

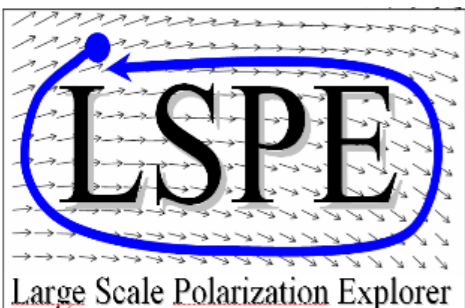


UNIVERSITÀ  
DEGLI STUDI  
DI FERRARA  
- EX LABORE FRUCTUS -

# LSPE

## the Large-Scale Polarization Explorer

Luca Pagano



Ferrara, July 5th, 2021



# LSPE in a nutshell

---

- The **Large-Scale Polarization Explorer** is:
  - an experiment to measure the polarization of the **CMB** at large angular scales
  - Frequency coverage: 40 – 250 GHz (5 channels, 2 instruments: **STRIP** & **SWIPE**)
  - **SWIPE**: a spinning stratospheric balloon payload at high frequency to avoid atmospheric noise flying long-duration, in the polar night. Equipped with a polarisation modulator to achieve high stability
  - **STRIP**: Using a ground based complementary instrument at low frequency, located at high altitude in Tenerife
  - Current collaboration: Italy + UK (Cardiff, Manchester and Oxford)
- Angular resolution: 1.3 degree FWHM. Sky coverage: ~30% of the sky
- Combined polarizatton sensitivity: <10  $\mu$ K arcmin per flight
- Targets:
  - CMB **B-Mode** reionization and recombination bumps
  - Cosmic **variance limited reionization optical depth** measure

PI ASI **SWIPE** (balloon borne) Paolo de Bernardis (Università La Sapienza, Roma, Italy)

PI ASI **STRIP** (ground based) M. Bersanelli (Università di Milano Statale)

Sigla INFN: GE (Gatti), FE (Pagano), MI (Caccianiga) PI (Signorelli), RM1 (de Bernardis), RM2 (Rocchi)

# Activity in Ferrara (2020/2021)

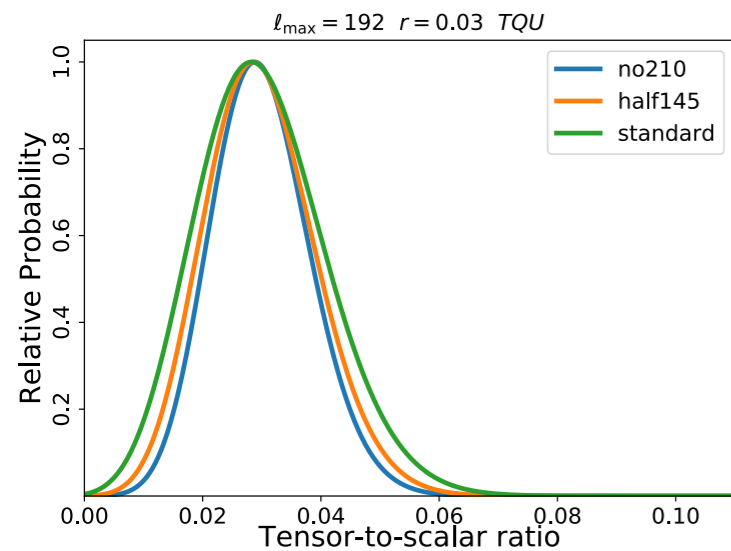
Mainly focussed on: White Paper with updated performance status: final iteration refs, minor comments

## The Large Scale Polarization Explorer (LSPE) for CMB measurements: performance forecast

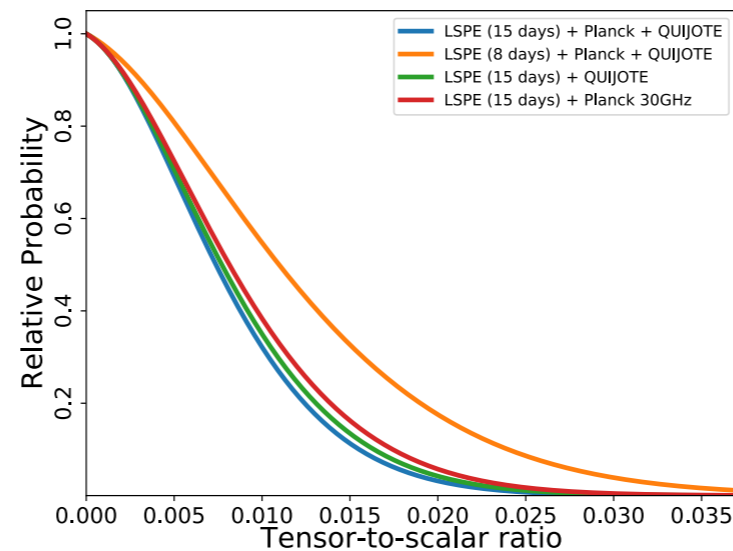
<https://arxiv.org/abs/2008.11049>

Several contributions:

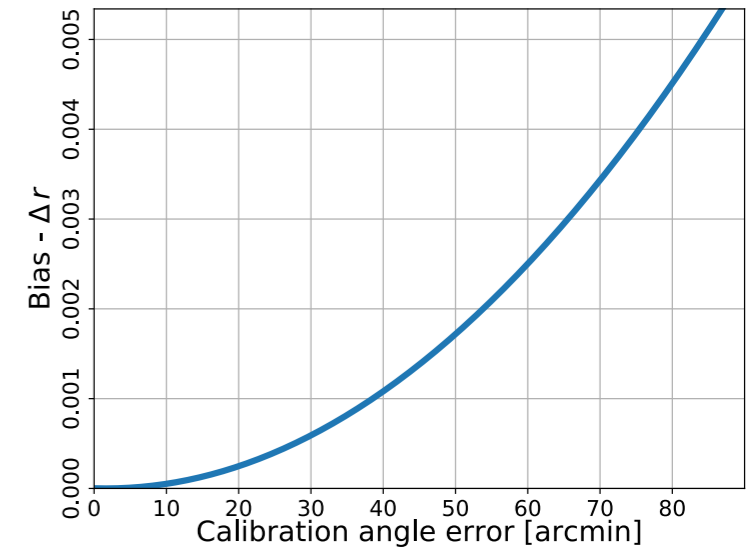
**Focal Plane optimization:**



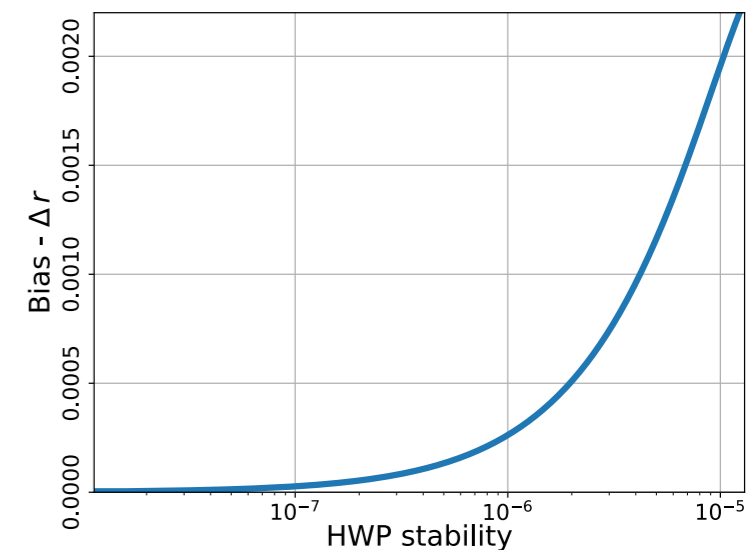
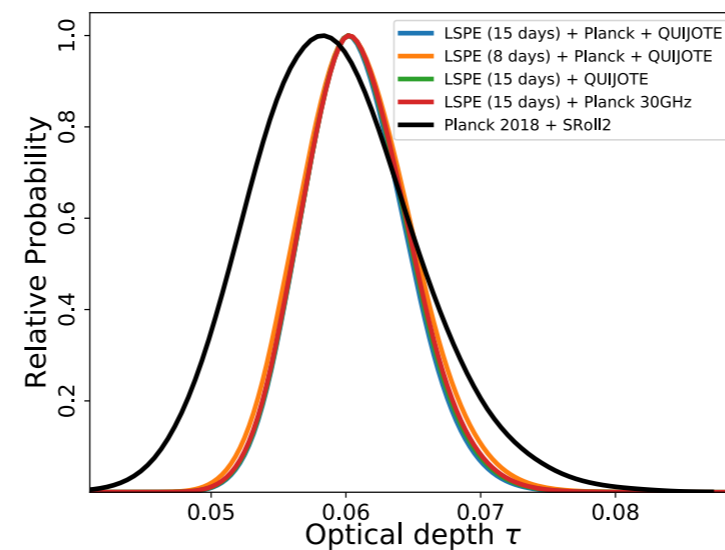
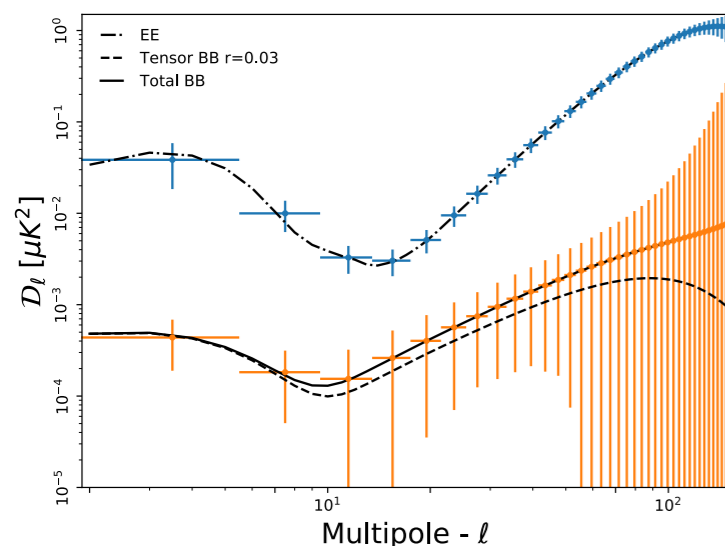
**Performance forecast:**



**Impact of systematic effects:**



**Foreground cleaning and spectra est.:**



# Activity in Ferrara (.../2020/2021/2022/...)

Suite of codes under development within the INFN gitlab:

[https://baltig.infn.it/cosmology\\_ferrara/lspe](https://baltig.infn.it/cosmology_ferrara/lspe)

- Flight Simulator
- Component separation
- Spectrum estimation
- Likelihood
- Cosmological Parameters

The screenshot shows the GitLab interface for the project 'LSPE' (Project ID: 1557) under the namespace 'cosmology\_ferrara'. The left sidebar contains navigation options: Project, Details, Activity, Releases, Cycle Analytics, Repository, Issues (0), Merge Requests (0), CI / CD, Operations, Registry, Wiki, Snippets, and Settings. The main content area displays project statistics: 32 Commits, 1 Branch, 0 Tags, and 447.1 MB Files. A commit history table is visible, showing the most recent commit by Luca Pagano 4 weeks ago with the message 'solved a bug in the simulator and in the par estimation'. Below the table are buttons for adding project metadata like README, CHANGELOG, CONTRIBUTING, and CI/CD.

Name	Last commit	Last update
CAMB	new fiducial added	4 months ago
ancillary	likepixel_mpi_covdiag_2par_QU added	1 month ago
lspe_simulator	solved a bug in the simulator and in the par estimation	4 weeks ago
parameter_estimation	solved a bug in the simulator and in the par estimation	4 weeks ago
tools	driver of new gird added	7 months ago

# Activity in Ferrara (2021/2022)

---

## 1. Preparation of the SWIPE pipeline:

- a. Data management definition (Instrument model and database)
- b. Simulation and low-level data analysis pipeline development (partially shared with LiteBIRD )
- c. Realistic systematic effects injection (cosmic rays, ...)
- d. Map-making (a specific code for SWIPE is necessary here)

## 2. High-level analysis pipeline preparation (substantially ready, some optimization necessary):

- a. Component separation (shared with TS)
- b. Likelihood
- c. Parameter estimation

### Main collaborations with:

- Roma1, for instrument model and data handling
- Milano, Roma1 for optimization of observational strategy
- SISSA, for foreground cleaning

# Anagrafica e Richieste (2021)

Ricercatori						
	Nome	Età	Contratto	Qualifica	Aff.	%
1	Chiocchetta Caterina		Associato	Dottorando	CSN II	100
2	Gruppuso Alessandro		Associato	Ricercatore Confermato (Ricercatore)	CSN II	25
3	Pagano Luca		Associato	Ricercatore B Tempo Determinato Tipo B	CSN II	75
Numero Totale Ricercatori				3	FTE: 2.00	

Tecnologi						
	Nome	Età	Contratto	Qualifica	Aff.	%
Numero Totale Tecnologi				0	FTE: 0.00	

Tecnici						
	Nome	Età	Contratto	Qualifica	Aff.	%
1	Chiozzi Stefano		Dipendente	Collaboratore Tecnico E.R.		10
Numero Totale Tecnici				1	FTE: 0.10	

Servizi			M.U.
	Servizio		
1	Elettronica cotta@fe.infn.it		1.00
Totale Mesi/Uomo Servizi Per LSPE Ferrara			1.00

Sigla Loc.	Capitolo	Riunione	Note Alla Richiesta	Rich.	Rich. SJ	Assegn.	Assegn. SJ	Assegn. Dot.	Commento Alla Assegnazione
FE	MISS	Assegnazioni	Meeting di collaborazione in Italia (uno ogni 2 mesi x 4 persone su 2gg)Â§	7.0	0.0	7.0	1.0		A corpo. SJ situazione COVID
		Assegnazioni	Missioni per integrazione elettronica con nodo di Pisa (1 MU)Â§	4.0	0.0	0.0			
		Assegnazioni	Conferenza internazionale di cosmologia per 2 persone, per pubblicizzare LSPEÂ§	6.0	0.0	0.0			
		Totale MISS			17.0	0.0	7.0	1.0	0.0
	LIC-SW	Assegnazioni	Rinnovo licenze software per data analysis (IDL, Matlab, Mathematica)Â§	3.0	0.0	1.0			
Totale LIC-SW			3.0	0.0	1.0	0.0	0.0		
Totale FE				20.0	0.0	8.0	1.0	0.0	

# Anagrafica e Richieste (2022)

---

- Luca Pagano: **0.75**
- Alessandro Gruppuso (INAF Bo): **0.25**
- Caterina Chiocchetta: **1.0**

Attività officina elettronica terminata

Variazione:

- Stefano Chiozzi: **-0.1**

Totale FTE: **2.0**

Richieste:

- Meeting di collaborazione in Italia (uno ogni 2 mesi x 3 persone su 2gg): 7 K€
- Conferenza internazionale di cosmologia per 2 persone, per pubblicizzare LSPE: 6k€