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Application for membership to LSC

Riccardo DeSalvo

Visiting Adjunct professor at

Università degli studi del Sannio

GW science activities

- I started working on GW in 1994 in Virgo
- I have been a member of LIGO-lab and LSC from its foundation, and a council member until 2006, in the years of its constitution writing
- I have been an active GW instrumentation scientist practically from the very beginning, without interruptions, to the present, and I expect to continue my activities on GW instrumentation until my retirement (if any)

Present and Future work for LSC

- Develop better mirror coatings for room and cryogenic temperatures
- Parallel work at LCGT (not LSC, but producing many results listed in the White paper)
- Develop techniques and parameters for 3rd generation observatories including 3rd generation seismic attenuation techniques (Homestake, w. Minnesota, ET)

A comment on percentages

- A specific percentage of my time on optics was specified [35%, my activity at UniSannio].
- Difficult to make a clear cut for other activities
- Most R&D activities overflow the confines of individual GW Observatories
- Assisting LCGT, an activity started while I was still in the LIGO-lab (Lazzarini, *G1100218, p.16*), has wider effects besides helping creating a new observatory, it
- produces first-hand know-how for the white book and for when LSC will attack the 3rd generation issues.

Mirror Optics

- Wider beams to suppress thermal noise; Mesa beam profiles, mexican hat mirrors
- Optimized coatings (many cubic parsecs of added visibility volume)
- Radiative thermal compensation

(thought for LIGO now used in a heating variant in Virgo)

- Motivating and stimulating many

scientists on material developments

- Fundamental R&D on coating noise

  (Chao and Innocenzo presentations)
- Cryogenic coating studies

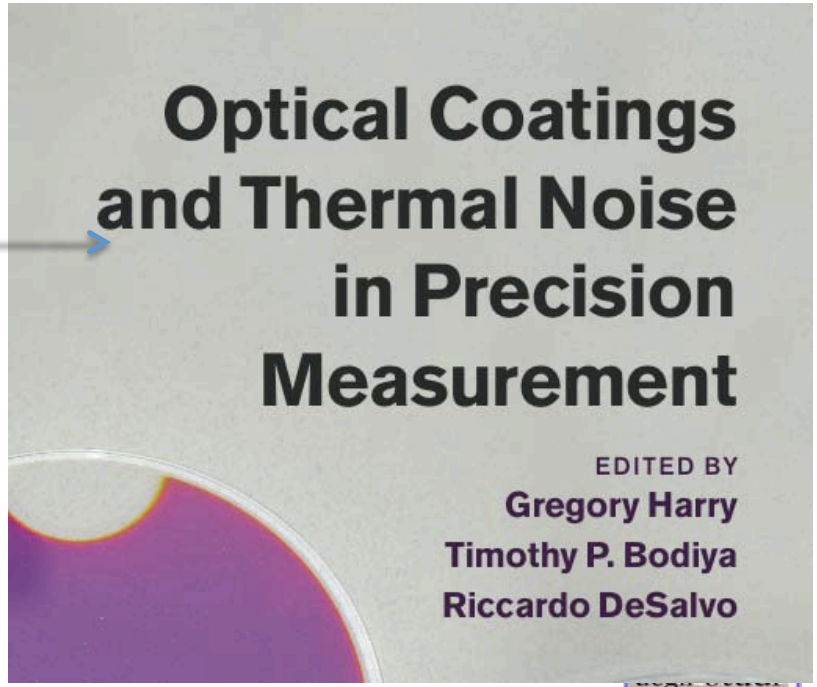
12

Reflectivity and thickness optimization

INNOCENZO M. PINTO, MARIA PRINCIPE, AND RICCARDO DESALVO

Directional radiative cooling thermal compensation for gravitational wave interferometer mirrors

Carl Justin Kamp[a,*], Hinata Kawamura[b], Roberto Passaquieti[c], Riccardo DeSalvo[d]



aLIGO Optical levers

- Found angular instability problem from laser mode jumping
- Partially mitigated using angle cut fibers
- Eliminated using S-LED

Future work

- Optical levers to mitigate Newtonian noise

Third generation GW Obs.

- Past
- Xylophone concept
- Cryogenic suspension studies
- Underground “seismic weather” studies
- Newtonian noise subtraction techniques

Present/future

- Homestake seismic noise studies
- Down-well seismic isolation techniques
- LCGT has double use

Einstein gravitational wave Telescope

Conceptual Design Study

Seismic attenuation (past)

- Introduction of Maraging in GW springs
- Virgo Superattenuator design (before LSC)

- SAS design for LIGO (=>HAM SAS)
- SAS design for TAMA (=>LCGT design)
- SAS design for AEI 10 m facility
- SAS design for Virgo injection benches

Seismic attenuation (present/future)

- SAS design for LCGT
- Development of underground configurations
- Phasing out Maraging ?
- Seismic attenuation for 3rd generation
- Cryogenic

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More on Maraging

- Introduced Maraging for seismic attenuation
- Studied maraging creep, enabling its generalized use in GW observatories.
- Discovery of Self Organized Criticality (SOC) of dislocations in metals
- Impact on future suspensions
  - Operational modes
  - New designs

Eur. Phys. J. Plus (2011) 126: 75 DOI: 10.1140/epjp/i2011-11075-y

The role of Self-Organized Criticality in elasticity of metallic springs: Observations of a new dissipation regime

Riccardo DeSalvo, Arianna DiCintio and Mark Lundin

Società Italiana di Fisica Springer

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SOC fall-out

- Developing new class of tiltmeters
  - Enabling active seismic attenuators to work at lower frequency (for a-LIGO)
  - Rotational seismology
- Developing new class of seismic sensors

My best achievements in the GW field !

- Some played physics with me for *years*
- Some just touch and go
- I am proud of every single one and of their achievements,
- Several active in GW ! !
- All of them, I am sure, are proud of having played some GW physics with me
- They all remember:
- *if it is not fun, it is not physics*!

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(I apologize with those friends, hopefully few, that I forgot !)

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