Observing Tools

Feedback from the COSMIC-LAB project

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on behalf of the COSMIC-LAB team

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THE PROJECT

Star Clusters as Cosmic Laboratories for Astrophysics, Dynamics and Fundamental Physics

- 5-year project funded by the European Research Council (ERC)
- PI: Francesco R. Ferraro (Dip. of Physics & Astronomy – Bologna)
- Co-Is: B. Lanzoni, A. Mucciarelli, E. Dalessandro + 4 Post-doc and 4 PhD
- kickoff: May 2011

- AIM: understanding the complex interplay between dynamics and stellar evolution

- HOW: using globular clusters as cosmic laboratories and
  - Blue Straggler Stars
  - Millisecond Pulsars
  - Intermediate-mass Black Holes

as test particles
MID-TERM REPORT – first 30 months

Granted telescope time:

More than 200 orbits with HST and 500 hours at the 8-10m class telescopes have been assigned to projects related to COSMIC-LAB

- **HST:** Cycle 19 = 39 orbits  Cycle 20 = 28 orbits  Cycle 21 = 15+131 orbits
- **ESO-VLT:**
  - Period 87 = 6 nights + 15 hours
  - Period 89 = 3 nights + 3 hours
  - Period 90 = 5 nights + 21 hours
  - Period 91 = 2 nights + 24.5 hours
  - Period 92 = 3 nights + 33 hours
  - Period 93 = 31 + 194 hours
- **GEMINI:** 7.5 hours  **KECK:** 30 hours

Published papers:

24 papers have been published in peer-reviewed journals
THE PROJECT

web-page: http://www.cosmic-lab.eu/

Star Clusters as Cosmic Laboratories for Astrophysics, Dynamics and Fundamental Physics
Focus on VLT observations

Cosmic-Lab: Probing globular cluster internal dynamics

Radial velocity dispersion and rotation profiles for 30 Galactic globular clusters
ESO-VLT LARGE PROGRAMME (P93+94+95)  KMOS + FLAMES  PI: Ferraro  194 hours

Inner velocity dispersion and rotation profiles of five concentrated globular clusters from the radial velocities of individual stars
COMPANION PROPOSAL (P93)  SINFONI  PI: Lanzoni  31 hours
VLT-SINFONI AO-assisted

pilot project in the core region of NGC 6388

$K$ band spectra at $R \sim 4,000$

~60 stars at $r < 1.6$ arcsec
VLT-KMOS deployable IFU

SV - pilot project in the NGC 6388 central region

YJ band spectra at R~3,400

nod to sky mode

4 pointings, ~90 stars at R<70”
NGC 6388
outer regions
GIRAFFE/MEDUSA
HR21 CaT  I<17
Focus on VLT observations

Cosmic-Lab: stellar systems with large pop of MSPs

Bulge building blocks: chemistry and kinematics of Terzan 5, Liller 1, Terzan 6
ESO-VLT Proposals (P85-P91)  X-Shooter + FLAMES  PI: Ferraro  10 nights + 23 hrs

high reddening $\Rightarrow A_v > 7$ mag

**XSHOOTER**

VIS arm (RVs, CaT)
slit 0.9", $I < 18$

NIR arm (RVs, chemistry)
slit 0.6", $J < 16$

**FLAMES**

GIRAFFE/MEDUSA HR21
(RVs, CaT), $I < 17$
Focus on VLT observations

P2PP - general considerations

**facts/requests**

almost every period new releases of P2PP and related
instrument software/tools

releases for Mac OS should become a standard

number of independent packages to manage is becoming large

tools, e.g. to produce finding charts, to check target
visibility, to recover basic info (e.g. target and NGS coordinates, id, setups etc.) from Phase-I etc., **inside the P2PP**

e.g., HST APT
e.g., the HST APT tool bar

displays exposure apertures against an image of the sky, it is useful for target and/or coordinate confirmation
generates fixed target confirmation charts
checks and displays constraints on a proposal, and calculates observing windows
e.g., the HST APT

Contains items such as SAVE and LOAD

Server Selector (alternate way to load data)

HST Aperture

Used to make blinked images (see separate help)

Display area

Multi-view (multiple images in the display area - see separate help)

Used to open/close mini-spreadsheet; default is spreadsheet closed.
Focus on VLT observations: Positioners

FPOSS-FLAMES

- It does not run on Mac OS (only on a 32 or 64-bit Linux pc)
- The finding charts must be prepared with the FIMS software that runs only on 32-bit Linux pc
- It does not allow to load a FITS image and overplot the target catalog for an easier identification
- It does not allow to save intermediate configurations (e.g., with partial fiber allocation)
- Once a fiber configuration has been finalized (saved in a .ins file) it is not possible to update/modify it (e.g., change some fiber allocation)

Successfully used by the Community since many years
Focus on VLT observations: Positioners

KARMA-KMOS

- It runs on both Mac OS and (32 or 64-bit) Linux pc
- It allows to load a FITS image, and to overplot target positions
- It allows to modify the display setup (e.g., colors, cuts etc.)

- valuable if one could offset a given ifu from the nominal target position, e.g., to include an additional target that is just outside of the ifu fov, without having it automatically flagged as sky

- to observe globular clusters in nod to sky mode, one must load a fits image with a large fov (>>KMOS) for checking offset positions (a few arcmin) ➔ ~ only 2MASS (low resolution, bad to check target allocation)
  valuable if one could have the option to load a high res image (small fov) to allocate/check targets, then change to 2MASS to allocate/check sky
Focus on VLT observations: SINFONI

ETC facts/requests

AO-mode requires R and (B-R) photometric info for the guide star

can V and (V-I) be an alternative?

(MCAO WFS response curve not found)

if R and (B-R) critical, in which photometric system?

(e.g. Johnson, Cousin, SLOAN; Vegamag or AB etc.)

e.g., for a star with $T_{\text{eff}} = 5000$ K

$\Delta(R_C - R_J) \approx +0.2$ mag

$\Delta(R_C - R_S) \approx -0.2$ mag

$\Delta(R_{\text{Vega}} - R_{\text{AB}}) \approx 0.4$ mag

also, the observed (B-R) can be red since the star is intrinsically cool (BB-like) or reddened ($\sim \lambda^{-1.5}$) or both
Focus on VLT observations: SINFONI

ETC facts/requests

output: s/n and encircled energy over the DL core

max intensity (obj+bg) and bg per pix & DIT

however, in crowded stellar fields

➢ the background can be enhanced due to the unresolved stellar continuum

➢ the usable star signal is the one in the brightest pixel and occasionally around it (within about the PSF DL core)

it would be very valuable if the ETC could

➢ allow to change the bg value

➢ provide also the s/n of the brightest pixel (subtracted by the bg), now it can be computed manually by the user
Focus on VLT observations of X-Shooter

nod-on-slit tool inside the P2PP

to visualize target and the sky in the A and B positions within the slit, with varying the nodding throw and position angle

tool useful/available for any IR slit spectrograph

\[ \text{PA} = 0^\circ \]

slit \( \rightarrow \) 11"
throw \( \rightarrow \) 6"
position angle \( \rightarrow \) 0°

in A sky contaminated by a star

\[ \text{PA} = 20^\circ \]

slit \( \rightarrow \) 11"
throw \( \rightarrow \) 6"
position angle \( \rightarrow \) 20°

no contamination
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Summary

- P2PP and other sw/tools ➔ releases for Mac
- tools (e.g. finding charts, target visibility, etc.) within the P2PP

- new tools:
  - prop-info: to transfer Phase I info (targets coord, id, etc.) into Phase 2 OBs (also some info into the Readme file)
  - nod-on-slit: to set optimal nodding throw and PA for IR slit spectrographs (e.g. XShooter, CRIRES+)

- some new features:
  - in FPOSS and KARMA
  - in the SINFONI ETC