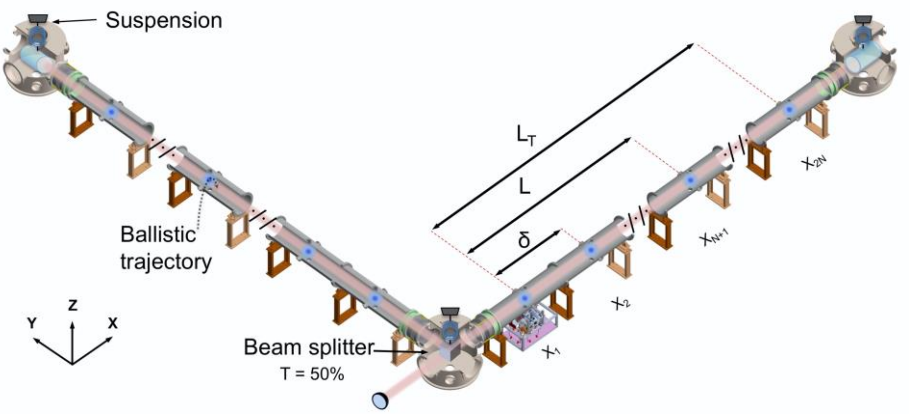


**International
Research Network
(IRN)
ELGAR**

ELGAR - a European Laboratory for Gravitation and Atom-interferometric Research

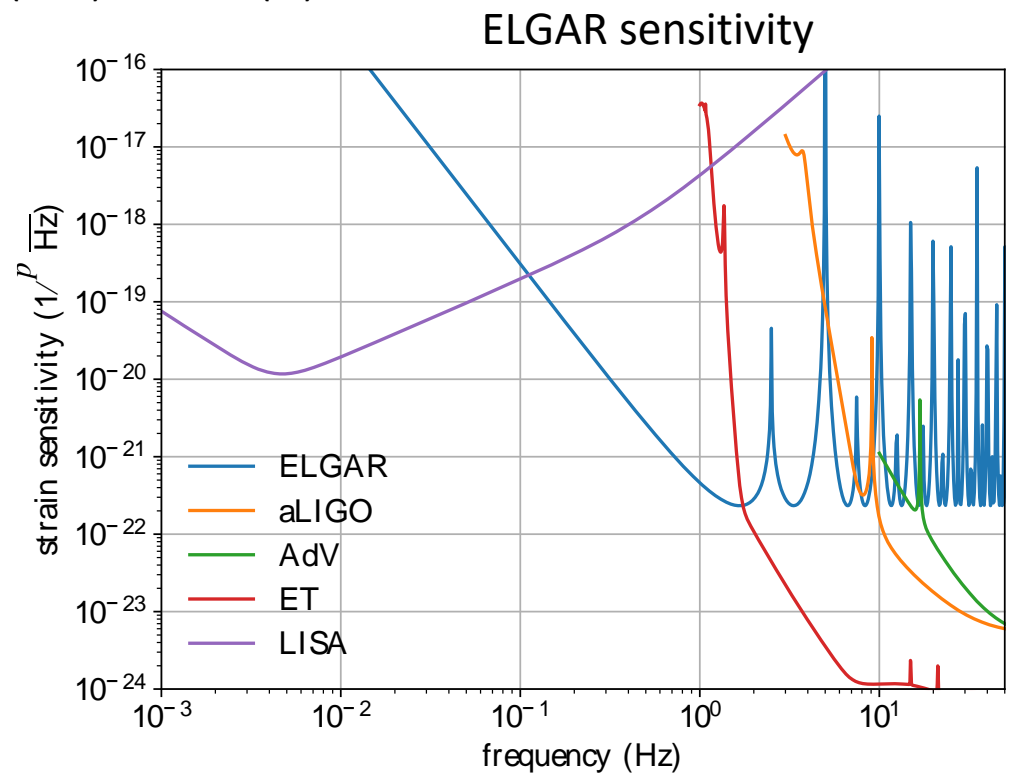
- Build an underground infrastructure based on large scale AI, to study space-time and gravitation with the primary goal of detecting **GWs in the infrasound band** (0.1 Hz-10 Hz).
- Opens multi-band GW astronomy: new sources, precision gravity/cosmology tests....
- ELGAR initiative is sustained since 2014 by a research group that now gathers about 60 scientists from more than 20 labs over 6 EU countries.
- Relies on large national initiatives for quantum technologies: MIGA (FR), VLBAI (GER), MAGIA (IT), UK National Quantum Technology Hub.



From Class. Quantum Grav. 37 225017 (2020)

Based on array of Atom gradiometers that reduces the contribution of Gravity Gradient Noise

Atomic source	
Species	^{87}Rb
Loading source	2D+ MOT
Equivalent atomic flux ^a	$1 \times 10^{12} \text{ s}^{-1}$
Ensemble type	ultracold source
Expansion velocity ($T_{\text{eff}} \approx 100 \text{ pK}$)	$100 \mu\text{m s}^{-1}$
Vertical launching velocity	4 m s^{-1}
Cloud size ^b	16 mm
Detector	
Single gradiometer	
Configuration	Double loop, four pulses
Interrogation time	$4T = 800 \text{ ms}$
Atom optics	Sequential Bragg
Momentum transfer	$2n = 1000 \hbar k$
Baseline	$L = 16.3 \text{ km}$
Peak strain sensitivity (at 1.7 Hz)	$4.1 \times 10^{-21} \text{ Hz}^{-1/2}$
Full detector	
Number of gradiometers per arm	$N = 80$
Gradiometer separation	$\delta = 200 \text{ m}$
Total baseline	$L_T = 32.1 \text{ km}$
Peak strain sensitivity (at 1.7 Hz)	$3.3 \times 10^{-22} \text{ Hz}^{-1/2}$



Objectives

- Organize coherently new research actions serving the objectives of ELGAR.
- Support the key technological future development of the ELGAR antenna
- Support the participation to specific conferences and enlarge the scientific community for the realization of the future infrastructure.
- Prepare and structure the future submission of ELGAR as design European call

Work Program

- WP1: Consolidating the science case and the technological aspects of the antenna
- WP2: Fostering collaboration between IRN members and enlarge the scientific support for

ELGAR:

- WP3: Organizing the support for the infrastructure realization at the EU level

Organization

Project Coordinator: Benjamin CANUEL (LP2N)

The steering committee: B. Canuel (LP2N), S. Gaffet (LSBB), S. Rosat (ITES), S. Guellati (LKB), A. Landragin (SYRTE), N. Christensen (ARTEMIS), A. Roura (DLR), A. Peters (Humboldt-Universität zu Berlin), D. Schlippert (LUH), F. Sorrentino (INFN), G. Tino (LENS), W. von Klitzing (FORTH), C. Sopena (IEEC), K. Bongs (University Of Birmingham).

Working Groups coordinators

- WG1 (Advanced atom source and matter wave manipulation techniques for ultra-sensitive matter-wave interferometry): D. Schlippert (LUH).
- WG2 (Strategies for Newtonian Noise (NN) reduction): S. Rosat (ITES) & W. Chaibi (ARTEMIS).
- WG3 (Advanced metrology and simulation of the antenna response for different sources): C. Sopena (IEEC) & A. Roura (DLR).

Members and Budget

Organisation			Country
Legal name		Short name	
1	Centre National De La Recherche Scientifique <ul style="list-style-type: none">LP2N Laboratoire photonique Numérique et nanosciencesSYRTE Systèmes de Références temps-espaceARTEMIS Astrophysique Relativiste, Théories, Expériences, Métrologie, Instrumentation, SignauxLSBB Laboratoire souterrain à bas bruitLKB Laboratoire Kastler BrosselITES Institut Terre Environnement Strasbourg	CNRS	FR
2	Gottfried Wilhelm Leibniz Universitaet Hannover	LUH	DE
3	IDRYMA TECHNOLOGIAS KAI EREVNAS	FORTH	GR
4	Istituto Nazionale Di Fisica Nucleare	INFN	IT
5	Institut d'Estudis Espacials de Catalunya	IEEC	ES
6	University Of Birmingham	UOB	UK
7	Institut für Quantentechnologien, Deutsches Zentrum für Luft- und Raumfahrt (DLR)	DLR	DE
8	Humboldt-Universitaet Zu Berlin	HUB	DE
9	European Laboratory for Non-Linear Spectroscopy	LENS	IT

Country	Budget(€)
France	73500
Germany	44100
Italy	24300
Spain	12000
UK	12900
Greece	7200

Total	174000
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