

PhD-granting PREMs

- City College of New York (Chicago) **
- Florida A&M (Carnegie Mellon)
- Howard University (Cornell)
- Jackson State University (UCSB)
- Norfolk State University (Purdue/Cornell/Michigan) ****
- Tuskegee University (Cornell)
- University of New Mexico (Harvard)
- University of Puerto Rico, Mayaguez (University of Wisconsin) **
- University of Texas, El Paso (UCSB)
- University of Texas, San Antonio (Northwestern) **



Interactions and Research Collaborations: UTSA PREM and NU MRSEC

Dr. Miguel Yacaman, Gilberto Casillas-Garcia, Ph.D. Student (UTSA) and Dr. Lawrence Marks (NU)

- UTSA-PREM collaboration with Dr. Vinayak Dravid from NU-MRSEC has resulted in a paper entitled “Morphology Control of Nanostructures: Na-doped PbTe-PbS System”. This paper is currently under review for publication in **Science**.
- A second joint paper is currently being prepared with Dr. Lawrence D. Marks (NU) on “Sliding and Transfer Layers in Graphite at the Atomic Scale”. The results look very promising and they are planning to send the paper to **Science** for publication.

Dr. Dhiraj Sardar, Dr. Ajith Kumar (Postdoc) (UTSA) and Dr. Vinayak Dravid (NU)

Our joint collaboration between UTSA and NU generated three manuscripts:

- Rare earth doped Bifunctional Upconversion Nanophosphors with Optical and Magnetic Properties (To be submitted to Advanced Materials)
- Feasibility Studies of $Gd_2O_2S: YbEr$ Multifunctional Upconversion Phosphor for Multimodal Bioimaging Applications (To be submitted to Small)
- Synthesis and Characterization of $MF_3:Nd$ ($M = Y, Gd$) downconversion nanophosphors for multimodal Biomedical Imaging applications (To be submitted)



Interactions and Research Collaborations between UTSA PREM and NU MRSEC

Dr. Xochitl Lopez-Lozano, Hector Barron (Ph.D. Student) (UTSA) and Dr. Monica Olvera de la Cruz (NU)

UTSA-NU collaboration has produced the following manuscript:

- Methyl-thiol adsorption on Ag and Au clusters (To be published)

This work is a joint collaboration between Dr. Monica Olvera de la Cruz and UTSA group. Hector Barron spent one month at NU in May of 2011 and Dr. Lopez-Lozano visited NU to discuss this project with their NU collaborator.

Dr. Marcelo Marucho, Zaven Ovanesyan (Ph.D. Student) (UTSA) and Dr. Monica Olvera de la Cruz (NU)

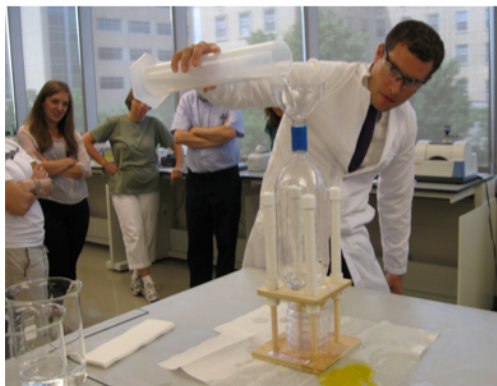
A joint paper is currently being prepared and will be submitted for publication soon.

Zaven Spent the month of June 2012 at NU to work with Dr. Monica Olvera de la Cruz and her group.

Cross-Cultural Connections: An RET Site Program with UPRM and UW

Award No. EEC-0908782

- Intensive, collaborative, six-week teacher professional development program.
- Each teacher works on a research and curriculum development project related to materials science and engineering.
- Develop educational materials, present their materials to the RET group, and implement their materials in their classrooms.
 - Summer 2011: 6 teachers at UPRM & 5 at UW
 - Chasing the trail of a Nanoparticle
 - Effect of Iron Oxide Nanoparticles on Water Treatment
 - Carbon Nanotube Biosensor & Paper Electrophoresis
 - A Generation of New Medicines
 - Biomass Catalysis
 - Liquid Crystals and Smart Glass
 - Summer 2012: 5 teachers at UPRM & 6 at UW
 - ✦ Seeing Graphene
 - ✦ 3-D Cell Cultures
 - ✦ Flexible Materials
 - ✦ Photodegradation of Environmental Pollutants
 - ✦ Metals and Microorganisms



Enhancing and Broadening the Undergraduate Experience

NSEC/MRSEC Research Experiences for Undergraduates (REU) programs

From UPR Cayey 2010

1. Elvin Morales (Song Jin)
2. Jaritza Gomez, currently enrolled at UW-Madison for graduate school (Mark Ediger).

From UPR Mayagüez

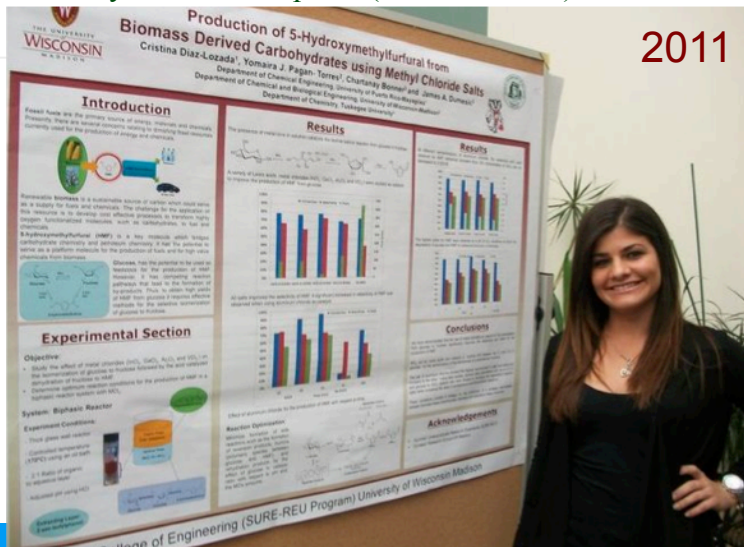
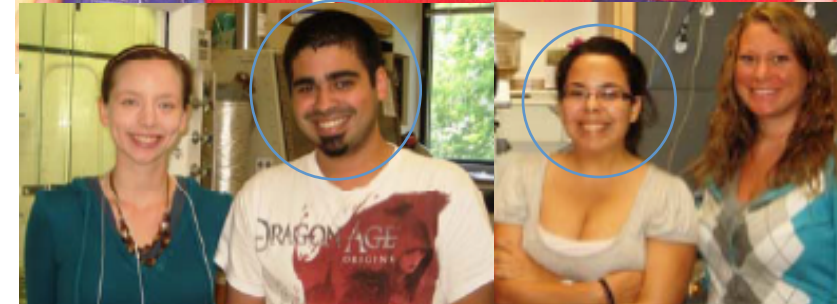
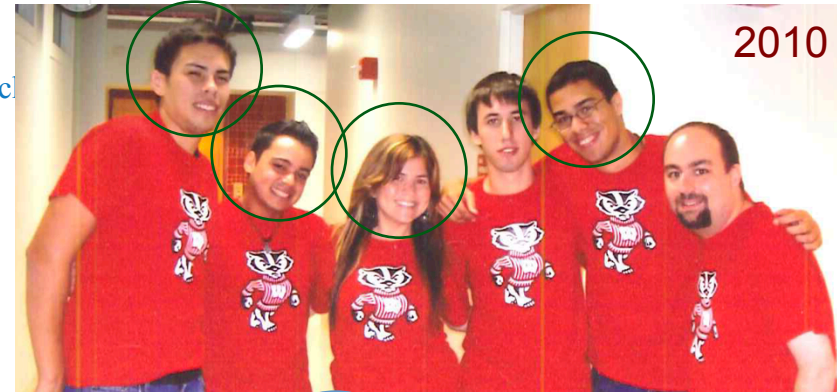
1. Francisco Chaparro (Patricia Ortiz and Sean Palecek)
2. Josseant Flores-Cruz (Jim Dumesic)
3. Juan Nieves-Christie (Patricia Ortiz and Sean Palecek)
4. Emely Medina (Jennifer Reed)

From UPR Cayey 2011

1. Frank Soto (Greta Zenner Petersen)
2. Stephanie Delgado (Sean Palecek)

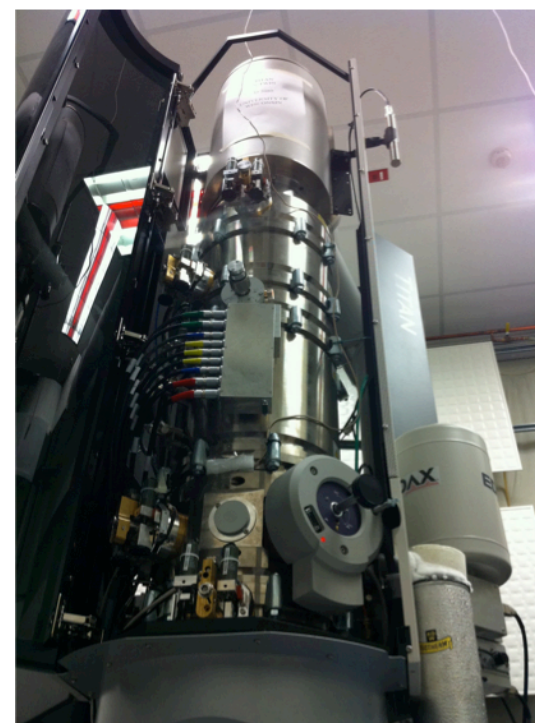
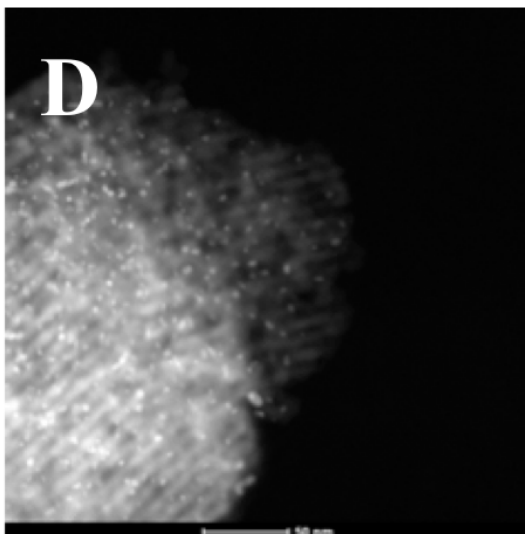
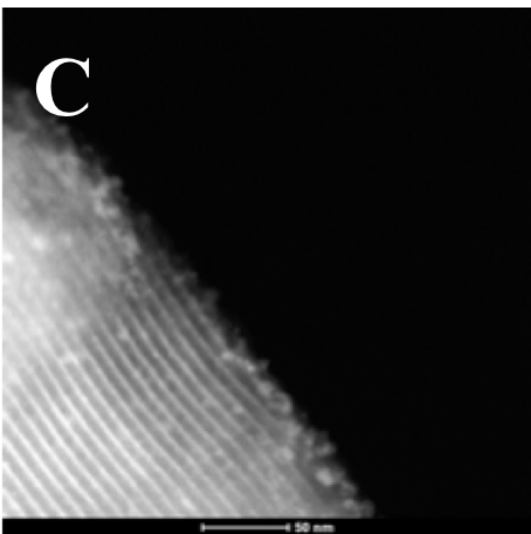
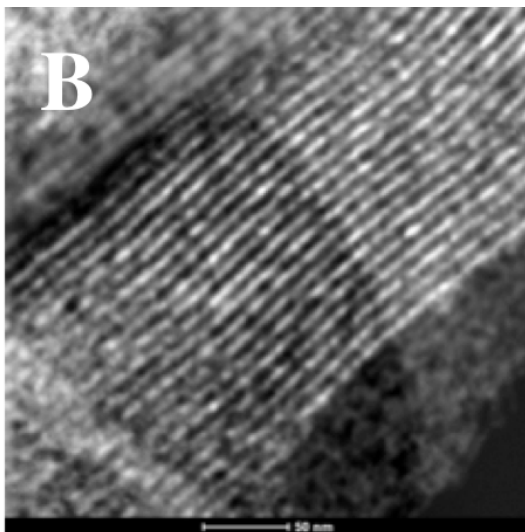
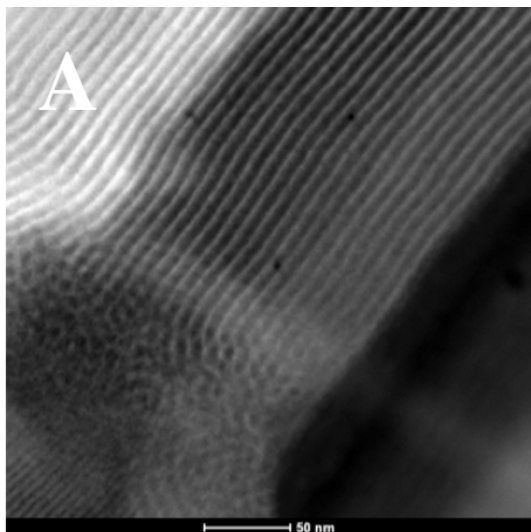
From UPR Mayagüez

1. Cristina Diaz-Lozada (Jim Dumesic)
2. William Arzola-Figueroa (Jim Dumesic)
3. Carlos Martes (Brian Pflieger)
4. Emely Medina-Chaparro (Thatcher Root)



UW STEM used to Study Hydrothermal Stability of Mesoporous Materials

Damian Reyes-Luyanda, Nelson Cardona-Martínez, Fengyuan Shi and Paul Voyles



FEI Titan STEM

A Fresh SBA-15S3

B SBA-15S3 after 24 h

C Fresh Ru/SBA-15S4

D Ru/SBA-15S4 after 24 h

Hydrothermal treatment in water at 210 °C and 35 bar of H₂

D. Reyes-Luyanda, J. Flores-Cruz, P. J. Morales-Pérez, L. G. Encarnación-Gómez, F. Shi, P. M. Voyles and N. Cardona-Martínez, "Bifunctional Materials for the Catalytic Conversion of Cellulose into Soluble Renewable Biorefinery Products," *ACS Catalysis* 2012, 55(3), 148-161.

PREM PI Meeting 9/14/2012

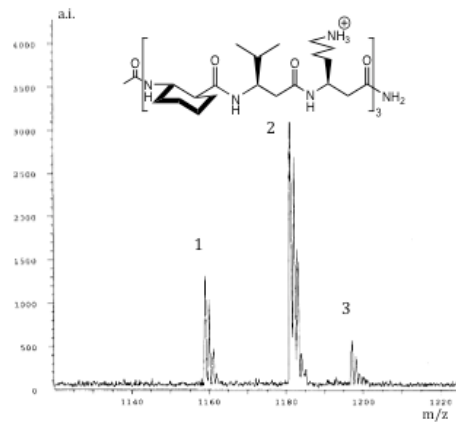
Interaction of IRT1 with UW-Madison Synthesis and characterization of antimicrobial β -peptides

Patricia Ortiz-Bermúdez, Camilo Mora-Navarro, Amy J. Karlsson, Claribel Acevedo, Samuel H. Gellman, and Sean P. Palecek



Synthesis and characterization

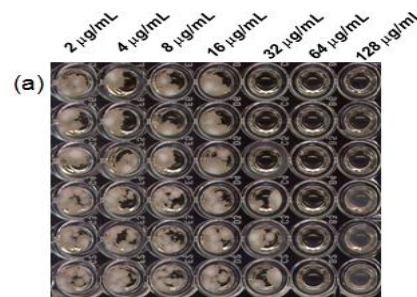
2009



Elucidation of the mechanisms of action of beta-peptides using a genetic approach

2010

(ACHC-V-K)₃ β -peptide



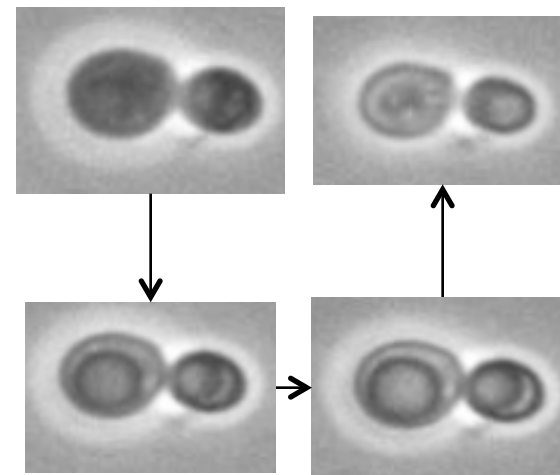
Established a system to visualize real time interaction of cells with labeled beta-peptides: Collaboration with the Chemistry Department at UW

2011

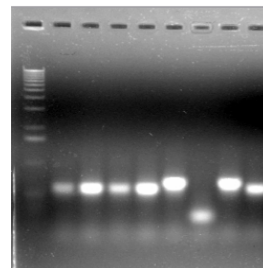
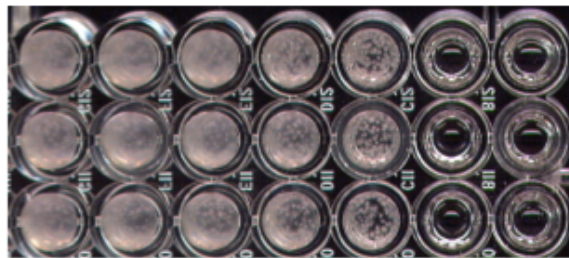


2012

Camilo Mora-Navarro worked in the laboratory of Sean Palecek to master β -peptide synthesis and gene disruption techniques in yeast.



[0] [beta-peptide]



Sam Gellman

Palecek

Weisshaar

PREM: City College-Chicago MRSEC Partnership:
Dynamics of Heterogeneous and Particulate Materials



Jeff Morris, PI (CCNY Chemical Engineering & Levich Institute)

Mark Shattuck, co-PI (CCNY Physics & Levich Institute)

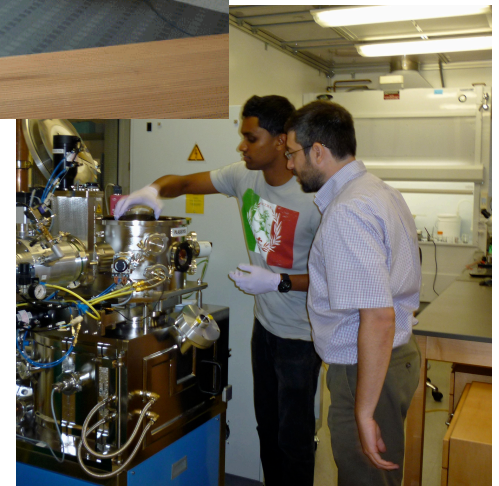
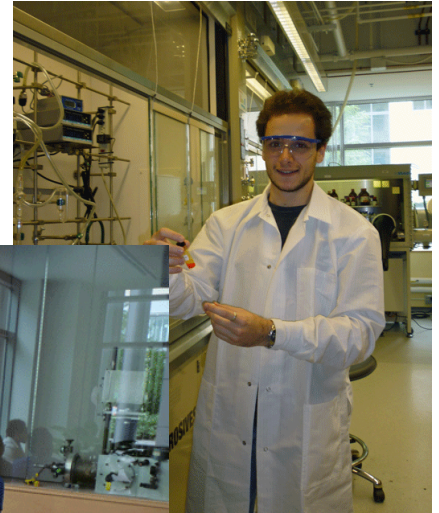
Sid Nagel, co-PI (Chicago Physics, James Franck Institute)



CCNY-Chicago PREM

A student-centered approach to increasing diversity within STEM

- Identifying talent
- Providing opportunities
- Developing talent
- Promoting people to the next level
(HS) → undergraduate → graduate → post-doc
→ professional positions



- City College of New York (CCNY)
 - flagship PhD granting college of City University of New York (CUNY)
 - 20 member campuses in CUNY
 - diverse student body
 - Undergraduates: > 60% African-American or Hispanic
 - Over 90 languages spoken on campus
 - 5-year graduation rate ~ 40% : Major challenges in retention --- ESL is a factor
 - research team in Soft Materials from Engineering, Physics, Chemistry

- University of Chicago (UofC)
 - Historic scientific achievements
 - first controlled nuclear pile
 - Nobel Laureates in Chemistry & Physics
 - MRSEC (past PI Nagel, PI K-Y Lee)
 - “Materials near Singularities” – Jamming, thin films, topological changes

How the Partnership started:

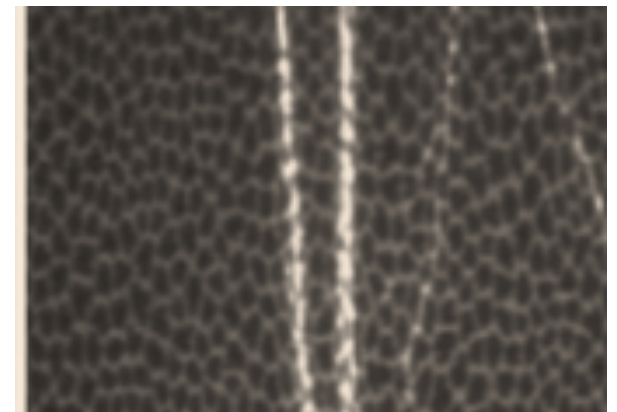
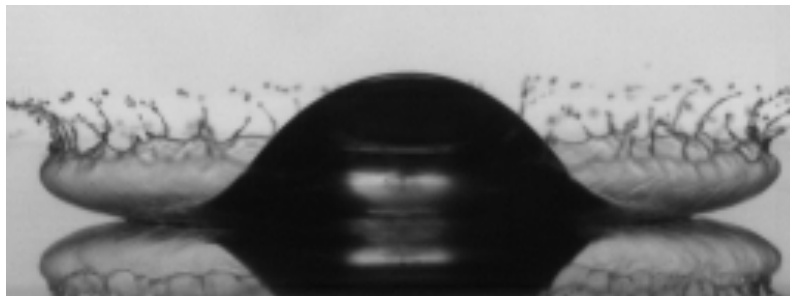
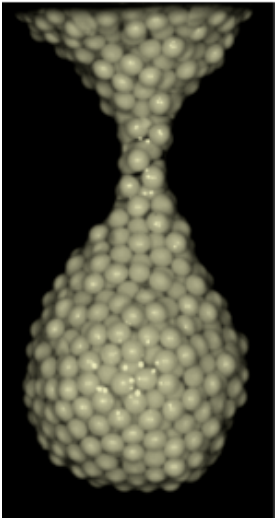
Interaction began in a prior CREST funding period: professional meeting interactions & clear synergistic interests

Granular matter, jamming, fluid dynamics, nanoparticles, particle-laden fluids, thin sheets...

CCNY has strength in simulations – multiphase flow, MD, colloids, DEM

UofC MRSEC has established strengths in experiment and theory

Scientific Opportunity:
Research collaboration is a natural!



Areas of overlap

CCNY

Joel Koplik, Physics

Fluids, Particle-laden flows, Simulation

Ilona Kretzschmar, Chemical Engineering

Micro-particle modification

Taehun Lee, Mechanical Engineering

Fluids, Particle-laden flows, Solid gas transition, Simulation

Jeff Morris, Chemical Engineering

Granular flow & jamming, fluids, Particle-laden flow, Colloids

Mark Shattuck, Physics

Granular flow & jamming, Fluids, Particle-laden flow

Raymond Tu, Chemical Engineering

Sheets & membranes, Biomaterials

Charles Watkins, Mechanical Engineering

Simulation

Chicago MRSEC

Aaron Dinner, Chemistry

Biomaterials, Colloids, Solid gas transition, Simulation

Heinrich Jaeger, Physics

Granular flow & jamming, Fluids, Particle-laden flow, Sheets & membranes

Ka-Yee Lee, Chemistry

Sheets & membranes, biomaterials

Binhua Lin, Materials Science

Sheets & membranes

Sidney Nagel, Physics

Fluids, Granular flow & jamming

Dmitry Talapin, Chemistry

Micro-particle modification

Tom Witten, Physics

Sheets & membranes

Wendy Zhang, Physics

Fluids, Particle-laden flow

Visits



Burton, Dinner*, Fefferman (Dean, Phys. Sci. Div.),
Jaeger, K.-Y. Lee (MRSEC Dir.), Nagel, Miskin,
Keim, Sheu**



Connington, Koplik, Kretzschmar, T. Lee,
Morris, Shattuck, Tu, Farokhirad, Baroudi
9 REU Interns to date



* Gave workshop on computational methods for out-of-equilibrium systems

** Advised on logic model for teacher-professional-development program

NOTE: Joint participation in Soft Matter Gordon Conference: Jaeger, Nagel, Kretzschmar, Morris

Summer Interns (REU)

Get full exposure to all UofC science and research.

Bring research problems, data back to CCNY.

Start collaborations.

Jessica Lenis (Lee – monolayers of Janus particles) - APPLYING TO GRAD SCHOOLS

Alex Ruditsky (Talpin - nanocrystals for optoelectronics) – GRAD SCHOOL Georgia Tech

Stanley George (Schuster – Nb superconducting films)

Kyle Lawlor (Witten – seasonal phase lag) –GRAD SCHOOL CCNY

Arash Nowbahar (Zhang – ice-shelf vibrations) – GRAD SCHOOL, UC Santa Barbara

Xiaohong Zhuang (Jaeger - friction in MR and ER fluids) – GRAD SCHOOL, Maryland

Wenyie Xie (Lin – folding of lipid films) – APPLYING TO GRAD SCHOOLS

Mamdou Bah (Lin – colloidal particle monolayers)

Dane Christie (Langmuir trough studies – lipid layers) – APPLYING TO GRAD SCHOOLS

Chicago MRSEC Role in Achieving PREM Goals

Provide opportunity for research to summer interns.
Collaborate on new projects once interns return to home institution.

Provide experimental data/facilities; theoretical ideas.
Benchmarks for simulations.

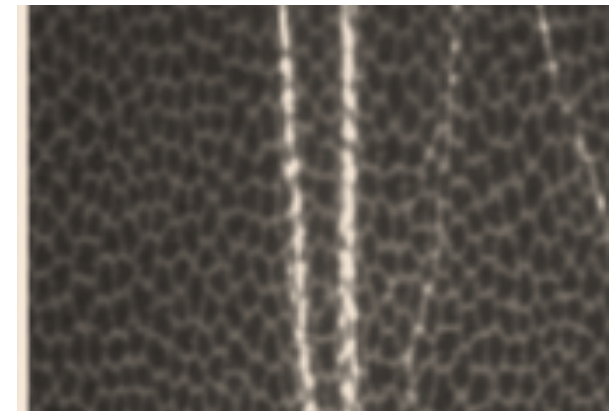
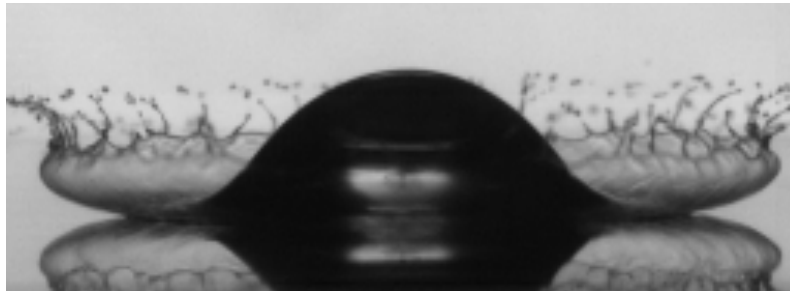
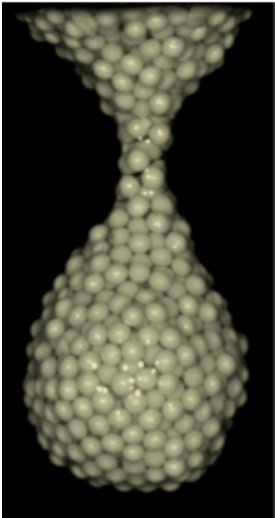
Exchange expertise on simulation methods.

Chose 3 Specific Areas of Collaboration

Particle-laden flows

Air-fluid interactions

Thin sheets at surfaces with particles



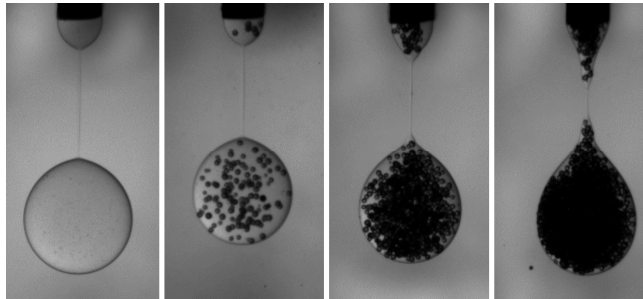
Particle-laden flows – How ideas propagate

Jeff Morris, Mark Shattuck – Heinrich Jaeger, Wendy Zhang

Droplet breakup

UofC: Nagel, Zhang on Newtonian fluids

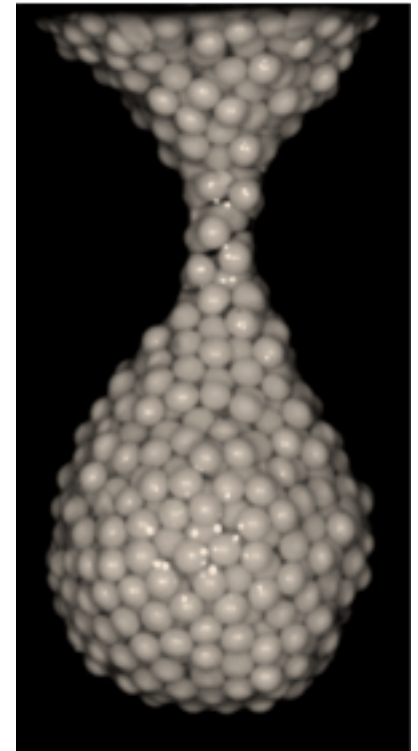
CCNY: Morris on suspensions



■ = 0 0.02 0.10 0.25

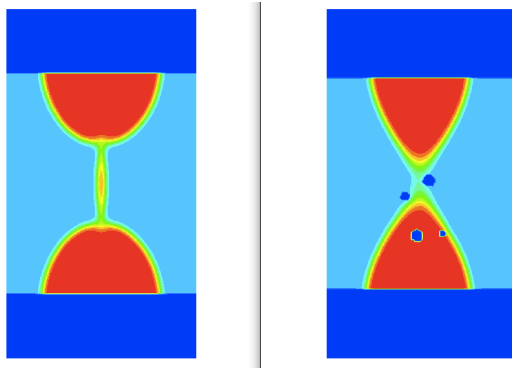
Dense Suspensions

UofC Experiments (Marc Miskin/Jaeger)



Suspension Breakup / Impact

CCNY, Novel Numerical Method
(Kevin Connington, Lee, Morris)



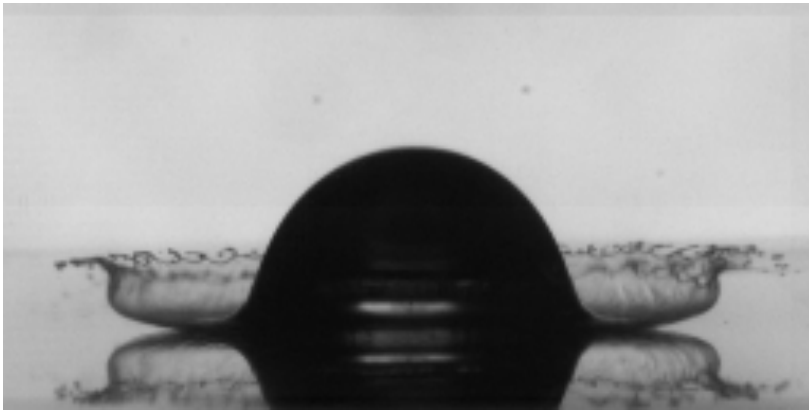
3-phase simulator

Air – Fluid Interactions

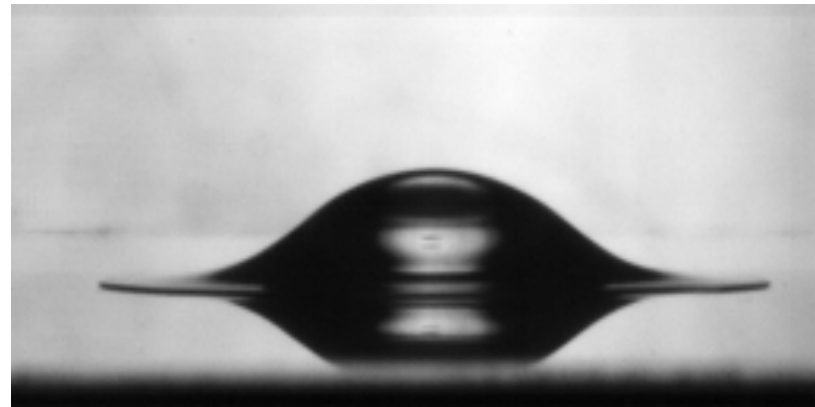
Sid Nagel, Wendy Zhang (Chicago Physics)

Where we started: Drop splashing

“**Droplet Splashing: Fundamentals & Materials Processing**” (organized by Zhang, Nagel, S. Sampath)



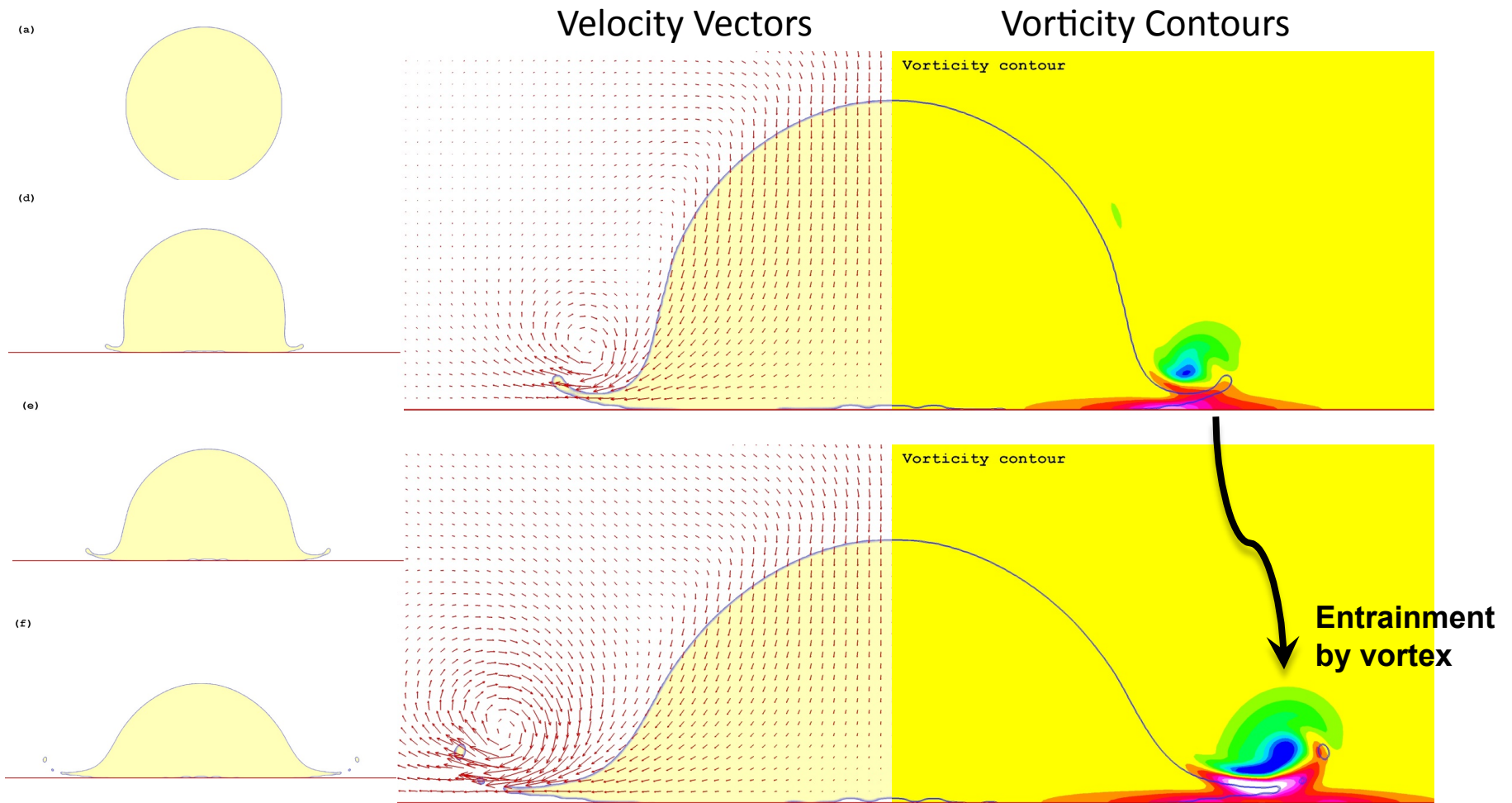
Atmospheric pressure



1/3 Atmospheric pressure

CCNY: Solution from Taehun Lee (using Lattice Boltzmann simulations)

Splash: Entrainment by Vortex in Air



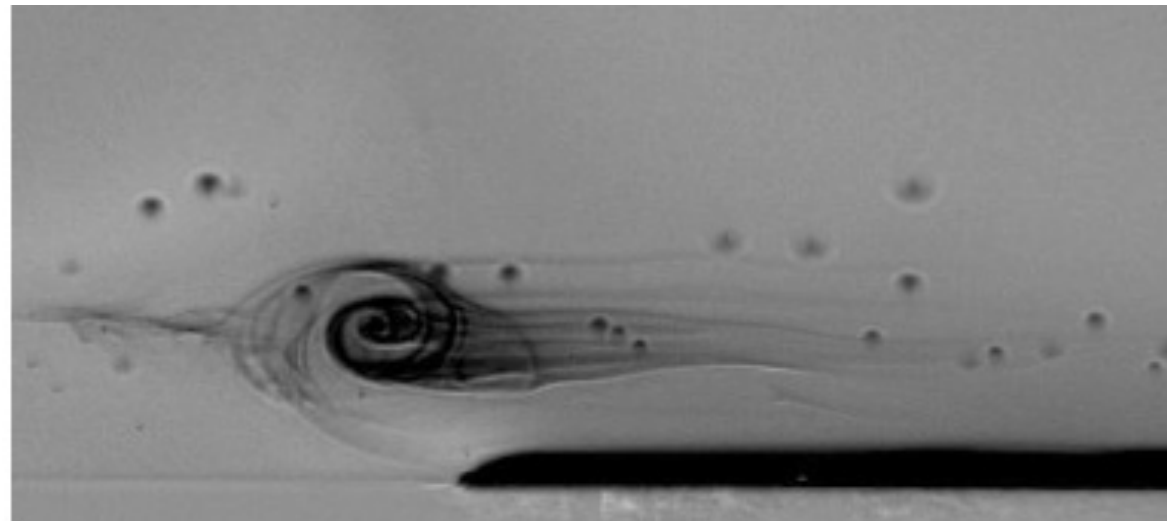
Molecular-scale drop impacts – Joel Koplik

Recent experiments at Chicago



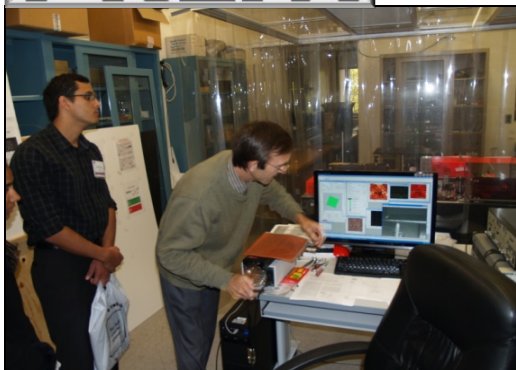
Drop just before impact

Visualized vortex structure in gas (air)





Graduate Recruitment Conference CCNY PREM Materials Research Symposium October 15-17, 2010



- Direct Chicago participation (Sid Nagel)
- Participants included 10 faculty mentors and 30 students, many from other minority serving institutions.

(UPR-Humacao, UPR-Mayaguez, FAMU-FSU, Drexel, Morgan State, USF, Clark Atlanta, Rutgers, Manhattan C, Southern A&M, Tuskegee, UMBC, Hostos CC, Lafayette, and CUNY Queens)

URM: 76% Women: 50%

- Recruited into CCNY and U of C programs:
 - UofC MRSEC REU – applicants from the visitors.
 - CCNY NSF- CENSES REU – 3 students: Omitope Taylor (FAMU), Henry Ayoola (UMBC), Elizabeth Engoren (Lafayette)
 - CCNY Doctoral Program – URM Applicants garnered from Clark Atlanta, USF, Morgan State
- ***2nd Edition October 2012 !!!***

Outcomes of partnership

- REU students
 - Continue research at CCNY; build collaborations; publish!
 - Most are in or seeking graduate study
- Graduates
 - Post-doctoral positions
 - Lorraine Leon, Chicago (PhD with Tu)
 - Ehssan Nazockdast, TBD (PhD with Morris)
 - Faculty
 - Luz Amaya-Bower, South. Connecticut State Univ. (PhD with T. Lee)
 - Parisa Mirbod, Clarkson (Post-doc with Morris, Koplik)
 - Two are seeking positions now
 - Professional employment (financial sector: Kai Gu, PhD Watkins)