato	University of Alabama at Birmingham	Poster Presenter	Male
Cendejas, Austin J	Washington University in St. Louis	Poster Presenter	Male
Chopra, Nirbhav Singh	Princeton University	Poster Presenter	Male
Dirks, Tim	Ruhr University Bochum	Poster Presenter	Male
Dubowsky, Scott	University of Illinois at Urbana-Champaign	Poster Presenter	Male
Eckert, Zakari	Sandia National Laboratories	Poster Presenter	Male
Filice, Dante	McGill University	Poster Presenter	Male
Fortugno, Paolo	University of Duisburg-Essen	Poster Presenter	Male
Gorky, FNU	South Dakota school of mines and Technology	Poster Presenter	Male
Hamdan, Ahmad	Université de Montréal	Poster Presenter	Male
Hein, Lynn	McGill University	Poster Presenter	Female
Herrmann, Antoine	Université de Montréal	Poster Presenter	Male
Hizon, Kimberly	University of California, Riverside/Department of Mechanical Engineering	Poster Presenter	Female
Husmann, Eric	Washington University in St. Louis	Poster Presenter	Male
Kaye, Andrew	Colorado School of Mines	Poster Presenter	Male
Keshani Langroodi, Saeed	AAPlasma LLC	Poster Presenter	Male
Kim, Minseok	UC Riverside	Poster Presenter	Male
Konina, Kseniia	University of Michigan, The Department of Nuclear Engineering & Radiological Sciences	Poster Presenter	Female
Kortshagen, Uwe R	University of Minnesota	Poster Presenter	Male
Kreuznacht, Simon	Ruhr University Bochum	Poster Presenter	Male
Krüger, Florian	University of Michigan	Poster Presenter	Male
Litch, Evan	University of Michigan	Poster Presenter	Male
Meyer, Mackenzie	University of Michigan	Poster Presenter	Female
Modérie, Charles	Université de Montréal	Poster Presenter	Male
Mukherjee, Dibyendu	University of Tennessee, Knoxville	Poster Presenter	Male
Nguyen, Hoang Minh	University of Massachusetts Lowell	Poster Presenter	Male
Pillai, Naveen	North Carolina State University	Poster Presenter	Male
Poirier, Deanna	University of Notre Dame	Poster Presenter	Female
Polášková, Katerina	Brno University of Technology	Poster Presenter	Female
Polito, Jordyn	University of Michigan	Poster Presenter	Female
Remigy, Alice	Laboratoire des Sciences des Procédés et des Matériaux (LSPM), Université Sorbonne Paris Nord, CNRS	Poster Presenter	Female
Robert, Raphaël	Université de Montréal / Université de Perpignan	Poster Presenter	Male
Rudnicki, Chris	University of California - Riverside	Poster Presenter	Male

Name	Affiliation	Participation	Gender
Schwan, Joseph	University of California at Riverside	Poster Presenter	Male
Shannon, Steven	North Carolina State University	Poster Presenter	Male
Stafford, Luc	Université de Montréal	Poster Presenter	Male
Tabu, Benard	University of Massachusetts Lowell	Poster Presenter	Male
Underwood, Thomas C	University of Texas at Austin	Poster Presenter	Male
van Helden, Jean-Pierre H	Leibniz Institute for Plasma Science and Technology (INP)	Poster Presenter	Male
VENG, VISAL	University of Massachusetts Lowell	Poster Presenter	Male
Wagner, Brandon	UC Riverside	Poster Presenter	Male
Wang, Xue	Colorado School of Mines	Poster Presenter	Male
Wubs, Jente R	Leibniz Institute for Plasma Science and Technology (INP)	Poster Presenter	Female
Yue, Yuanfu	University of Minnesota	Poster Presenter	Male
Biloiu, Costel	Applied Materials	Attendee	Male
Costantino, Zachary	Saint-Gobain	Attendee	Male
Garretson, Joshua S	Pacific Biosciences	Attendee	Male
Girshick, Steven L	University of Minnesota	Attendee	Male
He, Jinjie	Drexel University	Attendee	Female
Jacofsky, Marc	Plasmology4	Attendee	Male
Larson, Amanda	MKS Instruments	Attendee	Female
Lee, Hae June	Pusan National University	Attendee	Male
Osorio Tejada, Jose Luis	University of Warwick	Attendee	Male
Papson, Cameron	Michigan State University	Attendee	Male
Rosenzweig, Guy	MKS Instruments	Attendee	Male
Simasiku, Ephraim	University of Massachusetts Lowell	Attendee	Male
Tsoutas, Kosta	Sydney University	Attendee	Male
Wang, Ruigang	The University of Alabama	Attendee	Male

GRS Attendee List

The list of attendees appears below, sorted by the role recorded in their registration record.

Name	Affiliation	Participation	Gender
Golda, Judith	Ruhr-University Bochum	Chair	Female
Simeni Simeni, Marien	University of Minnesota	Chair	Male
Abe, Shota	Princeton Plasma Physics Laboratory	Speaker	Male
Anthony, Rebecca	Michigan State University	Speaker	Female
Buschhaus, Rahel	Ruhr-University Bochum	Speaker	Female
Chopra, Nirbhav Singh	Princeton University	Speaker	Male
Filice, Dante	McGill University	Speaker	Male
He, Jinjie	Drexel University	Speaker	Female
Hein, Lynn	McGill University	Speaker	Female
Held, Julian	University of Minnesota	Speaker	Male

Name	Affiliation	Participation	Gender
Hizon, Kimberly	University of California, Riverside/Department of Mechanical Engineering	Speaker	Female
Hopkins, Matthew	Sandia National Laboratories	Speaker	Male
Keshani Langroodi, Saeed	AAPlasma LLC	Speaker	Male
Pillai, Naveen	North Carolina State University	Speaker	Male
Remigy, Alice	Laboratoire des Sciences des Procédés et des Matériaux (LSPM), Université Sorbonne Paris Nord, CNRS	Speaker	Female
Sriraman, Saravanapriyan	Lam Research Corporation	Speaker	Male
VENG, VISAL	University of Massachusetts Lowell	Speaker	Male
Wang, Mingmei	TEL Technology Center, America, LLC	Speaker	Female
Wubs, Jente R	Leibniz Institute for Plasma Science and Technology (INP)	Speaker	Female
Yue, Yuanfu	University of Minnesota	Speaker	Male
Bal, Kristof	University of Antwerp	Discussion Leader	Male
Eckert, Zakari	Sandia National Laboratories	Discussion Leader	Male
Gorky, FNU	South Dakota school of mines and Technology	Poster Presenter	Male
Kim, Minseok	UC Riverside	Poster Presenter	Male
Konina, Kseniia	University of Michigan, The Department of Nuclear Engineering & Radiological Sciences	Poster Presenter	Female
Kreuznacht, Simon	Ruhr University Bochum	Poster Presenter	Male
Meyer, Mackenzie	University of Michigan	Poster Presenter	Female
Polito, Jordyn	University of Michigan	Poster Presenter	Female
Schwan, Joseph	University of California at Riverside	Poster Presenter	Male
Winter, Lea R	Yale University	Poster Presenter	Female