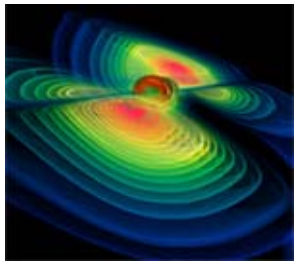
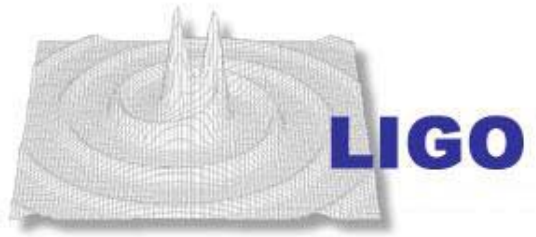
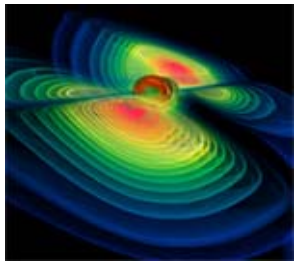




How a Theoretical Physicist..
..can have fun!

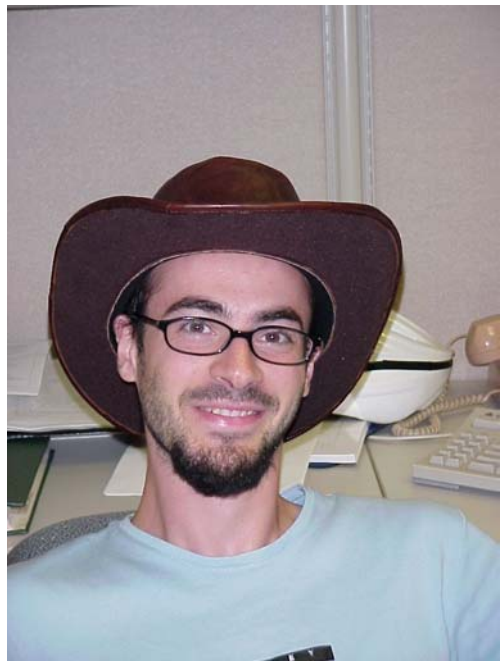
Dott. Juri Agresti

Labor Day party
01-Sep-03



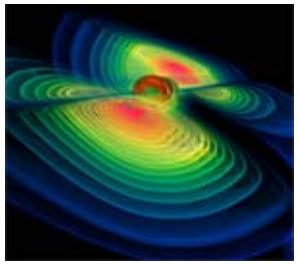
LIGO

Who am I ?



Graduated from Florence University with a Thesis that sounds like:

“Hamiltonian linearization of the rest-frame instant form of tetrad gravity in a completely fixed 3-orthogonal gauge: a radiation gauge for background-independent gravitational waves in a post-Minkowskian Einstein space-time.”

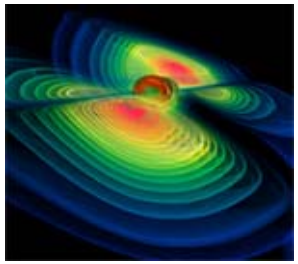


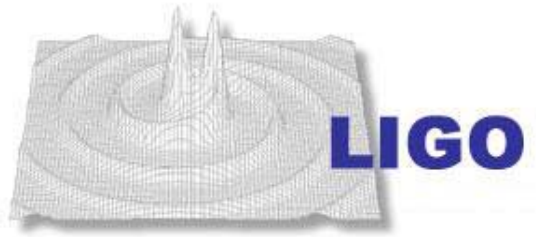
LIGO

And Now ?

Ph.D. student of Pisa University with a LIGO grant.

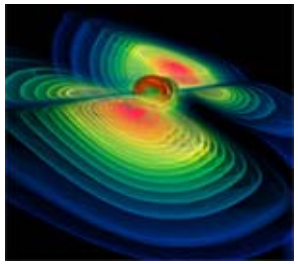
Caltech's visitor during this summer with my wife Chiara (SURF student)





How I spent this time?

Essentially learning a lot of stuff about gravitational waves interferometers and the *end-to-end (e2e)* simulation package developed to model LIGO detectors.

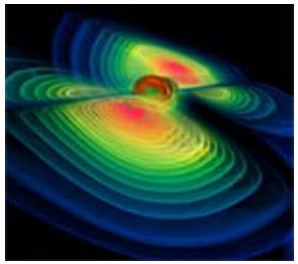


What is e2e ?

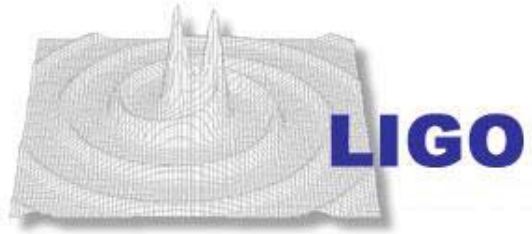
A time domain simulation program

(Time-domain simulation is necessary to understand non-linear behavior)

- **Fields**
- **Optics**
- **Mechanics**
- **Electronics**
- **Control syst.**



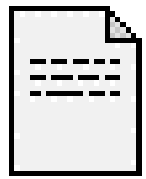
How it works :

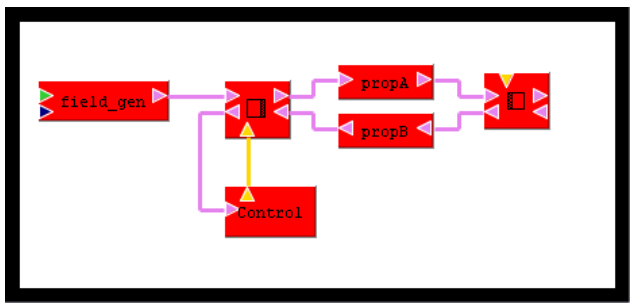


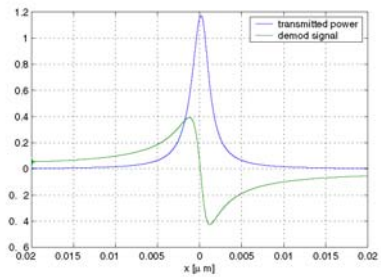
Setup a configuration using Graphical Interface or Text Editor

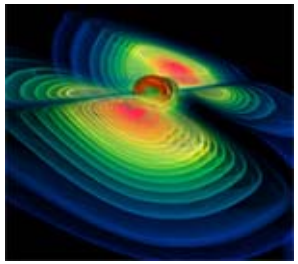
Time domain simulation

Simulated time series of data





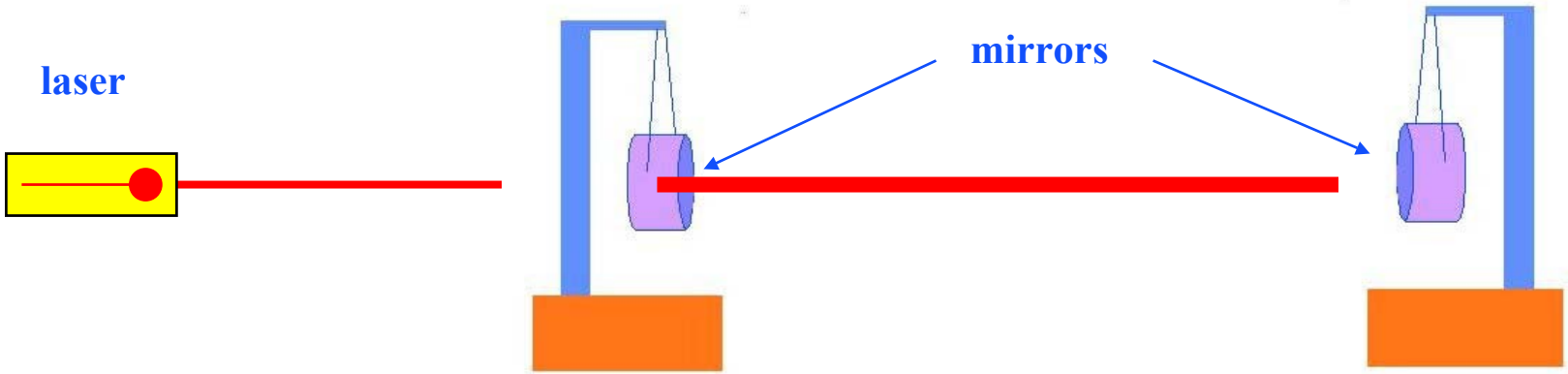




LIGO

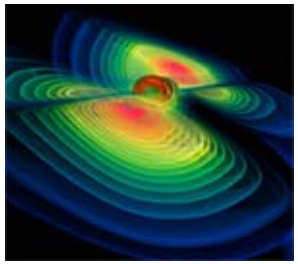
My personal training with e2e …..

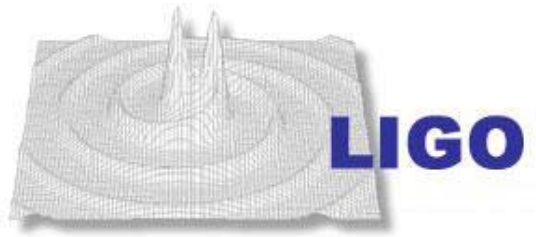
Fabry-Perot cavity with 3D suspended masses



Unexpected results ! → **Bugs fixed …**

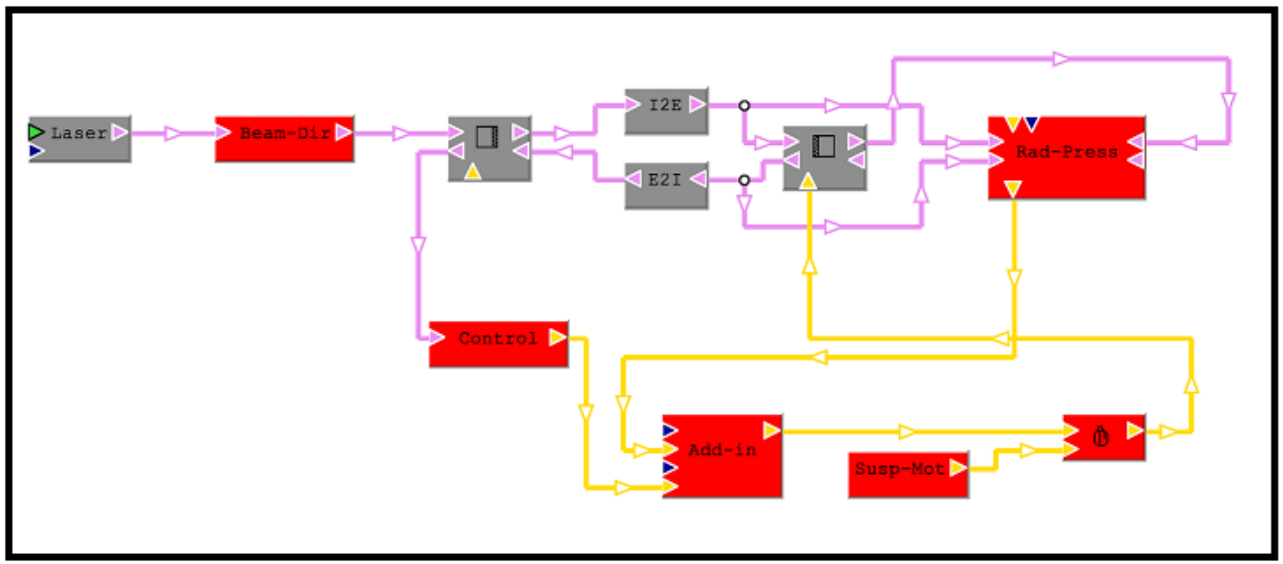
Training is useful !

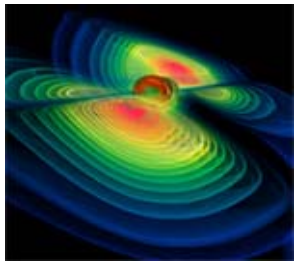




After these preliminary studies I have started to build a *FP cavity simulation* with radiation pressure effect.

This is to validate and extend the analysis by Danniel Sigg about angular instabilities induced in a FP cavity by radiation pressure.



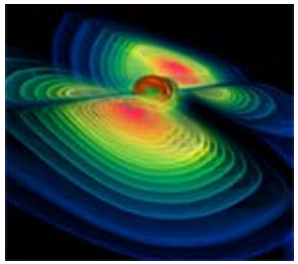


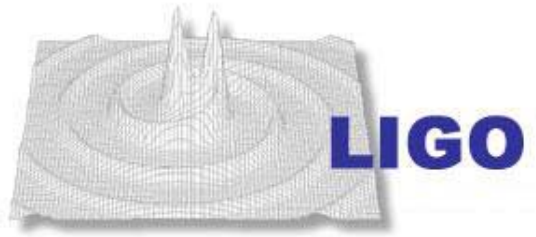
LIGO

The analysis is just begun …..

- Freeze all the degrees of freedom of the mirror but one (yow, pitch, z-motion,…….)
- Add a control system
- Add noise source (seismic motion….)

Cavity locking…….Under which conditions ?



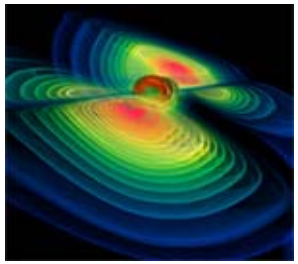


Power-Induced angular shift can be significant for LIGO I (laser power in the arms cavities ~ 10 kW)

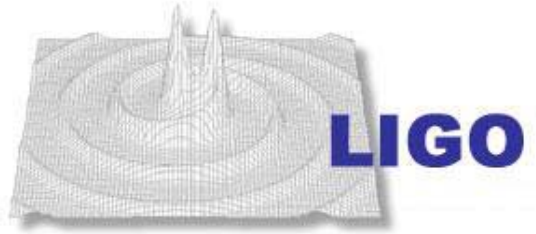
…but could be very important for LIGO II

(power ~MW)

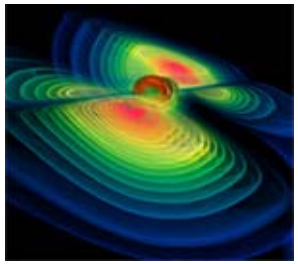
A lot of work to do !



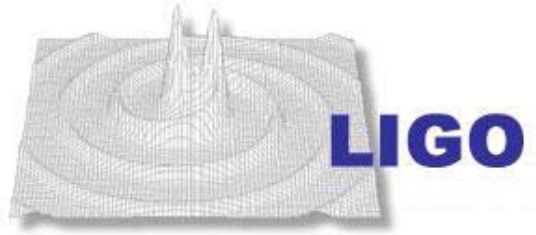
Thanks to :



- **Hiro Yamamoto** (he is very kind and patient)
- **Riccardo DeSalvo and family** (they accommodated us for a month)



Thanks to (2) :



- **Chiara** (for being as you are)
- **All new friends met in Caltech**
- **Albert ….** (he gave me something to have fun..)