

Ignacio M. Maravilla II

Undergraduate Researcher in Mathematics

California State University, Monterey Bay | igmaravilla@csumb.edu | ignaciomaravilla.com | Salinas, California

Research interests: combinatorial knot theory; knot shadows and resolution spaces; symmetry reduction; quantum topology; quantitative plant hydraulics; plant physiology imaging and data training for LLMs.

EDUCATION

Bachelor of Science in Mathematics (Pure Mathematics) — *California State University, Monterey Bay, Seaside, CA* **Expected Jun 2028**
Junior standing; McNair Scholar; undergraduate research in combinatorial knot theory and quantitative plant science.

RESEARCH EXPERIENCE

Combinatorial Knot Theory: Shadow Spaces of Torus Knots — *California State University, Monterey Bay* **2024–Present**
Collaborators: Gabriel Chavez, Arizona State University; Pedro Moranchel Jr.

- Model complete resolutions of $(2,q)$ -torus knot shadows as binary words and study the resulting resolution spaces.
- Proved that exactly $2 \cdot C(q, \lfloor q/2 \rfloor)$ of the 2^q resolutions of a $(2,q)$ -torus knot shadow are unknots.
- Apply the action of $D_q \times C_2$ and Burnside's Lemma to classify shadow spaces through symmetry reduction.
- Develop the results toward publication and communicate the work through national and campus presentations.

Leaf Hydraulics and Plant Fluid Transport — *Albuquerque Plant Physiology Lab, CSU Monterey Bay* **Summer 2026–Present**
Mentor: Dr. Caetano Albuquerque

- Measure leaf hydraulic conductance (Kleaf) in almond, pistachio, and olive using a custom dual-balance apparatus.
- Develop vulnerability curves at water potentials from 0 to 40 bar, including P50 and P80 response thresholds.
- Explore integration of micro-computed tomography imaging and automated three-dimensional analysis to detect xylem collapse and water-filled conduits.

Research Intern, Sonoluminescence — *Hartnell College × Lawrence Livermore National Laboratory* **Jun–Oct 2009**
Mentor: Dr. Sewan Fan

- Built a black-box experimental system to study sonoluminescent bubbles and contributed to high-speed imaging and experimental data collection.

Intern, Unmanned Systems Laboratory — *Naval Postgraduate School, Monterey, CA* **2008**
Mentor: Dr. Anthony Healey

- Supported autonomous underwater vehicle integration, sensor-data collection, and reliability testing.

SELECTED PRESENTATIONS

Accepted research poster — SACNAS National Diversity in STEM Conference, Long Beach, CA	Oct 29–31, 2026
Oral research presentation — Spring Research Showcase, CSU Monterey Bay, Seaside, CA	Apr 17, 2026
Knot theory research presentation, with P. Moranchel Jr. and G. Chavez — OUR FA ² M ² — Online Undergraduate Resource Fair for the Advancement and Alliance of Marginalized Mathematicians, 6th annual, Virtual	Feb 7–8, 2026
“An Introduction to Shadow Spaces and Resolution Enumeration,” with P. Moranchel Jr. and G. M. Chavez — Math For All Virtual 2026 (mathforallnola), Virtual	Apr 10–11, 2026
Combinatorial knot theory research presentation — Joint Mathematics Meetings	Jan 2026
“On the Resolution of Torus Knot Shadows” — UROC Summer Symposium, CSU Monterey Bay	2025
Research poster — SACNAS National Diversity in STEM Conference	2025
“On the Resolution of Torus Knot Shadows” — research poster, with G. Chavez — MAA MathFest, Sacramento, CA	Aug 8, 2025
“On the Resolution of Torus Knot Shadows” — research poster — Mathematical Association of America conference, Sacramento, CA	Summer 2024

HONORS AND FELLOWSHIPS

APS Student Ambassador — American Physical Society Selected to represent APS at the Fall 2026 Far West Section Meeting, Cal Poly San Luis Obispo.	2026–2027
Ronald E. McNair Postbaccalaureate Achievement Program Scholar — CSU Monterey Bay	2025–Present
Undergraduate Research Opportunities Center Scholar — CSU Monterey Bay	
SACNAS SACRED Scholar	
Mathematics, Science & Technology Initiative Scholar — CSU Monterey Bay	
TRIO Scholar	

TEACHING, TUTORING, AND ACADEMIC SUPPORT

GEAR UP Tutor — CSU Monterey Bay at Alisal High School	2024–Present
Tutor students in algebra and trigonometry and support preparation for advanced mathematics coursework.	
Student Assistant, Computer Talent Initiative — CSU Monterey Bay	2024–Present
Support students in linear algebra, differential equations, calculus, and discrete mathematics.	
MESA Tutor — Hartnell College	2008–2011
Tutored linear algebra, differential equations, calculus, and modern physics.	

SERVICE AND OUTREACH

Volunteer — Monterey County Office of Education Math Festival	2024, 2025
Student Ambassador — American Physical Society	2026–2027
Organize campus physics activities and represent APS at sectional events.	

PROFESSIONAL MEMBERSHIPS

Organizations: American Mathematical Society; Mathematical Association of America; Society for Industrial and Applied Mathematics; American Phytopathological Society; American Physical Society; SACNAS (Society for Advancement of Chicanos/Hispanics and Native Americans in Science).

TECHNICAL SKILLS

Programming: Python, MATLAB, R, C++, Java, SQL, Swift, and Fortran.

Scientific computing and fabrication: LaTeX, Git, Linux, Arduino, Raspberry Pi, circuit design, SolidWorks/CAD, and CNC.

Laboratory and imaging: Evaporative Flux Method, pressure chamber methods, digital image analysis, hydraulic vulnerability curves, and micro-CT research workflows.

Languages: English and Spanish (fluent).

Updated October 2026