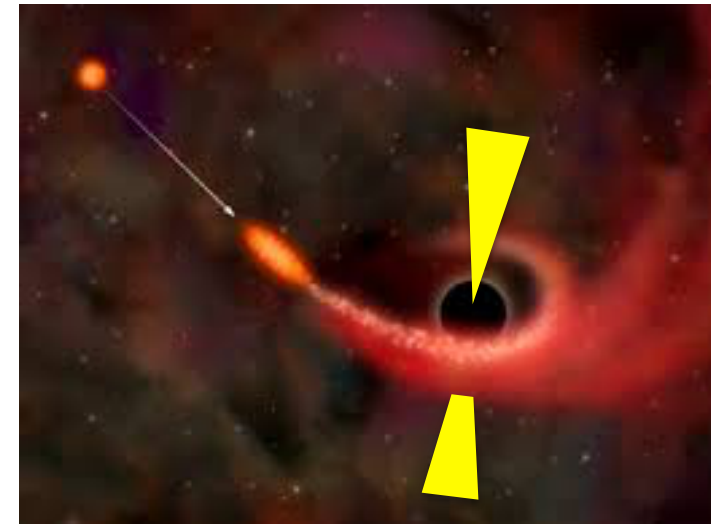
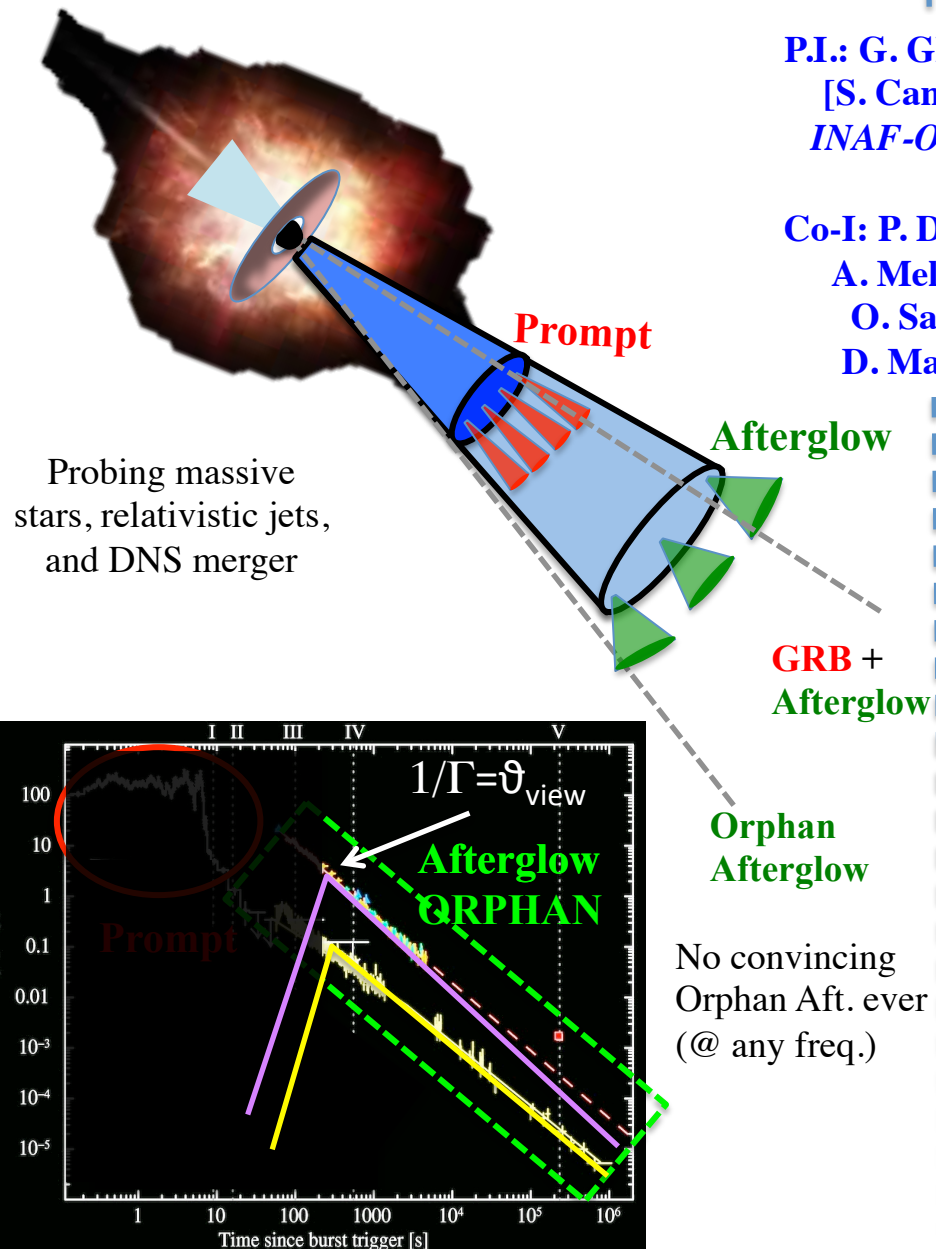


# Gamma Ray Bursts AND Tidal Disruption Events

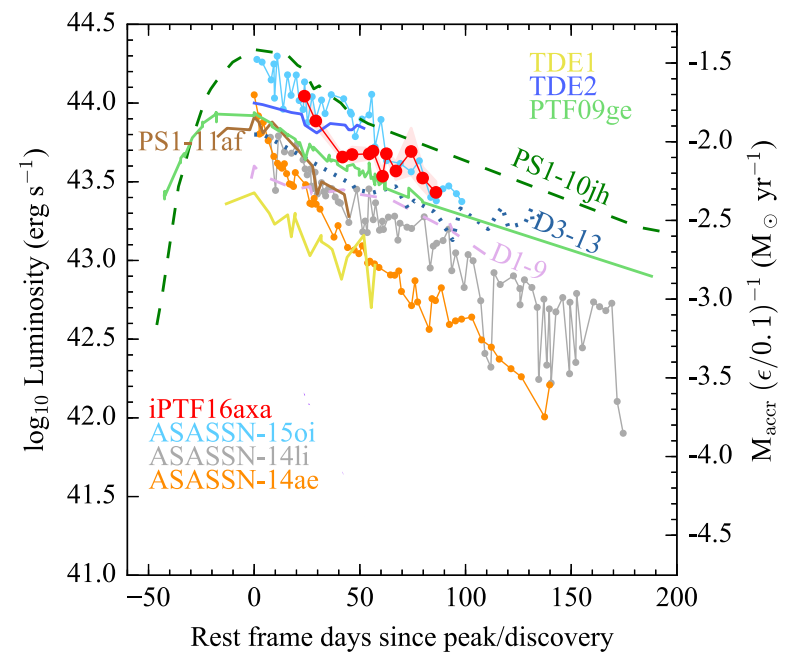
(orphans and parents)

P.I.: G. Ghirlanda,  
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Real time probes of SMBHs and accretion physics ... some jets



## Scientific objectives of the project

Preparatory  
(now – 2019)

### Rates of GRBs and TDEs in the reach of LSST

- a) Long GRBs
  - b) Short GRBs
  - c) TDE (population + dynamics + emission regimes)
- } population + emission components

### Strategies

#### 1. Classification:

- a) Spectroscopy
- b) Light curve
- c) Diagnostic tools

#### 2. MW follow up

### JETs:

- a) Measurements of  $\theta_{\text{jet}}$  in long and short GRBs
- b) Probing the structure of jets in GRBs
- c) Constraints on jetted TDE (jet origin and accel.)

### Progenitors/Engine:

- a) Long GRB-SN connection
- b) Short GRB progenitors (macronova, pre/post-merger dynamics)
- c) Fall back / accretion / debris dynamics (TDE and GRB)
- d) Dormant SMBH census from TDE
- e) TDE from NS

### Hosts/Environment:

- a) Long/short GRB closest “pristine” environ (off-axis)
- b) Large host samples
- c) Circum BH environ
- d) BH (from IM to SM) mass function
- e) TDE role in AGN-BH growth

>> 2019

## Working Groups and Activities

	Topics		Coordinator	Participants	Activities	
<b>Preparatory ( &lt; 2019 )</b>	<b>Rates</b>		<b>G. Ghirlanda</b>	<i>O. Salafia, D. Mainetti</i> R. Salvaterra, G. Lodato, M. Colpi, E. Rossi, G. Ghisellini, A. Franchini, A. Pescalli, L. Nava, M. Colpi, M. G. Bernardini, T. Sbarrato	Populations	Long
						Short
						TDE
	<b>Strategy</b>	<b>Classific.</b>	<b>S. Campana</b>	<i>D. Mainetti, O. Salafia</i> S. Covino, M. C. Baglio, G. Oganesyan, V. D'Elia, I. Donnarumma	Spectroscopy (different phases) + photometry, definition of diagnostic tools	
		<b>Follow up</b>	<b>P. D'Avanzo A. Melandri</b>	<b>S. Campana</b> , G. Tagliaferri, S. Covino, G. Oganesyan	MW follow up strategy with other facilities	
<b>Observations</b>	<b>LSST</b>		<b>S. Campana G. Ghirlanda</b>	<i>A. Melandri, P. D'Avanzo, D. Mainetti, O. Salafia</i> , S. Covino, V. D'Elia, G. Tagliaferri, R. Salvaterra	Data analysis (shortest cadence) + follow up (early spectroscopy + MW follow up)	
<b>Jets</b>	Structure Distribution Jet formation		<i>O. Salafia</i>	<b>G. Ghirlanda</b> , G. Ghisellini, L. Nava, E. Rossi	Light curve modelling (short!) Population rates (on-off axis)	
<b>Progenitors/ Engine</b>	GRB-SN Mergers/mass eject. Fall back/accretion IMBH-SMBH		<b>A. Melandri</b>	<i>D. Mainetti, O. Salafia, M. G. Bernardini</i> , M. Colpi, G. Lodato, S. Covino	Light curve modelling Spectroscopy BH dynamics	
<b>Hosts/ Environments</b>	Pristine medium Host demography BH-TDE connection		<b>P. D'Avanzo</b>	<b>S. Campana</b> , R. Salvaterra, S. Covino, G. Tagliaferri	Spectroscopy	

## Observations from other facilities

	Coordinator	Participants	Other Facilities
High Energy to Very High Energy	<b>G. Ghirlanda</b>	<i>O. Salafia, S. Campana, M. G. Bernardini, A. Pescalli, L. Nava, S. Covino, F. Tavecchio</i>	Fermi, Swift_BAT, Magic, AGILE, Integral <b>CTA, SVOM</b>
X-ray	<b>P. D'Avanzo</b>	<i>A. Melandri, S. Campana, M. G. Bernardini, F. Coti Zelati, G. Tagliaferri</i>	Swift-XRT, XMM-Newton, Chandra <b>IXPE</b> <b>eROSITA, Athena</b>
Optical	<b>S. Campana</b>	<i>A. Melandri, D. Mainetti, S. Covino, V. D'Elia, R. Salvaterra, M. C. Baglio</i>	Swift-UVOT, ESO-NTT, TNG, VST, REM, VLT X-Shooter, NOT-NTE, LBT <b>SOXS (P.I. Campana)</b> <b>JWST, e-ELT</b>
mm to Radio	<b>A. Melandri</b>	<b>G. Ghirlanda</b> , S. Covino I. Donnarumma	VLA, EVN, VLBI(A), SRT, ALMA <b>Pre-SKA, SKA</b>

### Future Facilities

SOXS = Son Of X-Shooter (P.I. Campana). Expected 2019-2020

0.35-1.75  $\mu\text{m}$

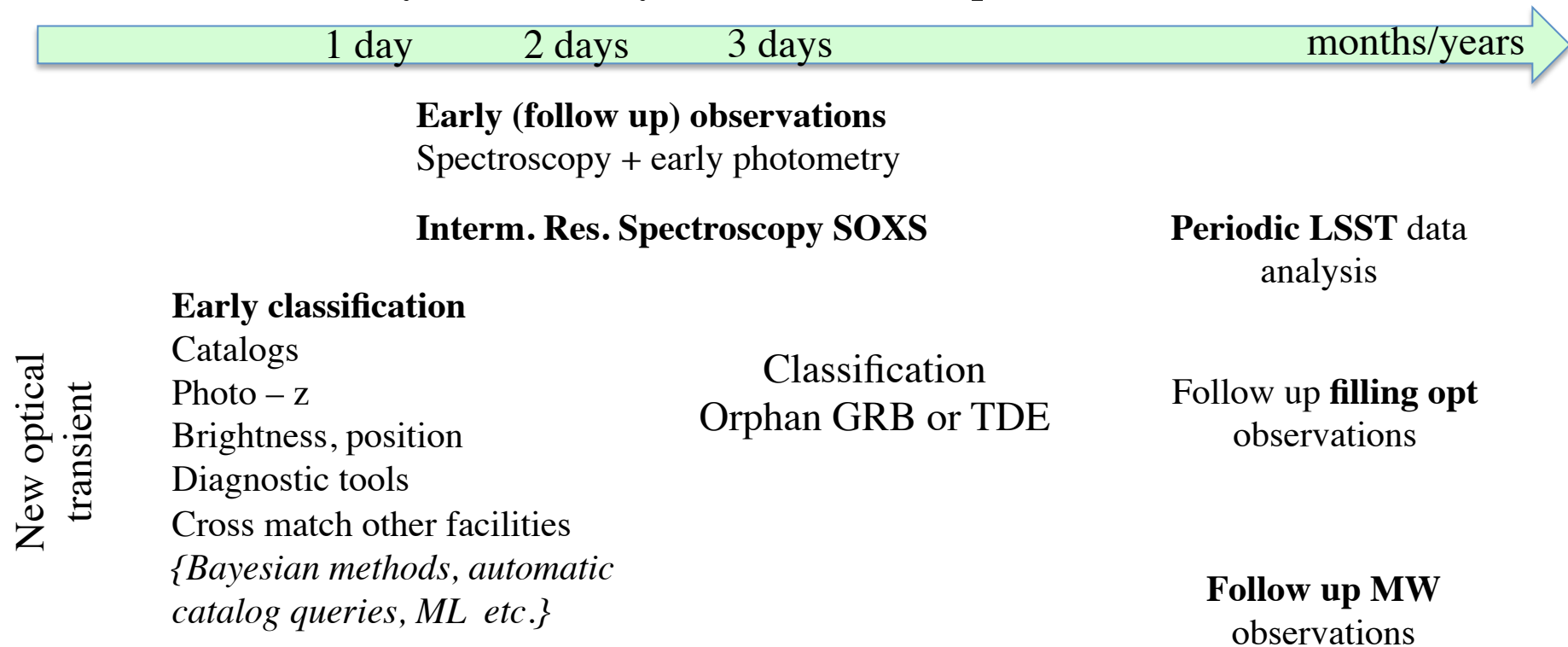
R~4500

@NTT

Goal: cont spect R=20.5 @ 10 $\sigma$  (1h)

SOXS  $\rightarrow$  > 180 night per year for transients

## Data analysis necessary/foreseen, development and cadence



The **core team** consists of 4 units.  
Expected needs for the project

Phase	Activity	Needs	HW
Early ( < 2019 )	Rates + Strategies	2 Positions YR full time	Workstation & upgrade
> 2019	LSST data analysis	2+2 Positions YR full time	

GRB: 50 yr<sup>-1</sup> orphan Long + 25 orphan Short GRBs  
 100-6000 yr<sup>-1</sup> TDE  
 25 yr<sup>-1</sup> Long GRBs + 5 yr<sup>-1</sup> Short GRBs with HE  
 10 – 600 yr<sup>-1</sup> jetted TDEs

**DEVELOPMENT****Scientific objectives of the project**Preparatory  
(now – 2019)**Rates of GRBs and TDEs in the reach of LSST**

- a) Long GRBs
  - b) Short GRBs
  - c) TDE (population + dynamics + emission regimes)
- } population + emission components

**Strategies****1. Classification:**

- a) Spectroscopy
- b) Light curve
- c) Diagnostic tools

**2. MW follow up**

Long GRB population synthesis code with afterglow dynamics and emission (accounting for geometry and beaming) from the early to the NR phase.

Mostly done  
(GG+2010,  
2014)

Simulation for early spectroscopy and follow up strategy

To do

Short GRB population synthesis code with afterglow dynamics and emission (accounting for geometry and beaming) from the early to the NR phase + Macronova component.

80%  
done

Light curve templates and filling follow up (optical and MW)

20%  
done

Short and long GRB low Bulk velocity jets

To do

TDE population synthesis code with full dynamics of debris and evolution, including corona and stream stream shock interaction and cosmological parent AGN.

20%  
done

Optical and MW studies of existing populations in search of classification tools

To do

Alternative channels (DBH and NS TDE events).

To do

## Affiliations



# Gamma Ray Bursts and Tidal Disruption Events (orphans and parents)



**P.I.: G. Ghirlanda**  
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O. Salafia, D. Mainetti



 *LSST Science Collaboration*  
 *Sub-groups*

## Transients and Variable Stars

Fast Transients

Tidal Disruption Events

Supernovae  
Classification/Characterization  
Multiwavelength – Characterization

Galaxies

Active Galactic Nuclei