

Small **I**talian Telescopes. A Context in Evolution (INAF biased ... but not only INAF)

Massimo Turatto



WINE BOTTLE SIZE CHART

A chart detailing the various wine bottle sizes; Names and volumes (in liters).

Standard wine bottle = 750 ml / 75 cl



starting points

ESO's mission: i) to enable major scientific discoveries by constructing and operating powerful observational facilities that are beyond the capabilities of individual Member States and ii) to foster astronomical cooperation within its Member States.

INAF: similar to a smaller degree

"no interest in such instruments"

==> Small telescopes are TRANSPARENT (invisible) to INAF

(but REM)

Left to the Institutes (funding, management, upgrade, ...)

what is "small"?

here "small" (or SMT) means $\leq 2\text{m}$

INAF (1999 -)

need of understanding: costs, organisation, scientific production of optical SMT

2003 - Tornambe'+

"... invest modest resources in upgrade and to select/
support the projects according to COFIN model"

2006 - Gratton+Leone+Zitelli

Remit:

- 1- more detailed overview of SMT in Italy
- 2- plan of use in coordinate way

Gratton's Conclusions (2006)

SMT research:

- cheap (1.3%), in niches.
- suitable for large surveys, long time series for bright objects and for methods not available in other contexts.
- closure is not economically convenient (personnel and Administrations).

Mid term:

- increase productivity through reorganisation toward a Network (RON) of the best facilities

Long term (TBD, after 2011):

- transform into Outreach infrastruct. with exceptions for R&D and monitoring
- Stop turn-over

==> **Network (RON):**

a) **Facilities**, national interest

b) **Others**, specific projects (TRANSPARENT = not supported)

REM not considered (ESO agreement)

For Facilities only:

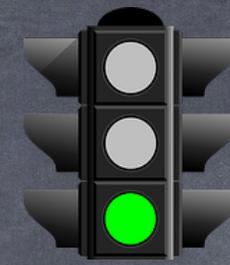
- INAF funds (~330 K€/yr) + local funding ==> Upgrade + Service Observing
- national time allocation together with LBT & TNG (single TAC)
- up to 2/3 as long-term programs, 1/3 local

A. - Management Board (CGE, board of institute directors)

B. - Science-Techno Committee (STC):

- approve the plans
- make suggestions for the optimization
- monitoring and control in a broad (TNG, LBT, ESO) context

07/2007 - ok by INAF Commissario



09/2007 - STC: Turatto, Brocato, Della Valle, Pasquini, Tosti, Zerbi

12/2007 - Implementation Plan by STC:

Short-term: Network (i.e. coordinated use) of:

- A. Asiago-1.8
- B. Loiano-1.5
- C. Campo Imperatore-1.1
- D. SLN-0.9
- E. REM-0.6

Long-term (in agreement with Long-term Plan of INAF):

- Outreach Transformation/Closure of "most" facilities in Italy
(driven by personnel retirement)
- Development new, devoted 2m-class tel in a good site

Where are we now?



Really nothing happened?

Predicted:

- need for Outreach increased
- reduction of personnel
- some closed (never open)

No Surprise:

- some/many SMT automatic/remote-control
- new actors in the world (LCOGT, ASAS-SN...)
- lot of science still appealing (GW !!!!)
- willy-nilly moving toward the "long-term goal"

IT: Outreach with Science Potential

| | | | |
|----------------------------------|-------------------------|-------------------|---------------------------------------|
| Aosta Valley Regional | 81 cm 5x 40cm WF | Region | Solar Corona Asteroids, ExoPL, AGN |
| Chianti Polifuct. 0 | 30⇒80cm Cameras | Municip/ UniFI | asteroids, VS, Exopl |
| Virtual Telescope Project 2.0 | 17", 14" +CCDs | commercial | Transients, Market |
| Antola Fascia Park | 80 cm + Echelle Spec | Region | AGN |
| GAL Hassin - Ishello | (100cm) | CIPE / Municip | OA-GRB, ExoPL, NEO, AGN |
| ... more | | | |

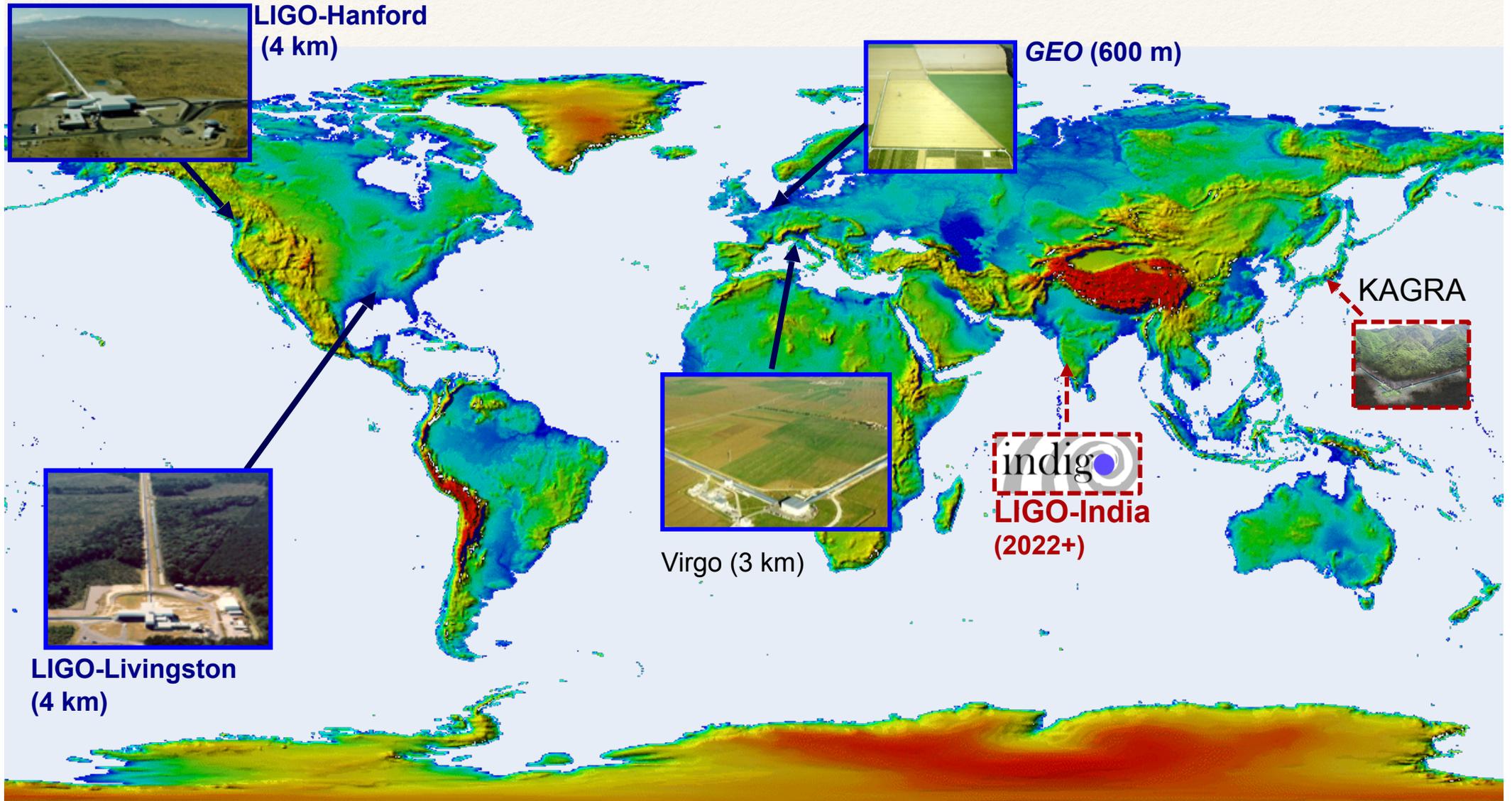
to be taken into account when/if a national SMT plan

Science first of all – also form SMT

- Solar System: NEO, asteroids, comets, ...
- Stars and stellar atmospheres: Stellar parameters MLT, Stellar Activity/Rotation, Magnetic Activity, Variability (CV ...), Formation, Open CL CMD, hard X-ray sources
- Asteroseismology (coverage)
- ExoPlanets: Transits
- Extragalactic: AGN census, QSO variability
- Survey follow-up: Gaia, Rave
- Transients: SN monitoring, Novae, GRB OA, Microlensing, GW EM

Mostly (not all) time domain

Ground-based Gravitational Wave Detectors



LIGO and Virgo detectors are currently being upgraded and will observe the sky (10-1000 Hz) as a single network

a recent test case

iPTF15dld

October 2015

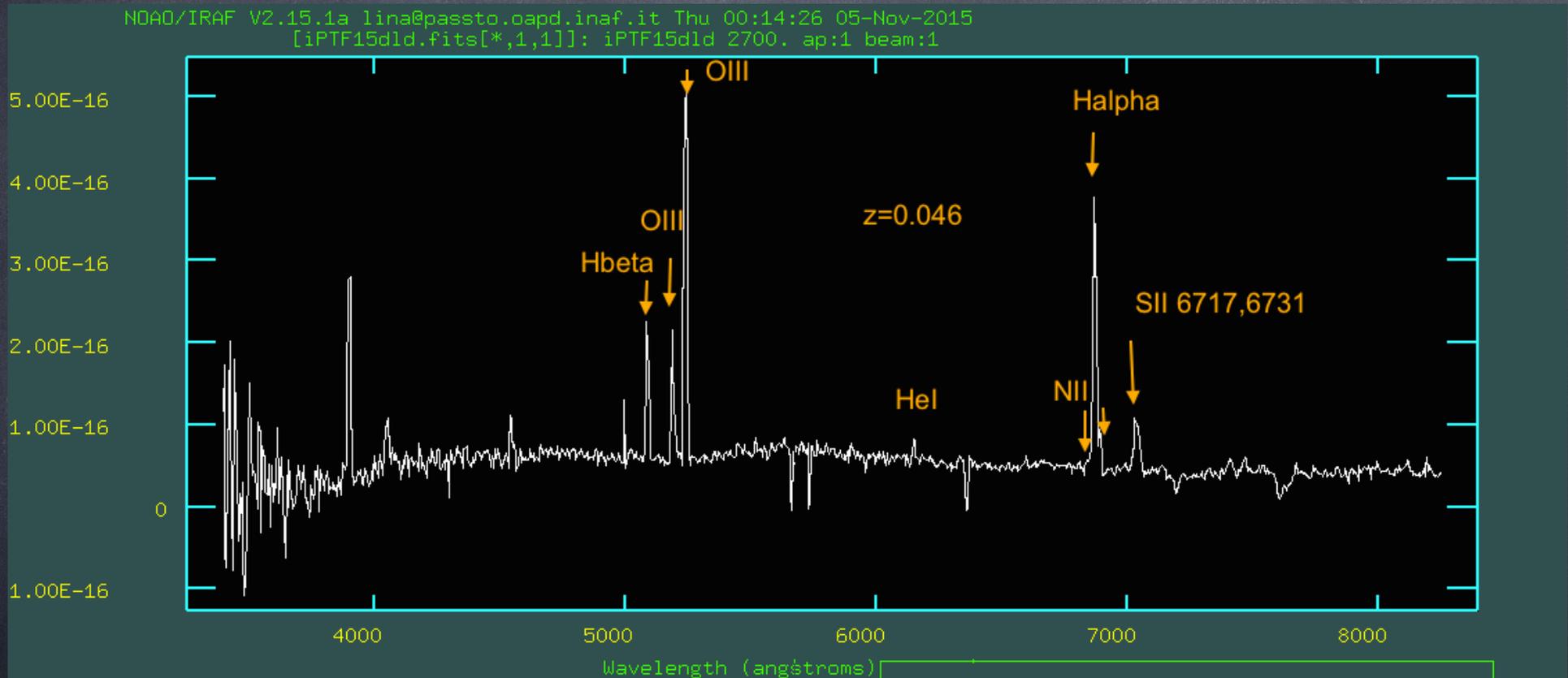
LIGO declassified

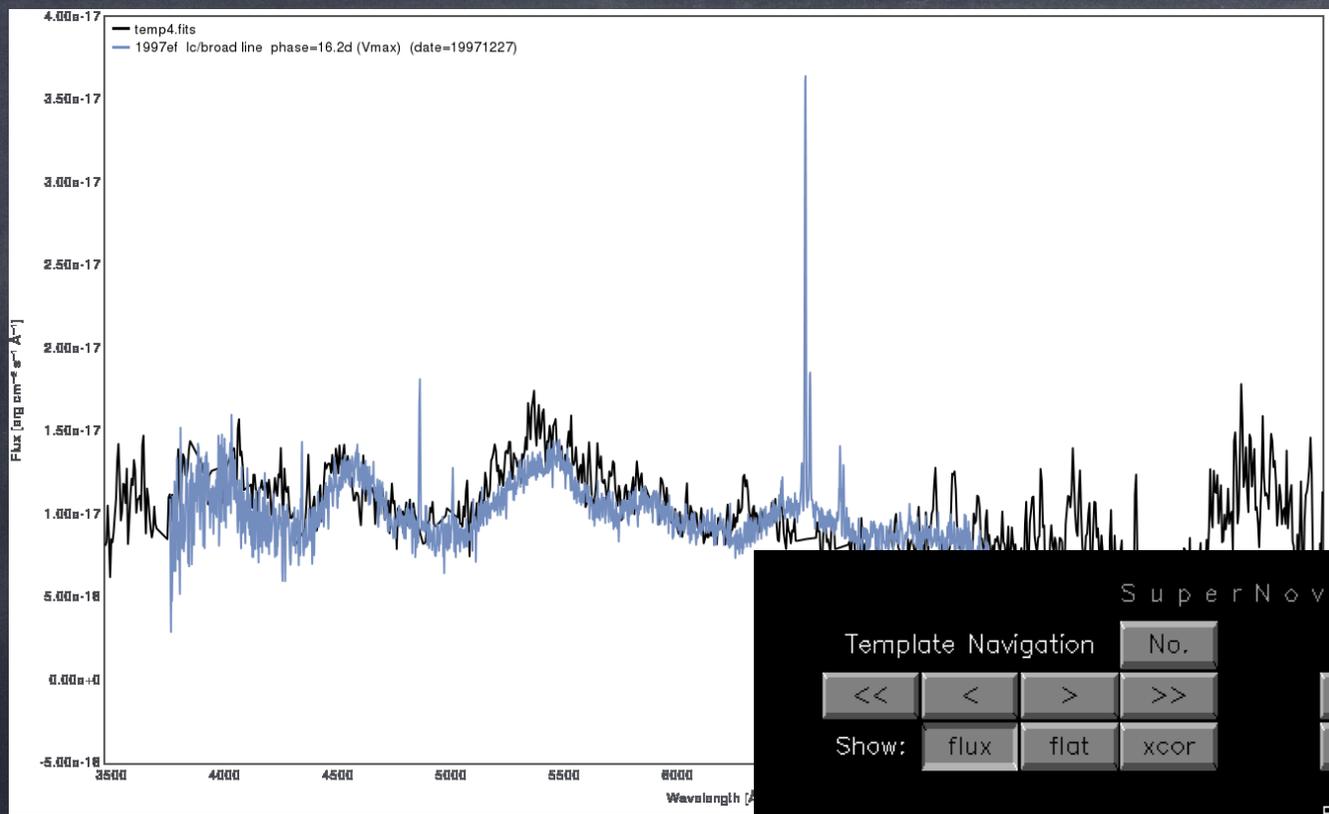


Asiago 182cm

The blob: a starburst at $z=0.045$

Asiago 182cm





Asiago 182cm - within a couple days
Ic/broad-line (SN 1997ef)
 (often associated to LGRB)
 + 16.2 days

TNG confirmed few days after

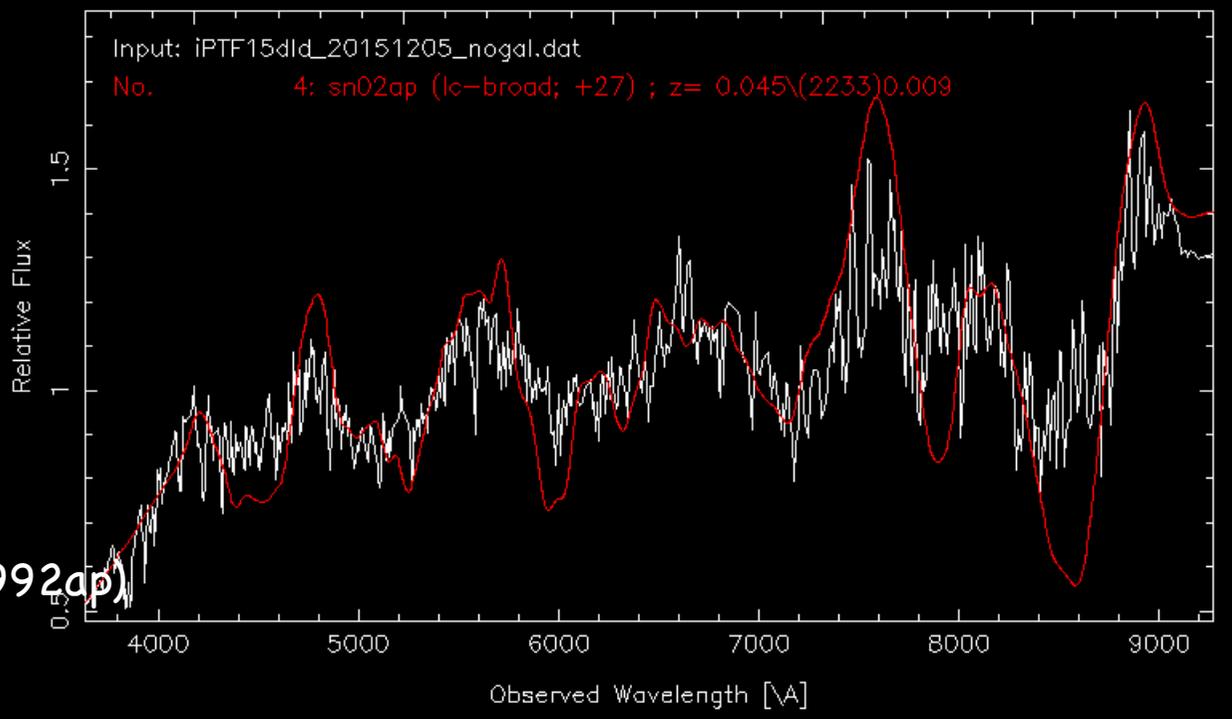
SuperNova IDentification (SNID) QUIT

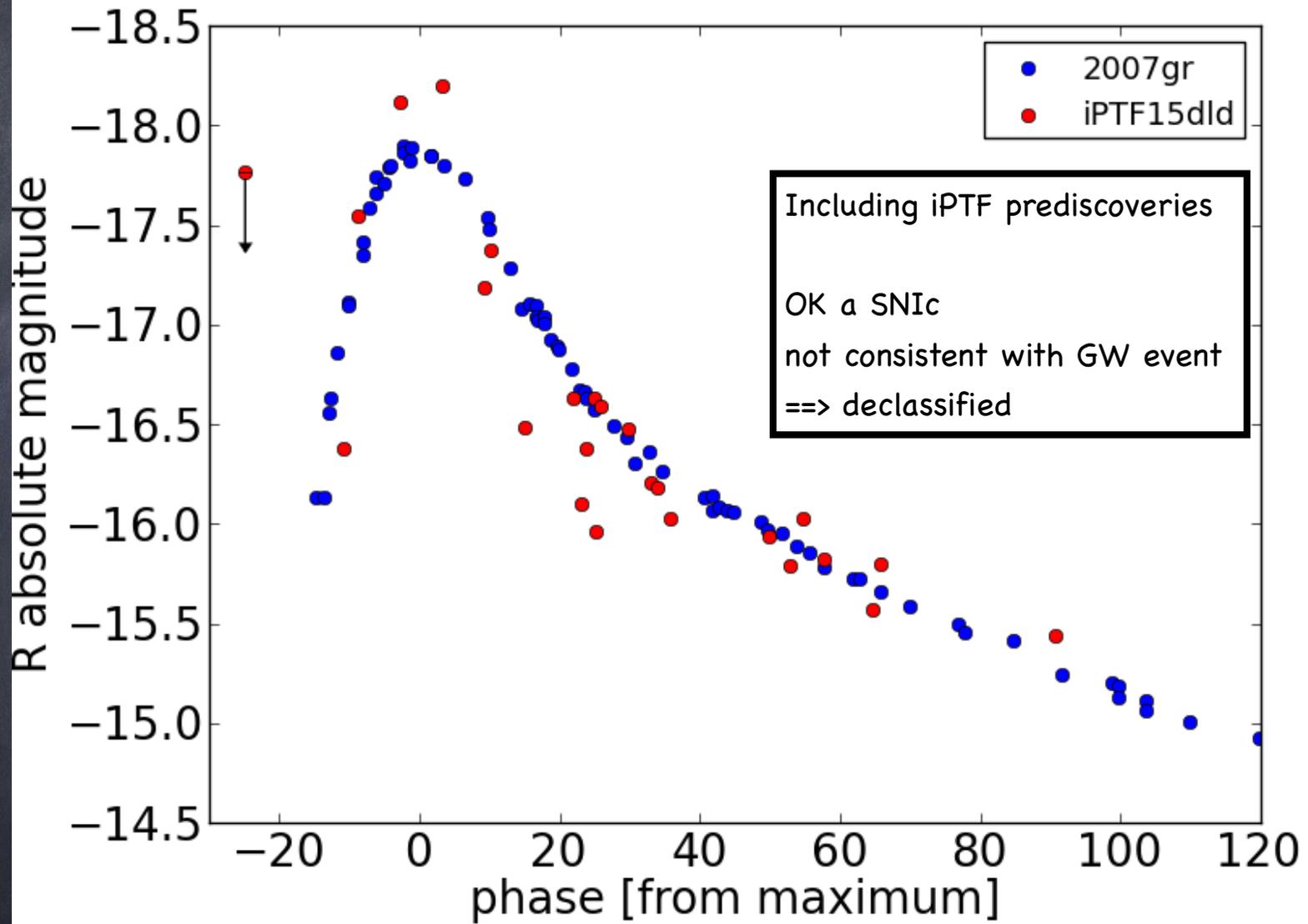
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Rest Wavelength [A]

ESO NTT - 1 month later
 confirmed

Ic/broad-line (SN1992ap)
 +27 days





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Long-term: 2011-2014

Report of the EU Tel Strategy Review Committee on Europe's 2-4m tel (for 2010-2020)

Emphasis on:

- Wide lambda coverage (0.4-2.4 μ m, at least 1.7 μ m)
- Override RRM/ToO mode
- 1 north + 1 south

Table 3: A list of identified capabilities that are incompletely/not met, requiring action. Suggestions for remedies and associated timescales are given in column 3.

| Capability | | Explanation | |
|--|-----------|--|--|
| ID & hemisphere/aperture | | problem | timescale/remedy |
| 1-1: $R \sim 5000$ optical wide-field spectrograph | N/4m | WHT/WYFFOS multiplex + unvignetted field inadequate | ~ 2015 on a 4-m |
| | S/4m | none available | new VISTA sp'graph after nir surveys |
| 1-2: $R > 20000$ optical wide-field spectrograph | N/4m | not available – needs 2-deg corrector | gain early S experience (below); combine with 1-1 capability |
| | S/4m | (as north) | AAT/HERMES buy-in and/or VLT/FLAMES use preparatory to new build |
| 2-1: highly stable $R \sim 10^5$ optical echelle sp'graph 2-3: $R \sim 70000$ nir echelle (with spectropolarimetry) | N/4m | HARPS-NEF private, temporary, uncertain | alternative from end of MOU (Mauna Kea pref.) |
| | either/4m | closest matches SPIRou, CARMENES not confirmed | ~ 2015 : support SPIRou or CARMENES |
| 3-1: $500 < R < 5000$ opt+nir spectroscopy | S/4m | ageing EFOSC2,SOFI: prospect of no 2-4m sp'graph of the class in the south | upgrade needed by 2015 |
| | N/4m | no northern son-of-X-shooter | new build for 2015+ |
| 4-1: wide-field nir imager | N/4m | northern cameras have $< 0.25 \text{ deg}^2$ FoV UKIDSS loss | 1 deg^2 camera on 4-m from 2015 |

NOT Transient Explorer – A new work-horse for the NOT

- 😊 A cross-dispersed spectrograph **covering 350-1700 nm, resolution ~4000** (possibly with also a higher-res mode), **single slit** (with different choices for the slit width), including ADC and efficient enough to be sky-limited in 30 min integration.
- 😊 Visible imager with 5-6 arcmin FOV, 2k x 2k detector, sampling 0.15-0.18 arcsec per pixel.
- 😊 Near-IR imager using a 2k x 2k HAWAII-II detector with same FOV and sampling as in the visible.
- 😞 De-scoped version: imaging reduced to a visible slit-viewing camera with FOV of 3 arcmin (similar to StanCam).

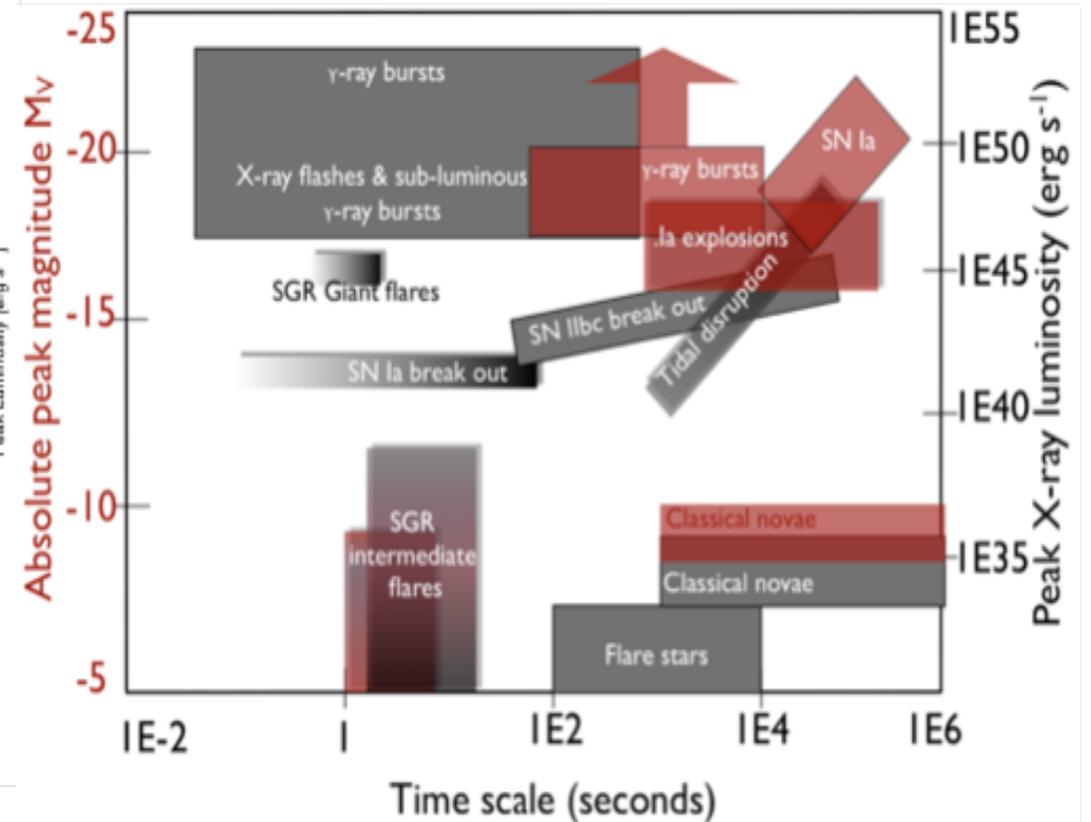
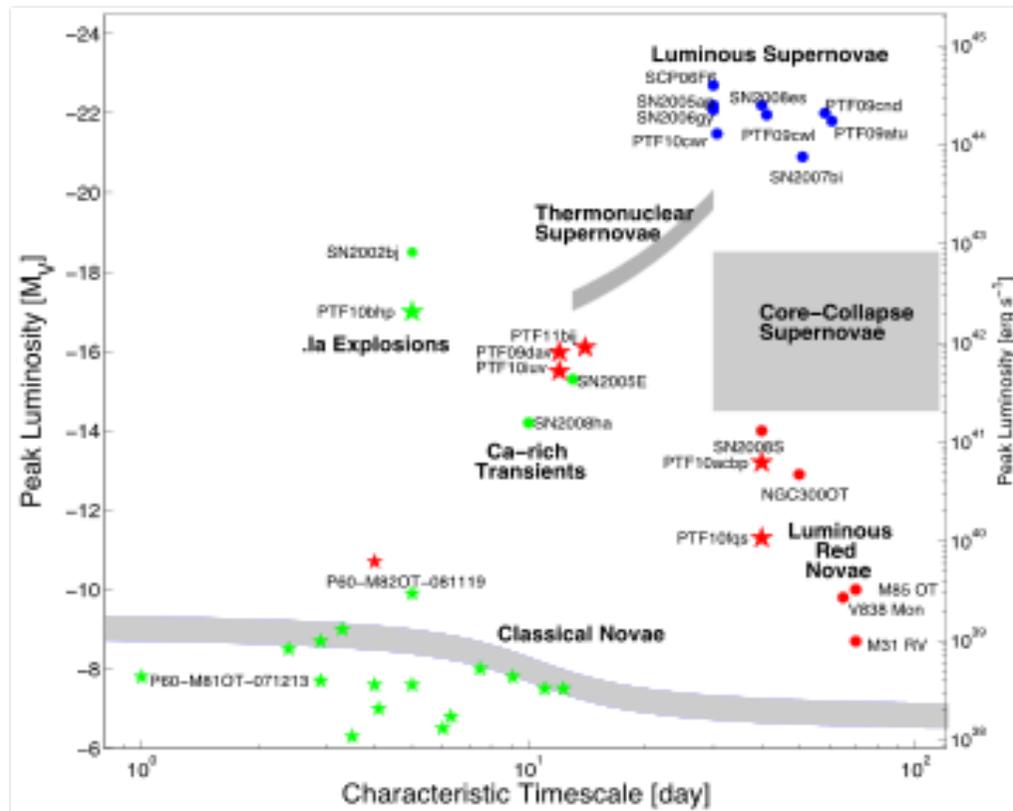
Nordic (Denmark Sweden, etc.) + Italian collaboration



ESO's SOXS project

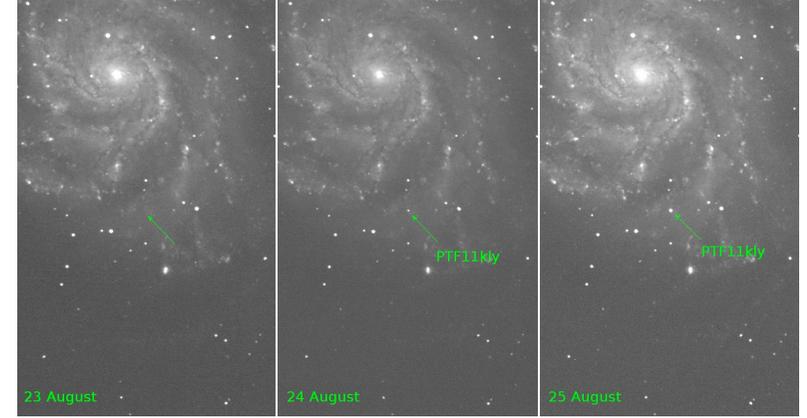
- ESO call for new instruments at NTT (06/2014)
- Proposal submission (02/2015)
- SOXS (PI S. Campana) together with other 19
- SOXS selected by ESO (05/2015)

SOXS Main Science case: the transient sky



Why SOXS

Spectroscopic machine for the transient sky.



Sexy:

2005-2013 Nature published ~ 180 astronomical papers with > 50 citations.

Among them **36%** are on transients objects.

Needed:

Now (PESSTO, Asiago, ... in place) $> 70\%$ of newly discovered transients without spectroscopic follow-up.

Near future many transient surveys:

- WF surveys (GAIA-alternatives, iPTF, DES, Pan-STARRS, LSST)
- high-energy transients (Swift, INTEGRAL, MAXI)
- GW-alternatives etc.

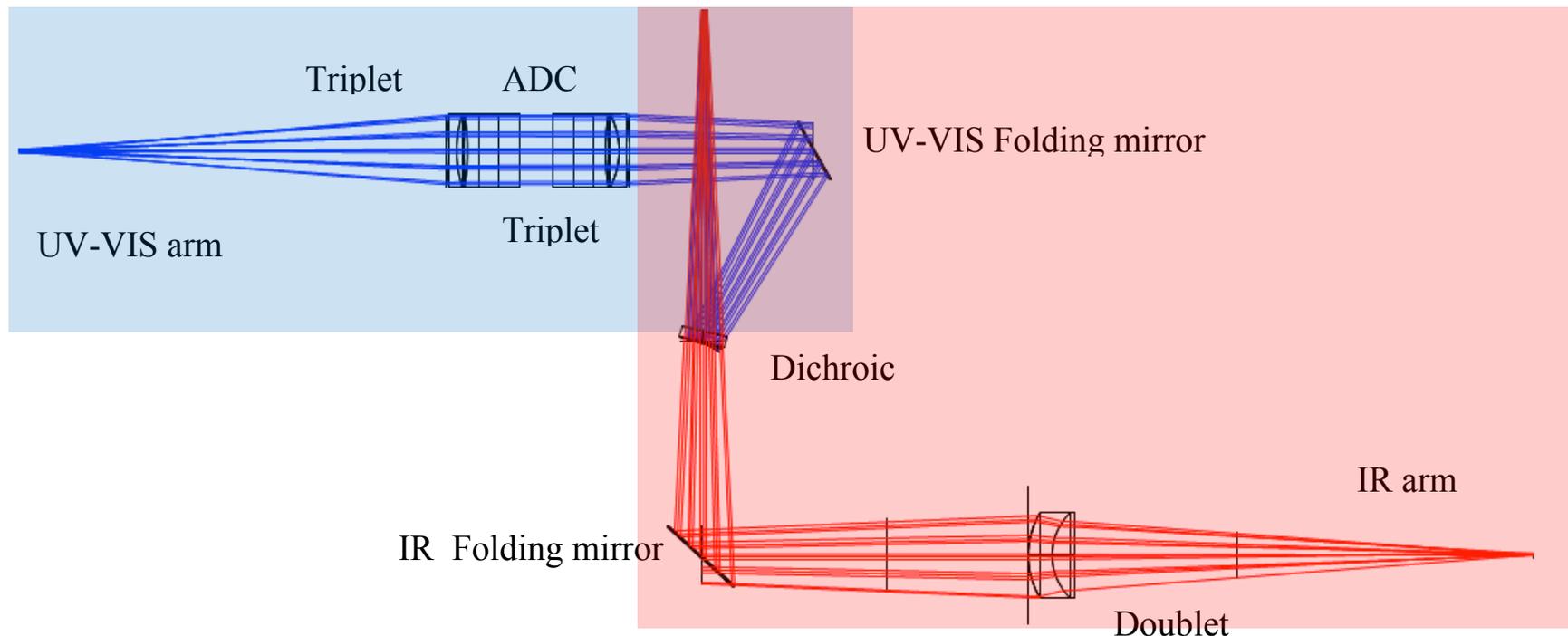
but very limited spectroscopic follow-up

SOXS @ NTT

Proposal to **build** and **operate** a spectrograph:

- wide spectral coverage (**0.35-1.75 μm**) **on two arms**
- good spectral resolution (**$R \sim 4500$**)
- to **characterize** and **follow-up** in depth any kind of **transient**

A possible optical layout of the Common Path



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Long-term (in agreement with Long-term Plan of INAF):

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We may be very close to it
(GTO ~150n/yr for TBD years)

scientist/personal conclusions

- Size does not matter

Good Science can be done with any size of telescopes

- INAF should NOT ignore SMT (coordinated use, avoid duplication, ...)

Network ==> LCOGT

Do Not rediscover Wheel (robotization, archives, ...)

- SMT must be automatic/robotic/remote-contr

- Outreach and R&D will increase

- Any telescope not producing good Science/Outreach) must be **transparent**