

h

THE GRAVITATIONAL VOICE

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NEWS FROM THE WORLD

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NEWS FROM THE SITE

2015 European Researchers' Night
at EGO

NEWS FROM THE COLLABORATION

The future of h

PEOPLE

Many new people in Cascina



News from EGO and VIRGO

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The crowded "Isola di Einstein 2015"

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EDITORIAL

A large part of this issue is devoted to various very successful outreach events that have taken place in the last months: local events, Italian events, European events and, surprisingly, events in London, but in the 19th century, in which Michael Faraday was one of the main actors.

From the point of view of the h editors, the most relevant article of this 30th issue of our newsletter is the one in which Gary Hemming reports upon the results of the survey on the future of h . There is interesting information and, in general, our efforts seem to be warmly appreciated by our readers. But it may be that only h fans bothered to answer the questionnaire; this explains also the small number of answers we got: 'only' 30, excluding the editors. We will keep studying and try to correctly interpret the answers and we will take advantage of reader's suggestions while preparing the next 2016 issue: it will contain many happy news, like the first lock of Advanced Virgo and.....!

*C.Bradaschia
Chief Editor*

LISA Pathfinder

LISA Pathfinder is now a reality. It will contribute to the development of gravitational wave astrophysics, complementing the interferometer observations in the range of sub-Hertz frequencies. We are glad to quote from its web site <http://sci.esa.int/lisa-pathfinder/>:

“ESA’s LISA Pathfinder blasted off on 3 December at 04:04 GMT (05:04 CET) on a Vega rocket that delivered it to a low-Earth parking orbit. From there, the satellite will perform a series of six critical burns with its own propulsion system over the coming week, to raise the highest point of its orbit and eventually start the cruise towards its operational orbit around the Lagrange point L1, 1.5 million km away from Earth towards the Sun.



LISA Pathfinder will pave the way for future missions by testing in flight the very concept of gravitational wave detection: it will put two test masses in a near-perfect gravitational free fall and control and measure their motion with unprecedented accuracy. LISA Pathfinder will use the latest technology to minimise the extra forces on the test masses, and to take measurements.

The inertial sensors, the laser metrology system, the drag-free control system and an ultra-precise micro-propulsion system make this a highly unusual mission. LISA Pathfinder is an ESA mission, which will also carry a NASA payload.”

The progress of the LISA Pathfinder mission can be followed at <http://sci.esa.int/lisa-pathfinder/>.

“h”

Wave Hunters

“The Virgo project unveiled at Einstein’s Island”

An island in the middle of a lake is the perfect setting to study waves. While resting and relaxing, you might get trapped by the lake water lapping by the shore, its recurring movements enchant you and you learn so many things about oscillations without even realising that you are learning. With your observations you are experiencing so many phenomena that you may write a book out of them or just six easy pieces (like Feynman, Richard, Six Easy Pieces, Perseus



Fig. 1

The experience can become even more intense if someone has decided to name the island Einstein's Island. In this case you cannot avoid celebrating the 100-year anniversary of the general law of relativity by playing with waves or, as scientists say, doing experiments with them.

This is not a joke, this is something that took place for real this year, during the first weekend of September at the Polvese Island, on the Trasimeno Lake, not far away from Perugia, the capital city of Umbria. The Island is a 70 hectare hill, covered with over 4000 olive trees, alongside a XIII century monastery, two homesteads and a villa, where the fourth edition of the Einstein's Island took place, from the 4th to the 6th of September: an international science-shows festival (Fig.1).

The event is a brainchild of Psiquadro, a non-profit organisation of science communicators, who have been working to transform ideas into engaging events on science and technology. Since 2012 Einstein's Island has hosted a wide range of artists, science communicators, musicians and scientists from all over Europe, making the island an outdoor laboratory.



Fig. 2



Fig. 3

Five arenas on the grass, under five big pines, hosted hundreds of shows, science demonstrations, concerts, theatre performances, experiments, juggling performances and a wide set of shows inspired by science.

From Friday the 4th of September to Sunday the 6th, over 12,000 visitors attended the events coming from all over Italy.

One of the main novelties of this

year's programme of events was the show entitled Wave hunters, jointly developed within a collaboration programme between the researchers of the EGO consortium and the communicators of Psiquadro.

Together, they found a creative way to talk about the interesting challenges of the Virgo project to the general audience.

The show was a 45 minute-long performance, in which pendulums, springs, laser pointers, elastic fabric and mirrors are protagonists of a plot that aims to engage the audience in the discovery of gravitational waves.

How to succeed in capturing the audience's interest and to invite them to join the communicators and scientists in the amazing hunt for gravitational waves?

The show focuses on two pivotal ideas: on the one hand, the quest for scientific instruments to visualise vibrations, on the other the concepts of space-time.

In the first case, the communicators on the stage used both classical didactic instrumentation such as the Chladni plates

(https://it.wikipedia.org/wiki/Ernst_Chladni) as well as instruments created from everyday, simple objects and transformed into scientific tools (Fig.2).

An example of this process is the cardboard cone used to visualise voice vibrations through Lissajous patterns (https://en.wikipedia.org/wiki/Lissajous_curve). A cardboard cone is an empty cone without bases and is usually a tool to store a wool thread. When the wool is over it can be transformed into a home made oscilloscope.

Stretch a piece of the rubber sheet from a balloon on the bigger base of the cone and stick to it a little perspex mirror and the tool is ready. While singing or chatting in front of the open smaller end of the cone the balloon sheet vibrates and so therefore does the mirror. Now, by pointing a laser beam at the mirror it reflects on to a white screen where it moves following the movement of the rubber sheet.

Staring at the white screen it is possible to see the path as a whole and, depending on the vibrations, a line in a figure of 8 or a deformed circle or another Lissajous pattern is shown (Fig.3). These patterns represent the vibrations of the rubber sheet.

While introducing the methods to visualise vibrations it is also possible to describe their features, such as pitch or wavelength. All of these puzzle tiles help the audience to construct a picture to interpret the phenomena observed on the shore or on the ferry while staring at the bow waves. It's a process that helps to get closer to the ripples in space-time.

The connection between the lake waves and gravitational waves is introduced using a sheet of lycra, an elastic fabric.

Volunteers from the audience hold the fabric tightly while the presenter puts a heavy ball on to it

creating a hollow, also known as a gravity well. Someone from the audience is invited to throw a marble into it with a sideways push; the marble starts orbiting and falling towards the ball moving along a spiral-like path. While moving, the marble modifies the curvature of the lycra and these changes propagate along the fabric generating ripples in the fabric that propagate on its surface.

These ripples represent gravitational waves. Such a simple model is an impressive way of introducing space-time curvature and waves propagating in space-time.

The enthusiasm triggered by the Einstein's Island context boosted the organisers imagination and

the model was developed and presented in a new format during the European Researchers' Night at the Department of Physics and Geology in Perugia. On the 25th of September a gravity well made out of lycra was presented to the audience and a laser interferometer was coupled with it (Figs. 4 and 5). Thanks to this coupling, when the ripples reached the interferometer an interference picture appeared on a screen. Researchers, communicators and the audience, fascinated by all these models, are now looking forward to observing the first real gravitational waves. We will all have a new beauty to reflect upon while relaxing by the lakeshore next time.

L. Alfonsi - H. Vocca



Fig. 4



Fig. 5

“Science is wonder-ful”

“10th anniversary of the
European Researchers’
Night”

“Science is wonder-ful” was the title given to the event that was held in Brussels on September the 23rd.

It was held to celebrate the 10th anniversary of the European Researchers’ Night, the first edition being performed in 2005.

I was accepted, as a representative of Virgo, EGO and Frascati Scienza, to present “hands-on” experiments based on the Archimedes principle and on interferometers. It was a tough day, with many visitors; my voice was gone for the next two days.

You can have a taste of the event by looking at the video accessible at the dedicated web page: http://ec.europa.eu/research/mariecurieactions/science-is-wonderful/index_en.htm.

C. Bradaschia

**Michael Faraday:
outreach since 1825**

While trying to imagine nice experiments for our public outreach activity I was thinking about the burning flame of a candle; and I opened Wikipedia to search for information.

I found “The Chemical History of a Candle” a booklet printed in 1861, written by a giant of physics: Michael Faraday.

The information, which was totally new and astonishing to me, is as follows.

In the first half of 19th century in England, scientifically educated people felt the need to convey the wonders of science to the less well informed. This purpose was

ROYAL INSTITUTION of Great Britain,
Albemarle street, Dec. 5, 1825.—A wish having been expressed by several of the Members that a Course of Lectures should be delivered at the Royal Institution, in the Christmas, and other vacations, on some of the leading branches of Natural Philosophy adapted to the comprehension of a juvenile auditory, the Managers announce to the members and Subscribers that JOHN MILLINGTON, Esq. F.L.S. Sec. Astron. Soc. Professor of Mechanics to the Royal Institution, will DELIVER a COURSE of TWENTY-TWO LECTURES on the various branches of Experimental Philosophy, including Dynamics, Mechanics, Pneumatics, Hydrostatics, Optics, Magnetism, Electricity, and Astronomy. To commence on Monday the 19th of December, at 2 o’clock, and to be regularly continued on Mondays, Wednesdays, and Fridays, with the exception of Monday the 26th instant, at the same hour, till the completion of the 15th Lecture. The remainder of the Course will be delivered in the Easter and Whitsuntide vacations. The terms of admission to the above Courses will be, for non-subscribers to the Institution 2 guineas for the whole, or 1 guinea and a half for the Christmas portion of 15 lectures. The wives and families of members will be admitted on the payment of 1 guinea and a half for the whole Course, and 1 guinea for the Christmas portion. A prospectus of these Lectures may be had of Mr. Fincher, at the Institution.
JOHN GUILLEMARD, Sec.

Fig. 1 The foundation announcement of the Christmas Lectures.

achieved by organizing conferences accompanied by easily understood experiments. This is exactly what we are trying to do today, believing we were pioneers!

Among the various initiatives, there are the “Christmas Lectures”, (<http://www.rigb.org/christmas-lectures>) which were started by the Royal Institution in London in 1825 and continue to this day.

These were first televised in 1936

and are currently broadcast on BBC Four. The 2015 subject was “How to survive in space”; but unfortunately it was impossible to be present at the Royal Institution building in Mayfair, London, as the 2015 ticket ballot was closed very early (as happens for tickets for Wimbledon). It was however possible to watch the lecture on TV on dates that have been published in December. Contact xmaslecs@ri.ac.uk for more information.



Fig. 2 Michael Faraday Lecturing in the Theatre at the Royal Institution, c.1856 (coloured lithograph) by Blaikley, Alexander (1816-1903)

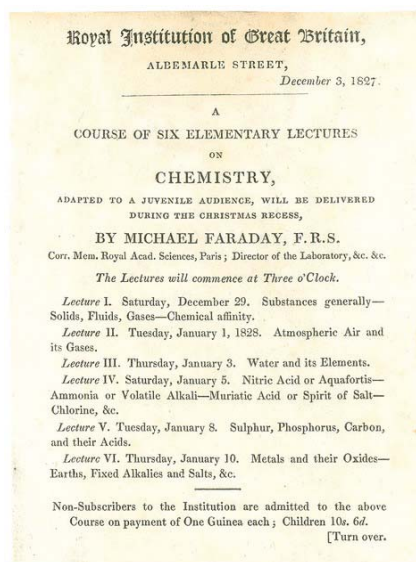


Fig. 3 The first lecture by Faraday.

In the Victorian age the stimulus to diffuse scientific knowledge was so strong that even novellas were adapted to bring science to the stage. The *Haunted Man* and the *Ghost's Bargain* by Charles Dickens, first published in 1848, was often performed for this aim. Faraday gave nineteen Christmas Lectures on various subjects,

1827 *Chemistry*
1829 *Electricity*
1832 *Chemistry*
1835 *Electricity*
1837 *Chemistry*
1841 *The Rudiments of Chemistry*
1843 *First Principles of Electricity*
1845 *The Rudiments of Chemistry*
1848 *The Chemical History of a Candle*
1851 *Attractive Forces*
1852 *Chemistry*
1853 *Voltaic Electricity*
1854 *The Chemistry of Combustion*
1855 *The Distinctive Properties of the Common Metals*
1856 *Attractive Forces*
1857 *Static Electricity*
1858 *The Metallic Properties*
1859 *The Various Forces of Matter and their Relations to Each Other*
1860 *The Chemical History of a Candle*

In his lectures he urged his audiences to consider the mechanics of his experiments: "you know very well that ice floats upon water ... Why does the ice float? Think of that, and philosophise". Faraday's enthusiasm will be a great stimulus to us knowing that great scientists have also been great at popularising science.

C. Bradaschia

Swimming Pia

"Not only gravitational waves"

For more than twenty years Pia Astone, senior researcher at the INFN used to dive into the noise of gravitational wave detectors of any kind, to search, track and rescue possible signals.

That's a hard job, which requires not only technical skill, but also a strong will and competitive attitude which is increasingly demanding as the number and variety of competitors increase. But Pia's competitive attitude, in spite of her natural discretion, is evident also in water waves! Yes, "sometimes" she used to go to the swimming pool... That's a good habit, I thought. Swimming is definitely healthy and provides a suitable recovery after so many



Fig. 3
Italian championship,
Palermo, 2008:
Pia's rankings: 1500m FS: 22nd,
800 FS: 3rd,
2.5 km Open Water: 1st,
5 km Open Water: 1st.

hours spent facing the screen and struggling with data analysis. Sometimes pictures and medals were spotted on her desk.

Wow, she's doing better than just fitness... Cups... Wow again... Pia is quite discrete and does not speak much about her athletic activity, unless asked.

Slowly, we got accustomed to having a champion in our group.

In the Facebook era, Pia's office pictures were easily accessed by her Facebook friends and we woke-up: guys, we have Pia; we are so proud of her and should tell the gravitational wave community! The social network is quite useful.

E. Majorana



Fig. 2 Open water. Pia in the Strait of Messina.



Fig. 3 2015, 10 km. Pia is alone on the podium since she is alone in her Master category (55), but she is the 4th among all the female Master categories and 9th when the males are included!

The future of “h”

Over the past couple of months a survey has been under way in an attempt to determine how and where our very own ‘h’ should go in the future.

The magazine has reached an important moment in its life: ten years old, nearly 30 issues under its belt, and looking into a future in which the next Chief Editor remains unknown.

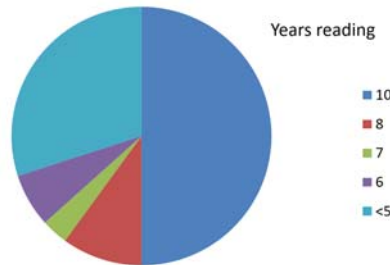
So, where to next? Would the survey provide the answers?

Maybe. Maybe not.

In total, 33 completed questionnaires were received; not the highest of numbers considering the available readership, but enough to at least draw a few simple conclusions.

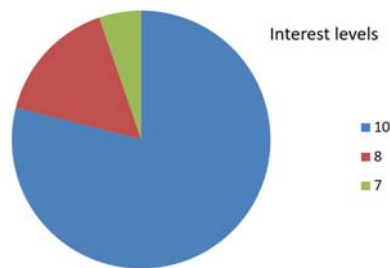
Readership

Of the respondents, half had been reading h since its inception, while a significant minority had only begun reading within the last five years.



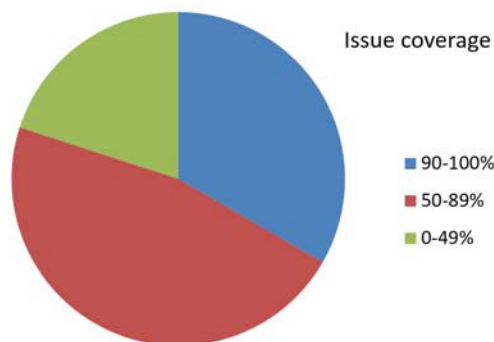
Graph. 1

While, in terms of levels of interests, the results painted a relatively static picture, with the majority of readers retaining a constant levels of interest over the years, and a small, but equal, number expressing either an increase or decrease in interest.



Graph. 2

In terms of issue coverage, a good number of respondents – ten overall – read between 90% and 100% of each issue, while a further 14 read between 50% and 89%. Six respondents stated that they read less than 50%.



Graph. 3

Contents

As part of the survey, users were asked to rate the individual h sections in terms of interest, awarding a score between one and five to each section.

These results were then averaged out to determine the most appreciated sections of the magazine.

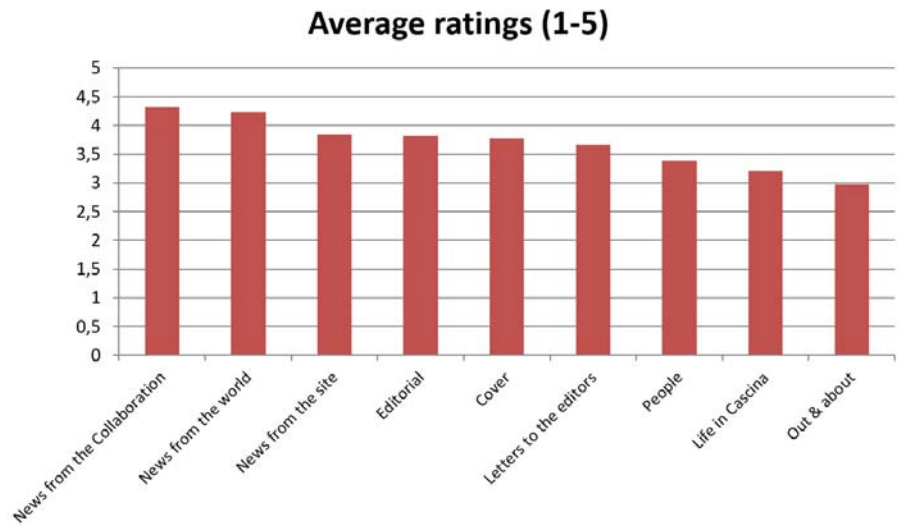
As can be seen in the plot below, the three ‘News’ sections – ‘News from the Collaboration’, ‘News from the world’ and ‘News from the site’ came out on top, with the ‘Editorial’, ‘Cover’ and ‘Letters to the editors’ sections all averaging above 3.5.

The more EGO- and Cascina-centric sections of the magazine scored the lowest: ‘People’ - 3.39; ‘Life in Cascina’ – 3.21; and ‘Out and About’ – 2.98.

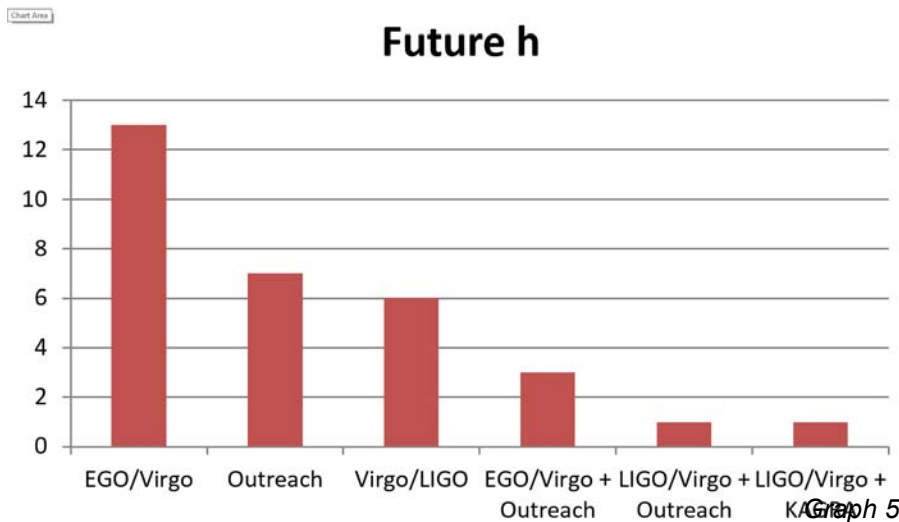
These results are certainly interesting and suggest a tendency towards a more Collaboration-centric and science news-type of magazine. (Graf. 4)

Respondents were also asked how they would like to see ‘future h’ in more general terms, such as to which groups should the magazine be dedicated and concentrate upon. Here, the largest single group – thirteen votes - preferred to see the magazine remain as it is in its current form; dedicated to EGO/Virgo, while seven were in favour of re-engineering it as outreach material.

A number of combinations were suggested along the way, with respondents suggesting various different combinations, as can be seen in the plot below.



Graph. 4



Graph 5

Subject matter

Respondents were also asked to nominate specific favourite articles, where applicable. The following were those named:

- Archimedes force of vacuum
- Atlantis in Africa
- BICEP2
- History of Virgo
- Virglish

Respondents were also asked to provide general comments in relation to h and its contents. This drew a wide array of thoughts and suggestions. A generalised selection is available below.

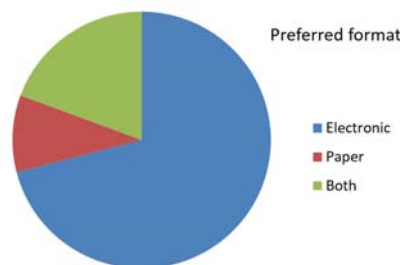
The following are subjects that respondents suggested they would like to see addressed in h:

- Progress and status of Virgo
- General gravitation-related discussions
- Complementary technologies which support gravitational wave observations, e.g. Can gamma ray telescopes
- Stories and curio in relation to the history of Virgo and GW
- News on funding and research calls in relation to our field
- Portraits/profession descriptions

Publishing

The survey also asked for readers' views on publishing issues.(Graf. 6)

In terms of format, the vast majority of respondents were in favour of producing an electronic format only, while more users were in favour of both paper and electronic formats together, than a paper-only format.



Graph. 6

- Strict guidelines on article length
- Articles on Virgo subsystem progress
- Both expert-oriented and simpler-level articles should be available.
- News from the world
- Life of the Collaborations
- Future R&D projects
- A short English lesson
- Science made easy
- News from other science fields
- News on science books
- Small section on games and jokes
- A focus on one, randomly-selected, person within the Collaboration, asking them to provide a 'day in the life of'
- A 'Where are they now' section-Following up on ex-members of the Collaboration, to see what they are up to and which changes have occurred in their lives; whether they still follow the progress of Virgo, etc
- EM follow-up-related articles
- Choose a Collaboration paper each issue and ask authors to describe it in accessible/general terms.

While there were also many general comments about h, the vast majority of which were very complimentary, soliciting continued efforts on the part of the h Editorial Team.

G. Hemming

The European Researchers' Night at EGO

Science and theatre, visits to the Virgo experiment, star-gazing parties with local groups of amateur astronomers from Pisa and Cascina.



This is just a summary of the many events hosted at the EGO site for this year's Researchers' Nights (Friday the 25th and Saturday the 26th of September).

About 500 visitors participated in the activities scheduled at the EGO site. The two open-lab days were organised in partnership with Frascati Scienza and with the Bright 2015 initiative of the Tuscan Region.

We welcomed about 150 visitors to the Virgo experiment and to an introductory seminar on the experiment, which was given on Saturday by the EGO Director, Prof. Federico Ferrini. During the visits, there was the opportunity to learn about the latest steps in the preparation for Advanced Virgo, and to see the Central Building and the interferometer Control Room.

This year, EGO also hosted two events of great interest to the public. During the Friday and Saturday afternoons, visitors were able to attend the interactive show "Wave hunters", which was written by the staff of Psiquadro, a company that specialises in science communication.

In the evening, the visitors were delighted to see "I Gravitons", a piece of theatre based on a great mix of comedy and science.

Actors from the company "I Teatri della Resistenza" were joined by some EGO and Virgo scientists in a brilliant play about the marvels of General Relativity. As part of the event, EGO also hosted star-gazing activities held by the local amateur astronomy clubs of Cascina and Pisa.

They used their telescopes to show the sun during the day, while, in the evening, they organised a night observation session. The schedule was packed with a wide range of activities, and the result was a great success.

"I want to thank all the staff who contributed to the great results of these two days at the EGO site", said Elena Cuoco, the EGO-Virgo Education and Public Outreach coordinator, "I was favorably impressed by the enthusiasm of all the EGO and Virgo personnel for these initiatives.

I am still receiving many messages from the people who attended, saying that they



were grateful for getting so much fun from somebody talking about science. This pays off all the work devoted to the organization of these days.”

During the event, we posted pictures in real time on Twitter and Facebook, which showed up on our social wall (hashtags #open_ego, #nottericeratori, #bright2015), in order to share the excitement for these great open days at EGO.

M. Razzano



Good Bye “PANDA”

Enjoy a well earned rest dear Panda 4x4, after faithfully serving for 21 years and 100000 kilometers. We sadly remember the days spent together with you and Giancarlo DeCarolis driving around the country to find an appropriate site for our adventure; and then studying the optimal direction for the 3 km arms. We remember the helpful farmers who pulled us out of the mud using their powerful tractors when we got bogged down. Your loyal service has contributed greatly to our impending discoveries.

C. Bradaschia



Many new people in
Cascina

Hi!
My name is Daniel Hoak. I've been working with LIGO and gravitational waves for more than a decade, first as an operator at LIGO-Livingston, and then as a graduate student at the University of Massachusetts, Amherst. I finished my PhD, so, this summer and received a grant from the U.S. government to work at EGO for the next several months.

For the last year I was part of the commissioning team at LIGO-Hanford, and I plan to work on similar projects with Advanced Virgo, especially the detection benches, lock acquisition, control systems, and noise hunting. I'm here to help make Virgo work, and I want to help with any projects to make AdV a success.

I love Pisa so far! I'm learning Italian slowly, and looking forward to exploring the country. In the spring I hope there will be time for hiking when I'm not commissioning. Cheers!



D. Hoak



J. Casanueva Diaz

Hola! Me llamo Julia Casanueva Diaz. I am a Second-year physics PhD student at LAL (Orsay). The commissioning of Advanced Virgo is one of the main topics of my PhD, so, for that reason, I will stay at the Virgo site for one year. I actually belong to the ISC

group; in particular I am working on the lock strategy, which basically means simulation work. I will also be involved in the commissioning tasks once they start.

Besides work, I find that the Pisan streets are always full of people, very close to the Spanish way!

AMERICAN GIRLS

Melissa and I are undergraduate physics students who had the fantastic opportunity to spend the summer working at Virgo.

I am entering my last year of undergraduate studies at the University of California Santa Cruz and Melissa is entering her third year at the College of William and Mary in Virginia.

The University of Florida and the US National Science Foundation organized to send thirteen undergraduates to five different countries to work in gravitational physics research groups, and we are very grateful to Irene for all the work she did to allow us to come to Virgo.

I learned a tremendous amount of physics from everyone I worked with at Virgo, and I was amazed how kind everyone was to teach me. I particularly enjoyed the diversity of physics topics involved in the interferometer.

I could spend time coding in the control room, checking accelerometers in central building, and helping Melissa bury a magnetometer in a field, all in the same day. Melissa worked on a project to measure the Schumann resonances that affect the stochastic background. I built a noise-hunting code and set up a Dead-Channel Monitor in the DMS.

Working at Virgo changed my ideas about projects that I hope to work on in the future. As I prepare my graduate school applications this fall I find myself looking for schools that are involved with interferometric gravitational wave detectors.

Events like the biathlon and the ping pong tournament also made Virgo a very fun place to work.



Melissa smiling in the gorgeous Florence!



And so does Kathryn!

Lunchtime ping pong was great and we are very grateful to everyone who tolerated our abysmal ping pong skills.

I think I understand the control loops that adjust the pitch and yaw of the mode cleaner end mirror better than the control loops that direct a ping-pong paddle. In both cases, most of what I learned is owed to Maddalena. Since Melissa and I now have ping-pong paddles signed by the Advanced Virgo ping-pong team, there is hope that our ping-pong ability shall continue to improve.

I was very reluctant to leave Virgo. As I sat in an airplane taking off from Pisa, I watched the 3-kilometer arms of the interferometer until they were out of sight. One of the first things I did when I returned to Santa Cruz was to plant sunflowers in my garden to remind me of the fields around Virgo.

Ciao,

*Kathryn and Melissa
"le ragazze Americane"*