California State University, Los Angeles applying for membership in LSC

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Greta O'Dea,
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PUSHING BOUNDARIES

LVC meeting 03/10/16 LIGO-G1600383

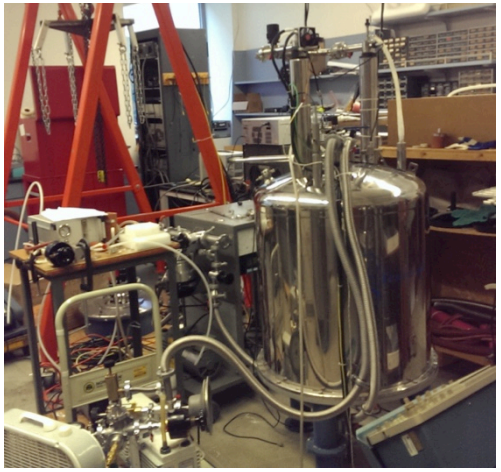
Related docs: LIGO-G1600430/31

About Cal State LA

- Founded in 1947 in the heart of LA
- Minority serving institution dedicated to **engagement, service, and the public good**
- 27,000 students, 87% low income commuters, 82% first generation college students
- Undergraduate and Master's programs
- Cal State LA has a strong desire to boost its contributions to scientific research, including **making significant contributions towards GW astronomy**

About the physics department

- Small department:
- ~60 Physics undergrads, ~36 Master's students
- Provides physics teaching for > 2,000 students/semester from other departments
- Strong in **condensed matter**: Oscar Bernal, Radi Jishi, Jose Rodriguez, Edward Reyazi, Guo-Meng Zhao
- **Astrophysics**: Susan Tereby
- **Cosmology**: Milan Mijic
- **Nuclear Physics**: Konrad Aniol
- **Bio Physics**: Paul Nerenberg



Bernal's lab of super-conductivity

About myself

- Transitioning from University of Sannio to California State University of Los Angeles

- In charge of **coordination of teaching and research labs**

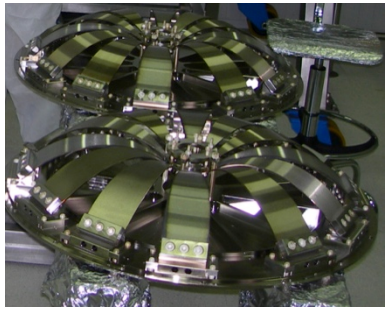
- Will maintain connection with UniSannio to provide:
  - Student exchange opportunities
  - PhD degrees for Cal State LA students

About myself

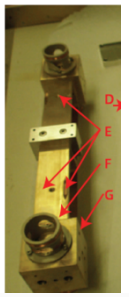
- Working on GW since 1995, early promoter of GW network, member of LSC and LVC since foundation

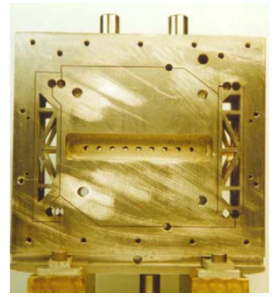
- Mentored, coordinated or supervised more than 100 **students and young scientists**, most of which were my co-authors on publications spanning several key areas of development, **many active in GW**.
- Outreach to high schools with seminars, outreach articles and involving high school students in scientific research and peer reviewed publications

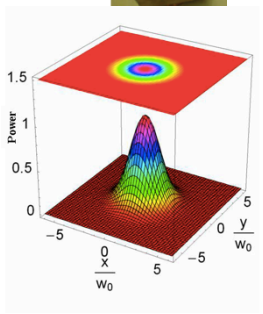
About myself

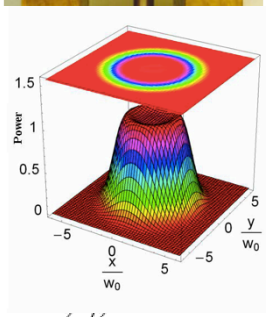


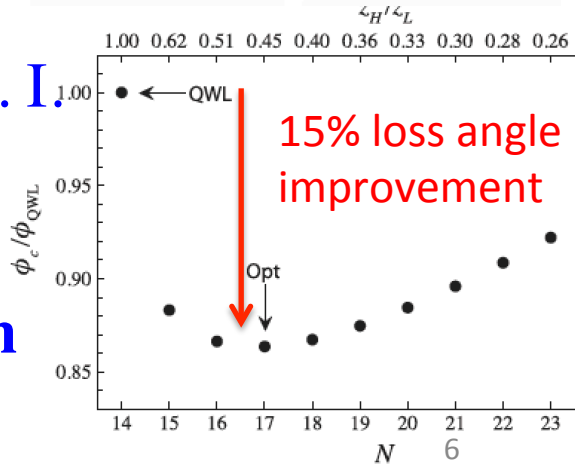
- Introduced **maraging**, now employed in all GW detectors (w. R. Valentini)
- Designed/build large mechanical sections of Virgo, LIGO, TAMA, KAGRA
- Designed and built numerous advanced inertial sensors and mechanical attenuators
- Coordinated/built the **non-Gaussian beam interferometer** for thermal noise suppression
- Invented/developed the **optimized coating**, (w. I. Pinto) presently known as dichroic coating, for **reduction of mirror thermal noise**, which **extends** the Virgo and LIGO GW **detection reach**











About my labs at Cal State LA

- Haptic Physics laboratory
- Advanced Physics laboratory
- Each grad student run an original project
- Undergrads involved for credit
- Possibly even High School Students
- **Aim to generate interest in STEM**
- Students learn mentoring and teaching while doing new physics

Haptic Physics lab

Advanced Physics lab

REVIEW OF SCIENTIFIC INSTRUMENTS 85, 075003 (2014)

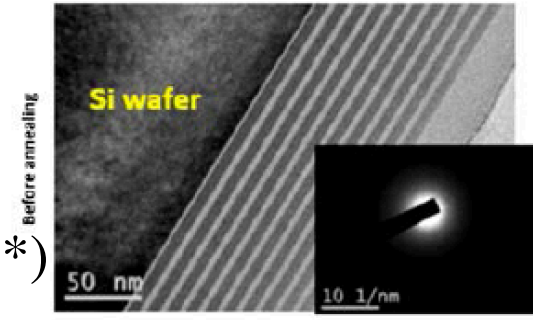
Design and initial characterization of a compact, ultra high vacuum compatible, low frequency, tilt accelerometer

A. O'Toole,[1,a),b)] F. E. Peña Arellano,[2] A. V. Rodionov,[3,c)] M. Shaner,[4,d)] E. Sobacchi,[5] V. Dergachev,[6] R. DeSalvo,[6,a),e)] M. Asadoor,[7,f)] A. Bhawal,[8,g)] P. Gong,[9,h)] C. Kim,[10] A. Lottarini,[11,i)] Y. Minenkov,[12] and C. Murphy[13]

High School Student
Undergrad student
Grad student

Cal State LA proposed contributions

1. Continued studies on scattering points of dielectric mirror coatings and their origin
2. Continue collaboration with UniSannio and Tsing Hua University in nanocoating development (*)
3. Studies of coating Quality factors(*)
4. Study of dissipation in metals(*)



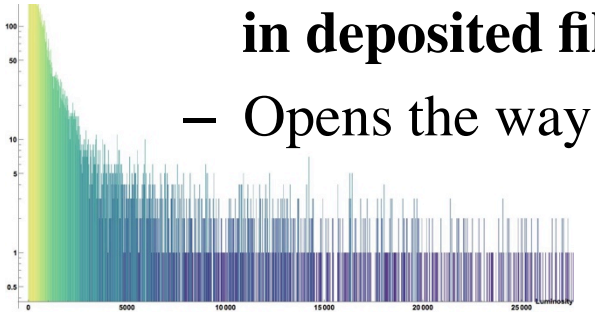
(*) subject to funding

Cal State LA proposed contributions, 1

1. Continued studies on scattering points on dielectric mirrors and their origin
   - Lamar found **$>10^5$ scattering points** of diminishing amplitude within stored beam profile
   - Appearing distributed through the depth of layers
   - Only a **thermodynamic origin** (classical nucleation theory) can explain this large number
   - Interface between crystallite nuclei and glass is strongly frustrated, it **may explain anomalous mechanical dissipation in deposited films**
   - Opens the way to **further thermal noise reduction!**

LIGO-G1600430

LIGO-G1600431



Cal State LA proposed contributions, 1

- Lamar in his thesis project proposes to:
- Continue study on images of beam illuminated mirrors
- map sub-micron scatterers' location

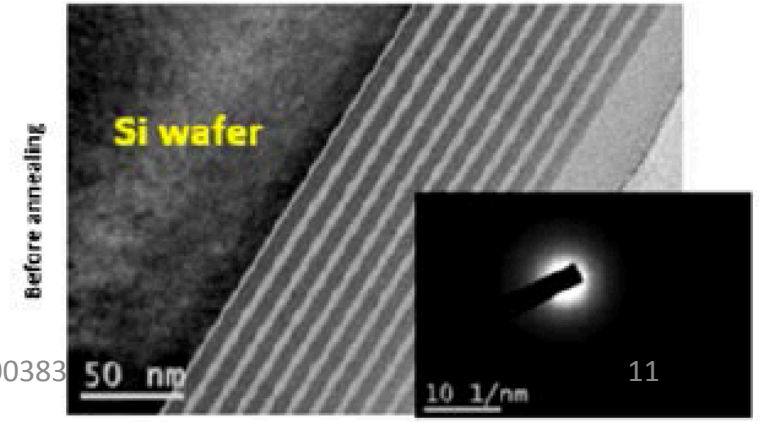
through thickness of coating with confocal microscope illumination and CCD readout on adLIGO mirrors

  - Cal State LA is located next to Caltech
  - Only LIGO lab resources needed

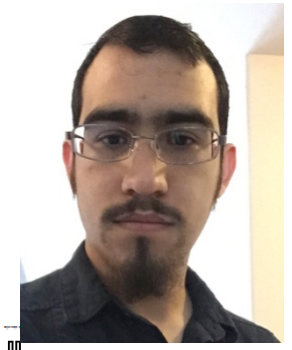
Cal State LA proposed contributions, 2

- Continue collaboration with UniSannio and Tsing Hua University in nanocoating development
- **Nano-layering below nuclei minimal size may suppress nucleation**
- **Thermal noise will be reduced** if crystallite nuclei are the location of mechanical losses
  - Will apply for financial support from NSF to send person(s) to Unisannio to commission/run the new coating facility

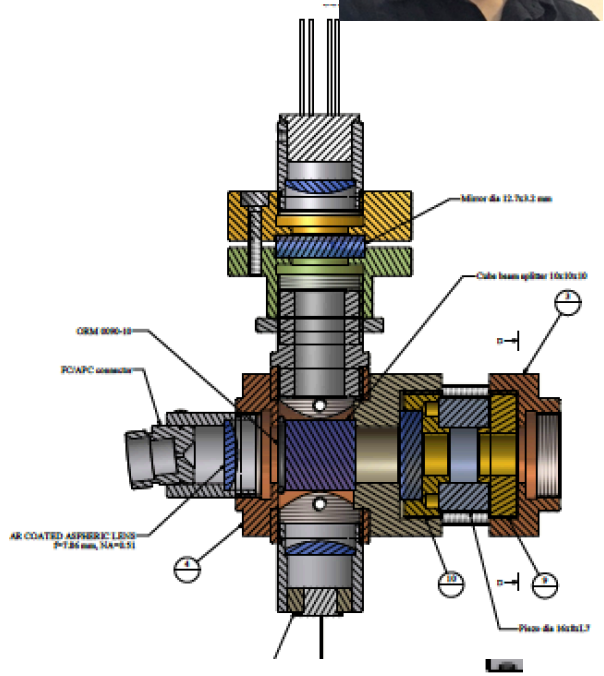
LIGO-G1600431

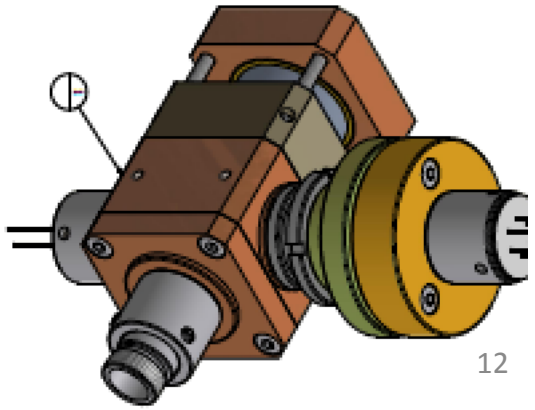


Cal State LA proposed contributions, 3



- Julian:
- Develop techniques for Q-factor measurement on sub-μm thickness SiN substrates
  - Starting using UniSannio resources
  - Will apply for NSF financing for continuation





Cal State LA proposed contributions, 4

- Greta in his thesis project will start to:
  - Study of dissipation in metals repeating with modern means Kimbal, Lovell, "**Internal friction of solids**" Phys. Rev. 1927
  - Looking for **Maraging replacements** in view of lower frequency suspensions/seismic attenuation
- Synergic with big-G measurement studies

  - Starting using internal resources
  - Will apply for NSF financing for continuation

- Thanks for your attention

- The Cal State LA group will strive to give its **strong contribution to the future of Gravitational Wave Astronomy**