

LXe | eXplore the invisible

XENON - DARWIN Local Group Activities



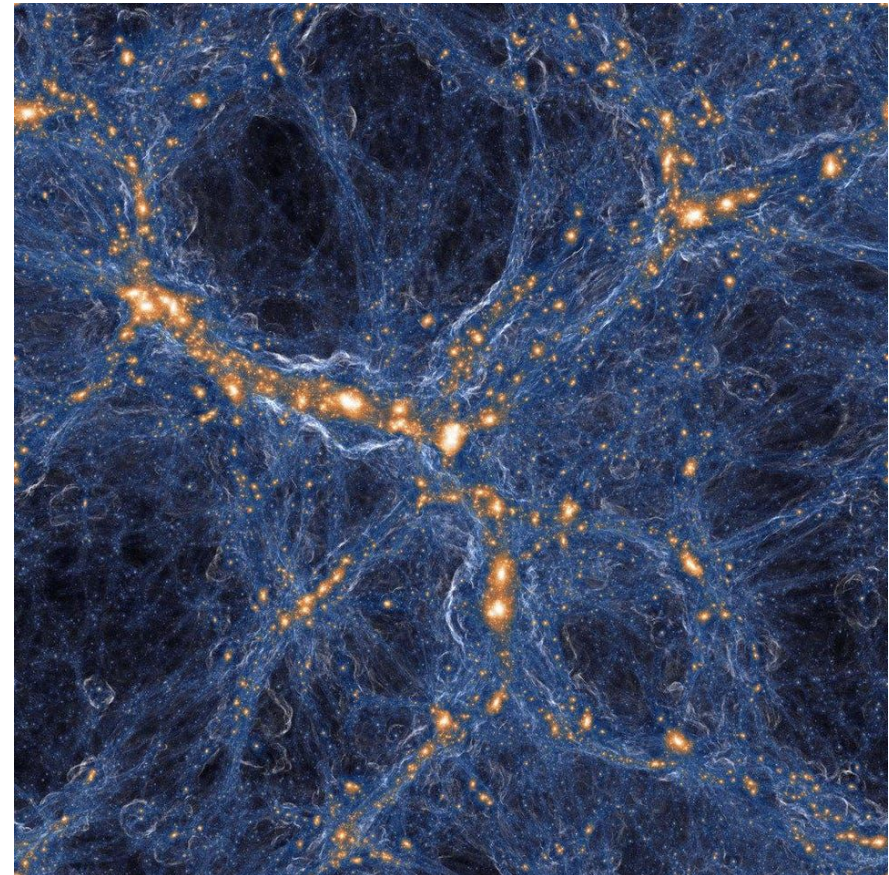


We know that we don't know.

- Is it matter?
- How does it interact?
- How much does it weigh?
- Can we directly see it?

But it is for the unknowns that we explore.

- Assume dark matter exists.
- Suppose it “weakly” interacts.
- If $m_{\text{DM}} > 1 \text{ GeV}$,
- We may directly see it.



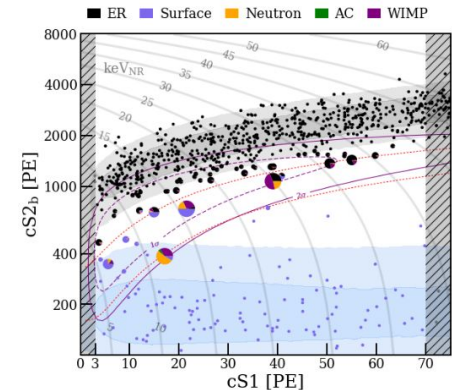
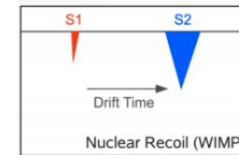
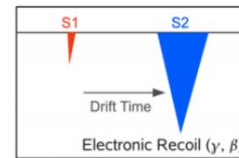
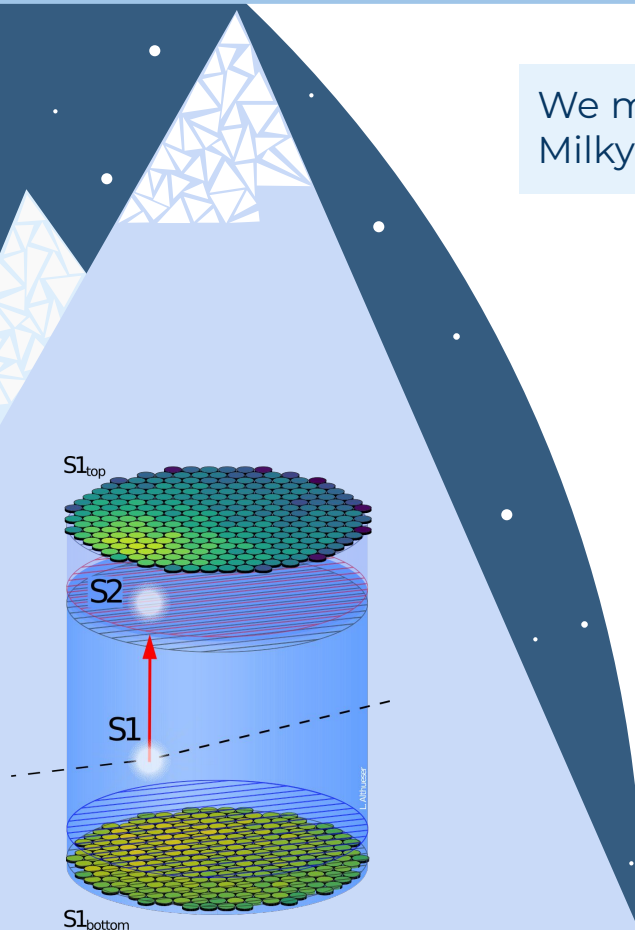


Our invisible eXplorer



We may directly detect DM particles belonging to the Milky Way Halo wind.

- Dual-phase (liquid+gas)
- Energy reconstruction
- 3D event reconstruction
- Fiducialization
- Event discrimination (electronic recoil vs nuclear recoil)



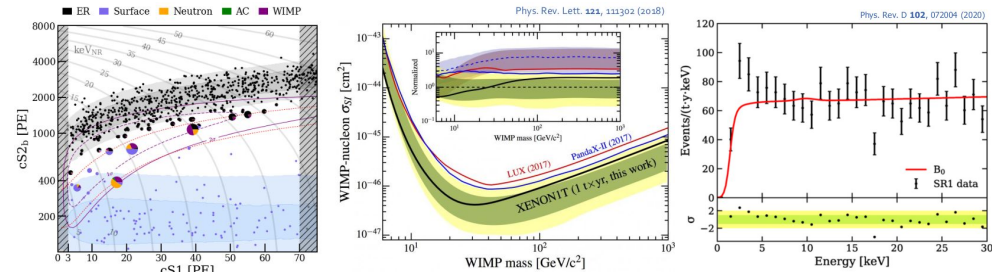


A powerful technique

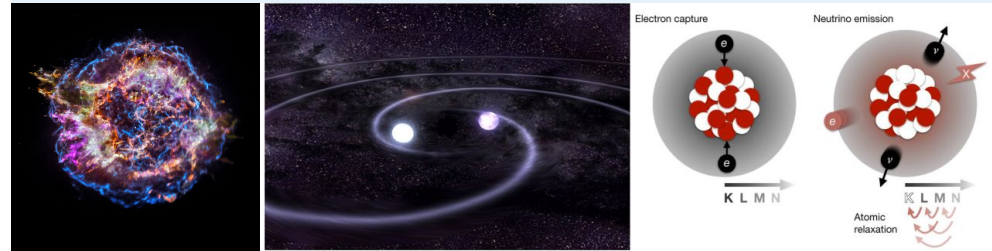


- [arXiv:1705.06655](#) - First Dark Matter Search Results from the XENONIT Experiment
- [arXiv:1805.12562](#) - **Dark Matter Search Results from a One Tonne×Year Exposure of XENONIT**
- [arXiv:1811.12482](#) - First results on the scalar WIMP-pion coupling, using the XENONIT experiment
- [arXiv:1902.03234](#) - Constraining the Spin-Dependent WIMP-Nucleon Cross Sections with XENONIT
- [arXiv:1904.11002](#) - **First observation of two-neutrino double electron capture in ^{124}Xe with XENONIT**
- [arXiv:1907.11485](#) - **Light Dark Matter Search with Ionization Signals in XENONIT**
- [arXiv:1907.12771](#) - Search for Light Dark Matter Interactions Enhanced by the Migdal effect or Bremsstrahlung in XENONIT
- [arXiv:2006.09721](#) - **Excess Electronic Recoil Events in XENONIT**
- [arXiv:2011.10431](#) - Search for inelastic scattering of WIMP dark matter in XENONIT
- [arXiv:2012.02846](#) - Search for coherent elastic scattering of solar 8B neutrinos in the XENONIT dark matter experiment

XENONIT Results



Beyond DM Searches





A long story with a sequel



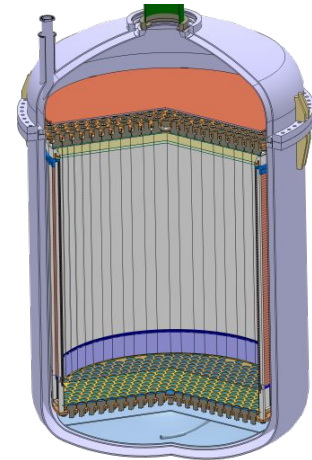
Past



Present



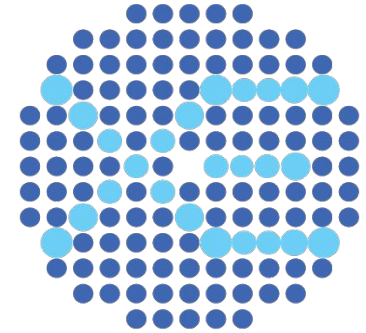
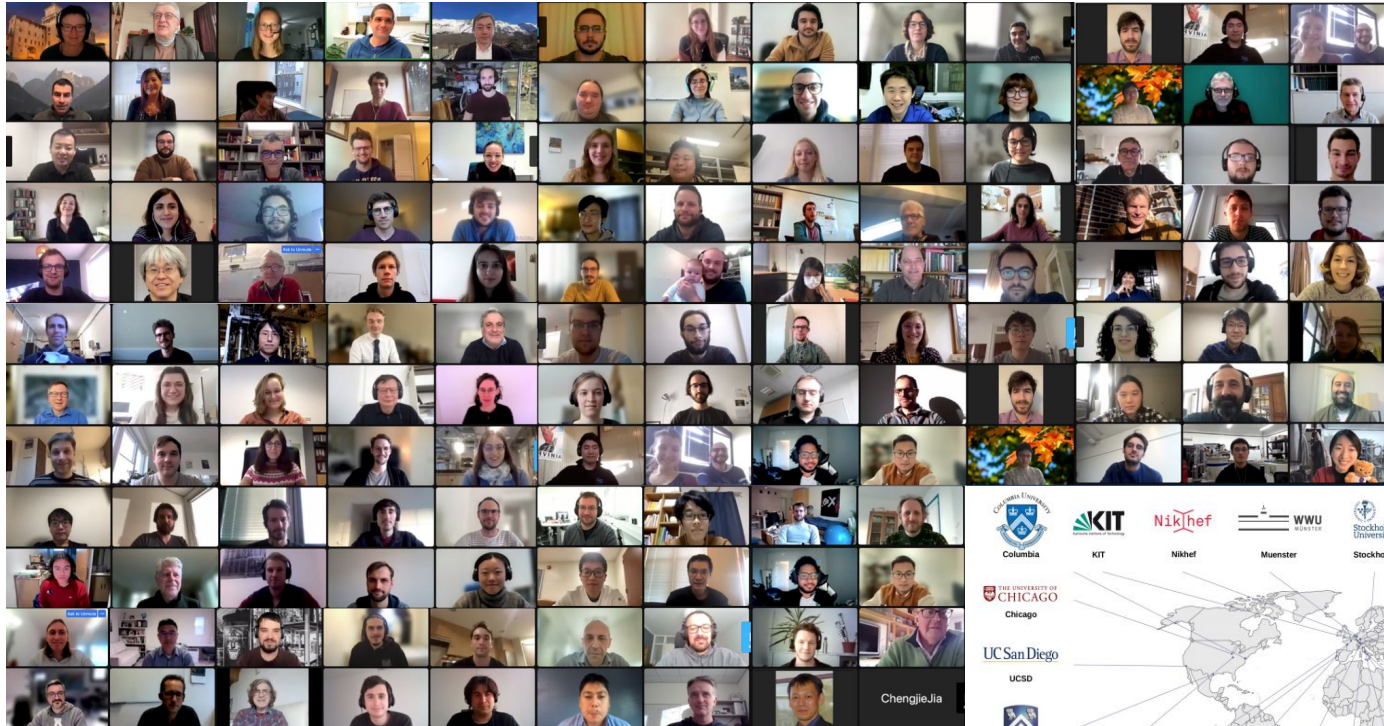
Future



XENON10	XENON100	XENON1T	XENONnT	DARWIN
2005 - 2007	2008 - 2016	2012 - 2018	2019 - 2023	2025 - ...
15 x 20 cm	30 x 30 cm	1 x 1 m	1.5 x 1.3 m	2.6 x 2.6 m
14 kg	62 kg	2 tons	5.9 tons	40 tons
$\sim 10^{-43} \text{ cm}^2$	$\sim 10^{-45} \text{ cm}^2$	$\sim 10^{-47} \text{ cm}^2$	$\sim 10^{-48} \text{ cm}^2$	$\sim 10^{-49} \text{ cm}^2$



Our team of eXplorers



XENON

- 27 Institutions Worldwide
- More than 180 Scientists

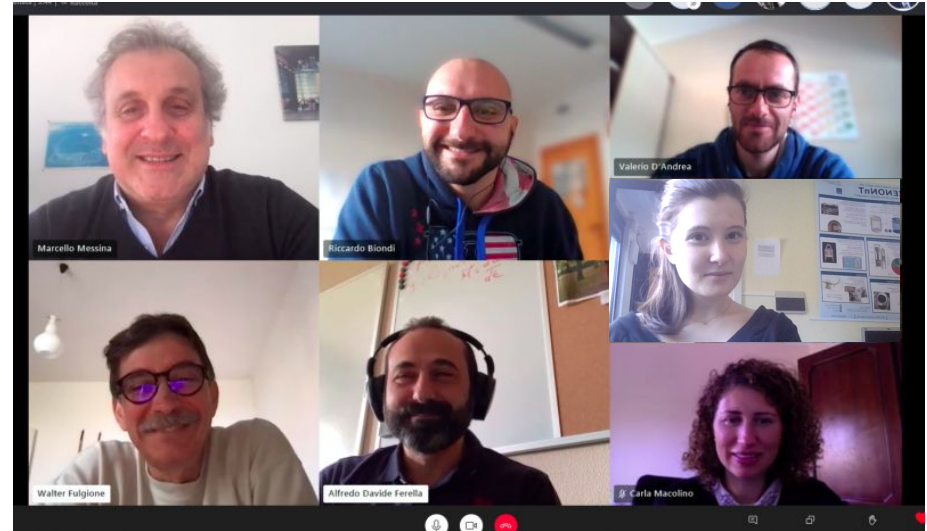
Columbia University
 Columbia
 KIT
 Nikhef
 WWU Münster
 Stockholm University
 Mainz
 MPIK, Heidelberg
 Freiburg
 Zurich
 University of Zurich
 Tsinghua University
 Tsinghua
 清华大学
 東京大学
 The University of Tokyo
 Tokyo
 Nagoya University
 Nagoya
 Kobe University
 Kobe
 Purdue University
 Purdue
 Subatech
 Coimbra
 LPNHE
 INFN
 Torino
 Bologna
 L'Aquila
 INFN GSSI
 LNGS - GSSI
 Napoli
 Weizmann
 NYU Abu Dhabi
 NYUAD



The local group



- **Walter Fulgione** (LNGS - Group responsible)
- **Marcello Messina** (LNGS - XENONnT Technical Coordinator)
- **Alfredo D. Ferella** (UnivAQ - Professor)
- **Carla Macolino** (UnivAQ - Professor)
- **Valerio D'Andrea** (UnivAQ - PostDoc)
- **Riccardo Biondi** (LNGS - PostDoc)
- **Cecilia Ferrari** (GSSI - PhD Student)
- **Andrea Melchiorre** (UnivAQ - Master Student)



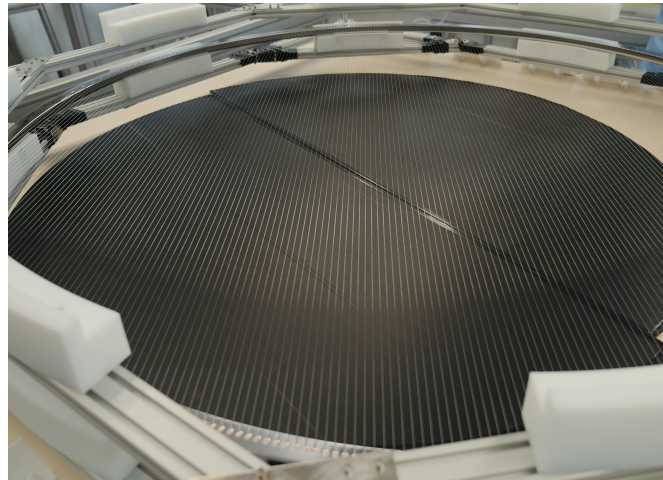
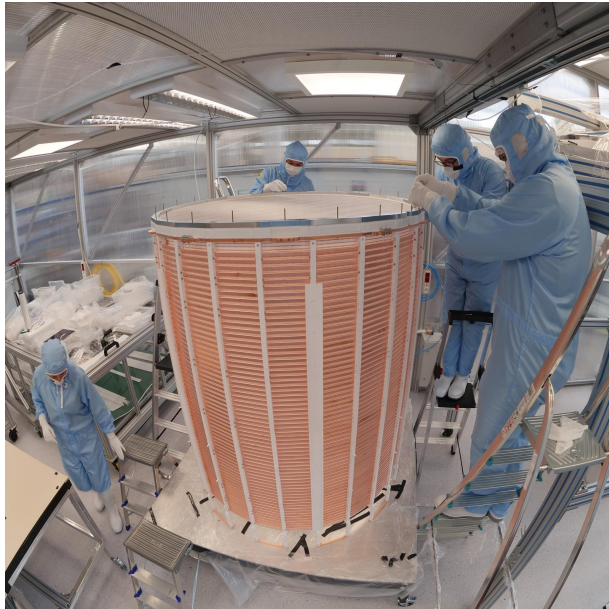
A little group embracing three different institutions.





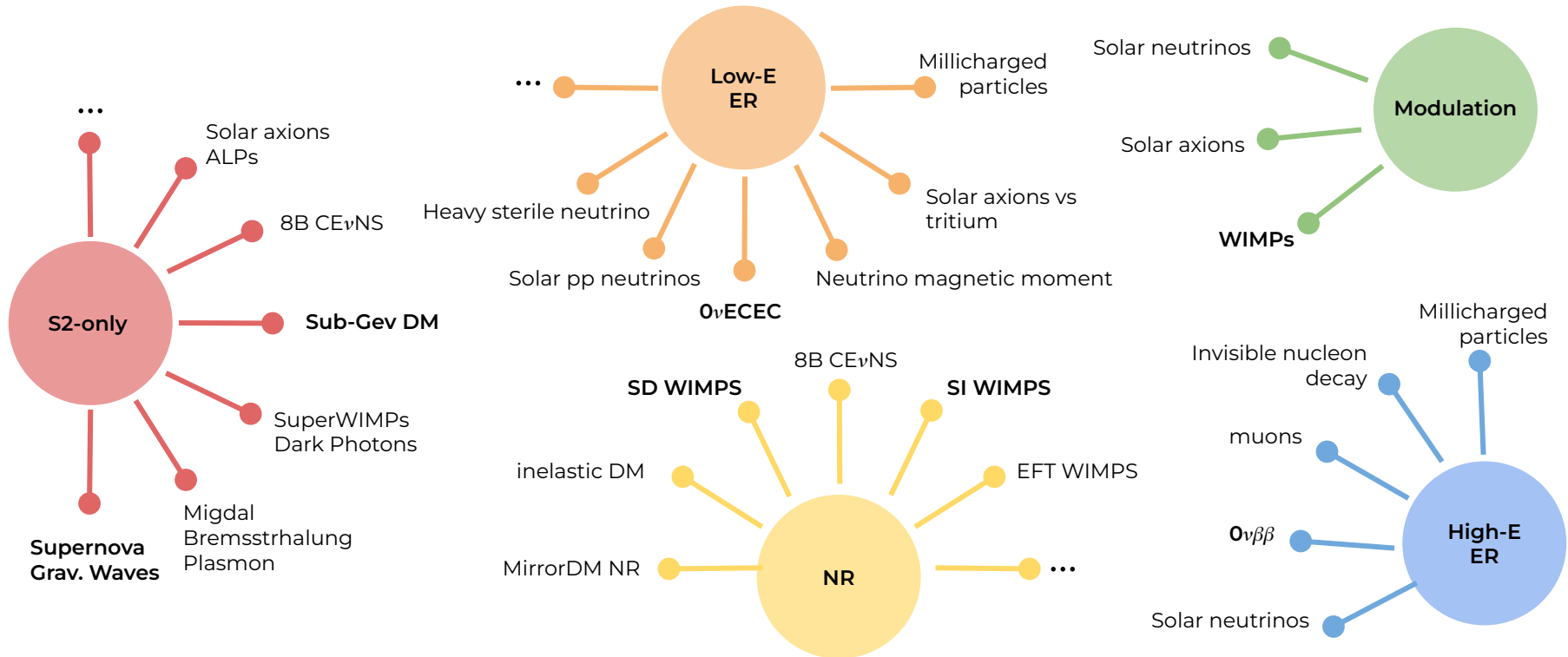
Hardware activities

- Realization and Installation of new Electrodes for the XENONnT TPC
- MugPump for GXe purification





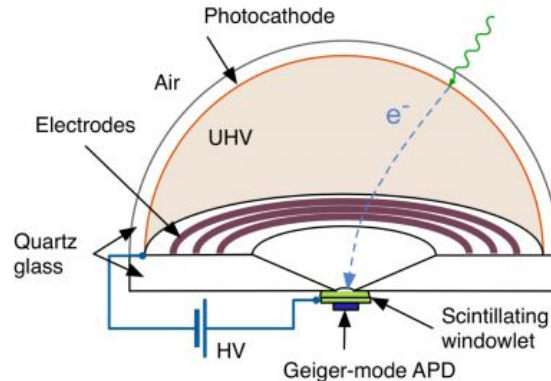
Current Science Analysis Topics





- The **ABALONE photosensor** is a modern, scalable, cost-effective, robust alternative to PMT and SiPM
- **High radiopurity** due to absence of metal
- **High detection performance**: UV sensitivity, low afterpulsing rate, sub-ns timing resolution
- Sensor like G-APD needed to detect photon signal from scintillator

R&D at LNGS and at Stockholm University



Activities on-going!

- Setup optimization
- Data analysis for detector characterization
- GEANT4 simulations
- Characterization in LXe



Join the group!



XENONnT SRO is just finished and data will be unblinded soon. But a **new science run** is coming, and you could be one of the few people so lucky to put their hand on this scientific treasure!

And also, if you are not afraid to get your hand dirty with a little mechanic, electronics, hydraulic ecc...

You will have a lot of fun in joining us!



So, if you want to know more about Xenon and Darwin, just **contact us!!**

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- riccardo.biondi@lngs.infn.it
- valerio.dandrea@lngs.infn.it

It is only in the heart of the mountain that one can see rightly;
What is fundamental in physics is invisible to the eye.

Edited from Antoine de Saint-Exupéry, [The Little Prince](#)



DARWIN

