NEXT GENERATION OF INFRARED SKY SURVEY WITH AN OFF-AXIS TELESCOPE FROM ANTARCTICA

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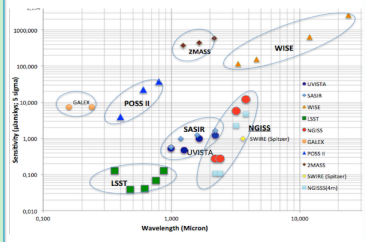
ANGISS project adresses the scientific relevancy and technical feasibility of a New Generation Infrared Sky Survey (NGISS) from the Antarctic plateau. The project proposes an innovative 2.5 m off-axis low emissivity, wide-field telescope with adaptive optics matching the outstanding atmospheric properties of the site. The major identified key-programs are (1) in the distant universe:high redshift galaxies and quasars, photometric redshifts at z > 1.5 and type Ia supernovae in dusty galaxies and (2) extragalactic stellar populations: synoptic time monitoring of stellar populations in the Magellanic Clouds and in galaxies of the Local Group.

Why a New Generation Infrared Sky Survey ?

Top Science drivers that will take benefit from a NGISS

- **Distant Universe**
  - ✓ Early Universe: high redshift galaxies, probing epoch of reionization; cosmic distance scale, Pop. III stars
  - ✓ Type Ia Sne in dusty galaxies (survey and light curve follow-up)
- **Extragalactic stellar populations**
  - ✓ Synoptic time monitoring of Magellanic Stellar populations (extension of VMC- deeper- λ>2.3)
- **Low mass stars, exoplanets and small bodies of the Solar System**
  - ✓ Stellar: extreme brown dwarfs/free floating planets (field and SFR)
  - ✓ Small bodies of the Solar system (complementary to LSST)

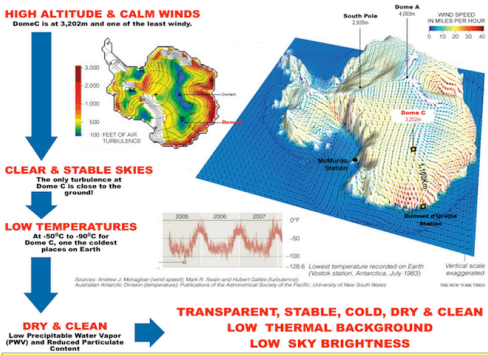


The expected sensitivity of NGISS compared to other surveys

Preparing, accompanying and following-up ELT IR key-programs

- 2MASS not deep enough, NGISS should supersede VISTA (sky coverage, sensitivity, angular resolution, spectral range)
- NGISS coverage: 5 to 15 000 square degrees (Southern Sky)
- High sensitivity: gain ~ 1000 with respect to 2MASS at K
- High contrast → off-axis telescope proposed (*see below*)
- High angular resolution **: 0.3''** or better (thanks to site quality + GLAO)
- Extend spectral coverage **beyond 2.3 µm** (in particular the K_{dark} and L windows); bridging ground/ space surveys (WISE, Spitzer, …)

Antarctica, an attractive site for infrared imaging surveys



- **Great seeing and atmospheric stability**
- **Great IR transmission**

Monthly average range of PWV from
0.72(+/-0.20)mm in December
to 0.26(+/-0.1)mm in winter period
The K_{dark} window is optimal
The L_{short} (3.2-3.6µm) window opens

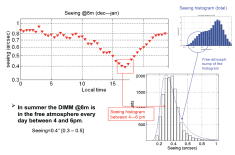
- **Low IR thermal background**

Concordia DOME C SITE QUALITY at a glance

WINTER:
Turbulent boundary layer = 23m
Above that seeing ~ 0."36

SUMMER @ 8m:
seeing ~ 0."40

	Seeing	Isop.	Coh. time
DIMM/GSM	0.4 ''	4.1 ''	
SSS	0.3 ''	6.9 ''	10.2 ms
Balloons	0.4 ''	2.7 ''	6.8 ms
AASTINO 2004'	*0.3 ''*	*5.7 ''*	*7.9 ms*
Simulations[2]	0.3 ''		
Mauna Kea	0.6 ''	1.9 ''	2.7 ms
Paranal	0.8 ''	2.6 ''	3.3 ms



Aristidi et al. 2009, A&A 499, 955.

TELESCOPE DESIGN:

An OFF-AXIS TELESCOPE
To minimize thermal emission and diffraction

SCIENCE CASE COMPLIANCE:

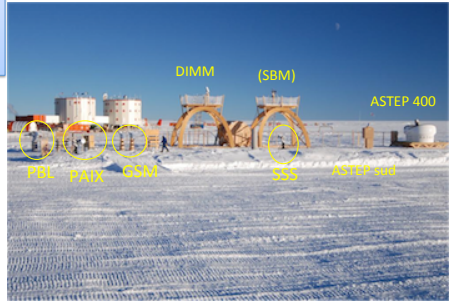
→Exploration of the distant univers and nature of the dark matter
→Discovery of extrasolar planets
→Characterization of stellar populations

Science cases call for
1) the highest possible dynamic range for photometry
2) the high angular resolution
3) a wide-field imaging
in optical and thermal infrared

The only concept of telescope that could comply with science cases and capitalize such unique site Dome C performances is

A THREE-MIRROR OFF-AXIS TELESCOPE DESIGN
optimized for low scattered light
low emissivity
wide field of view

Telescopes already in operation at Concordia:
ASTEP400: planetary transits (40 cm)
IRAIT: infrared telescope (80 cm)



Proposed concept of off-axis mirror for a 2.5 m NGISS *(Moretto et al., 2012, SPIE vol. 8444)*.
Assessment study *(Langlois et al.)*, submitted to the French ANR 2013 and 2014 + H-2020*)*.