

# Cerro Tololo Inter-American Observatory 50 Years as Gateway to the Southern Skies





# CTIO: The NEXT 50 Years

R. Chris Smith





# The Future in Two Distinct Periods



- The Decade of DECam
- The Era of LSST



*Our site continues to be one of the best sites in the world for optical astronomical observations.*

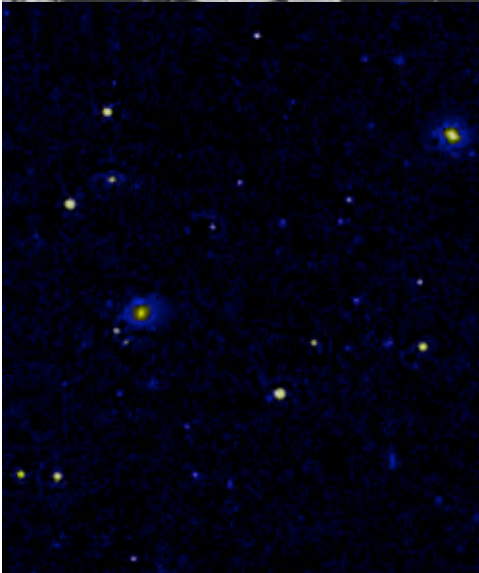
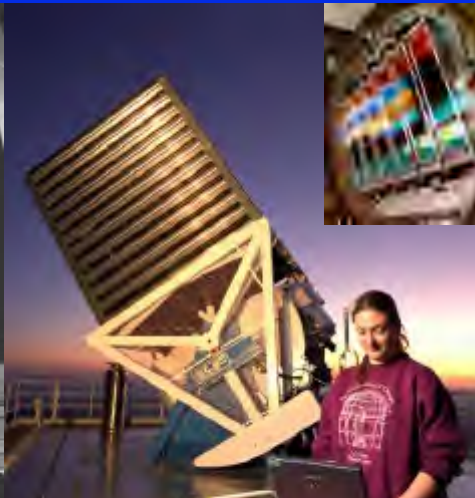




# Large surveys The past

ca. 1950 POSS  
Photographic

ca. 2000 SDSS  
Digital





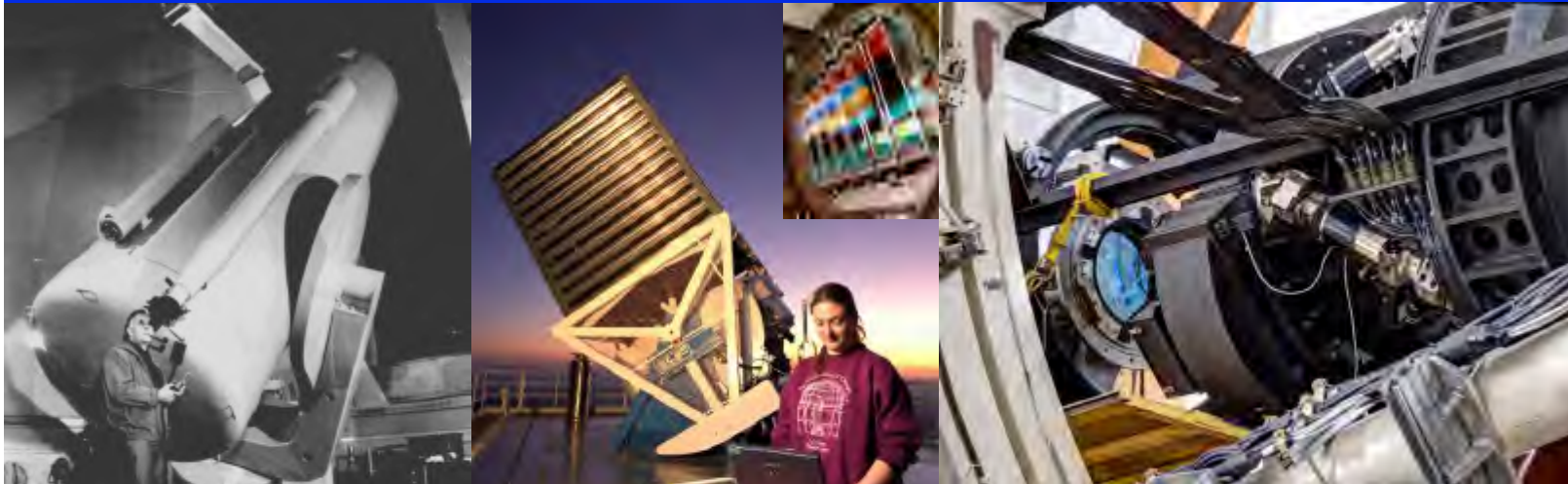
# Large surveys The Decade of DECam



ca. 1950 POSS  
Photographic

ca. 2000 SDSS  
Digital

ca. 2012 DES  
+ Depth

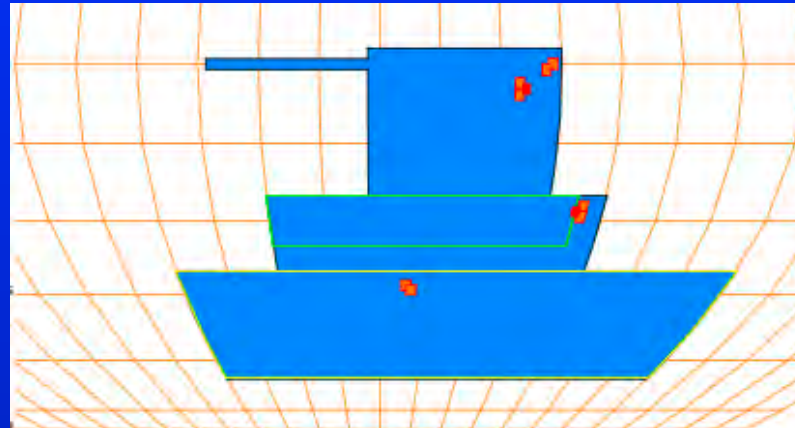




# DECam: The NEXT Generation Of Wide-field Surveys



- Beyond DES...



- A powerful capability for COMMUNITY SURVEYS





# Support for Large Surveys: Follow up observations



## *The local O/IR System*

Cerro Tololo  
& SMARTS



Gemini



SOAR







# New Instrumentation: Exciting new opportunities



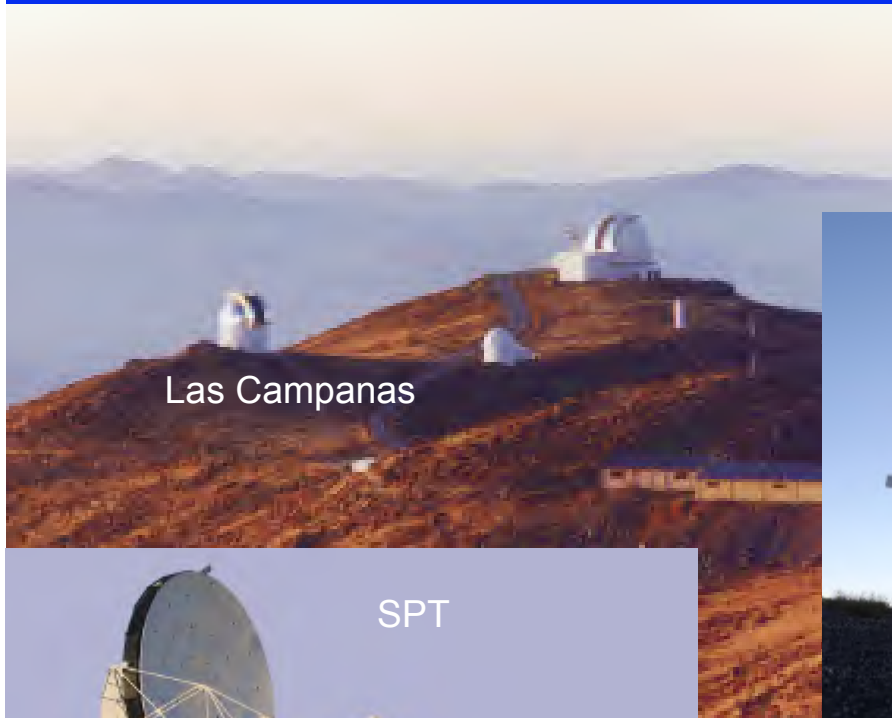
- Blanco 4m
  - COSMOS Optical spectrograph
  - TripleSpec NIR spectrograph
- SOAR
  - SAM AO,
  - SIFS IFU spectrograph,
  - STELES echelle spectrograph

## Complemented by...

- Gemini
  - GEMS AO,
  - Flamingos2,
  - GMOS CCD upgrade



# Southern Hemisphere Synergies



Las Campanas



Magellan



SPT



ALMA



# CTIO, global networks & a platform for Astronomy



Keeping  
astronomers  
in the dark



CTIO 50th/DECam Dedication



# Large surveys The future

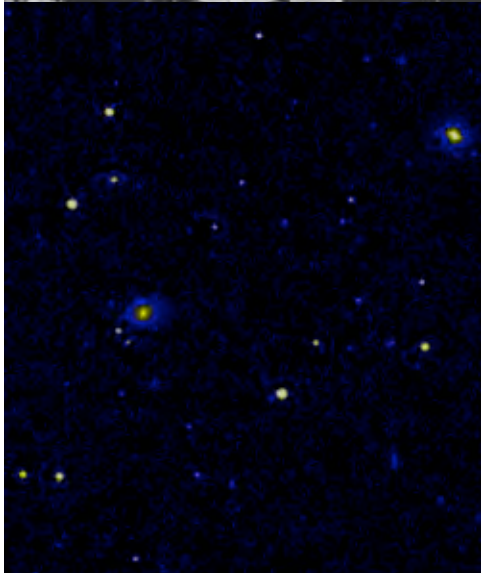
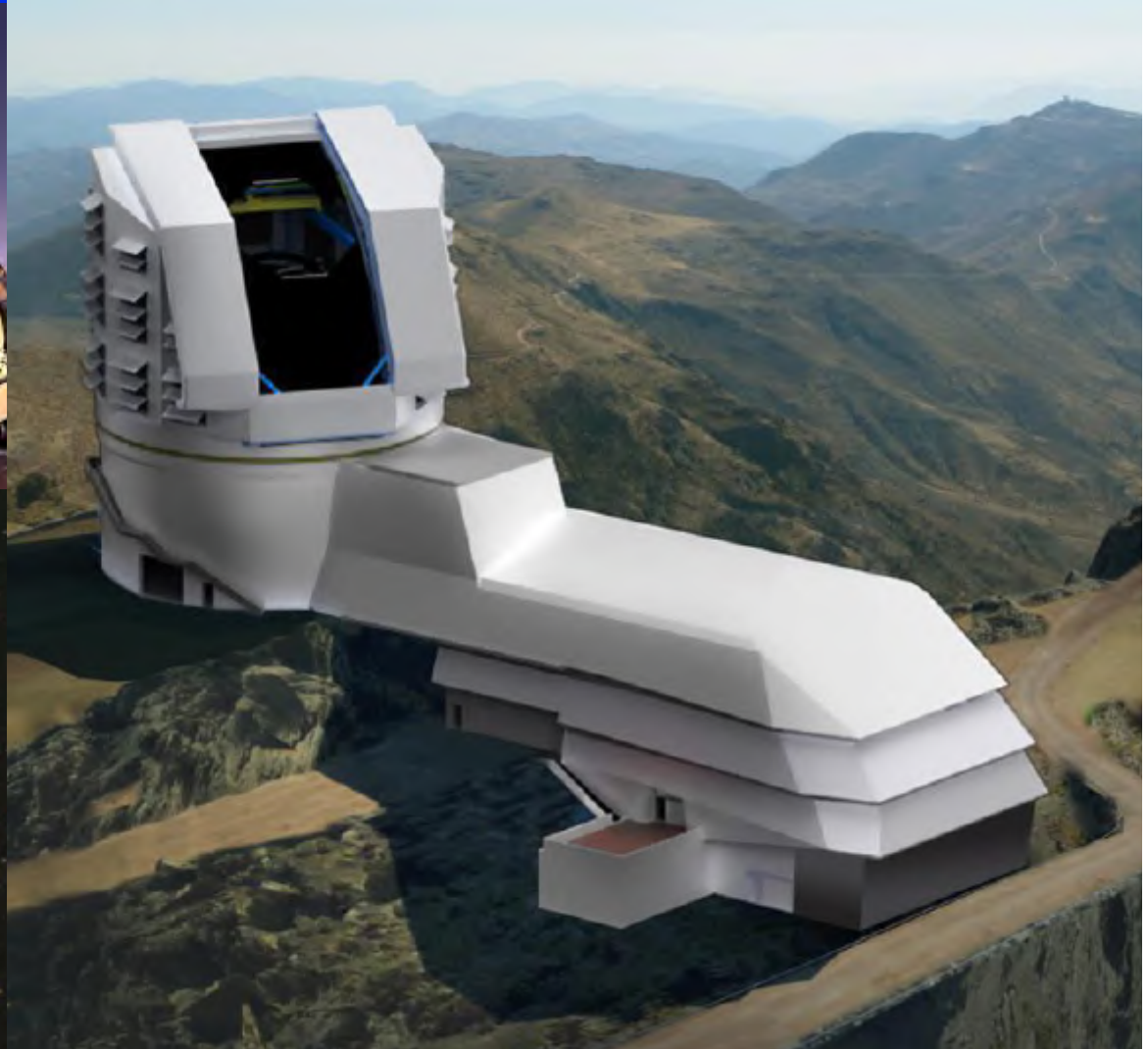


ca. 1950 POSS  
Photographic

ca. 2000 SDSS  
Digital

ca. 2012 DES  
+ Depth

ca. 2020 LSST  
+ Time domain

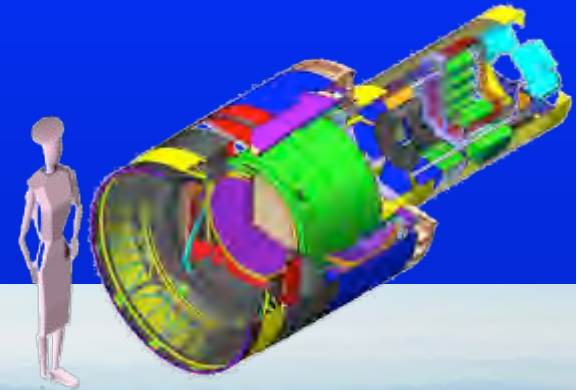




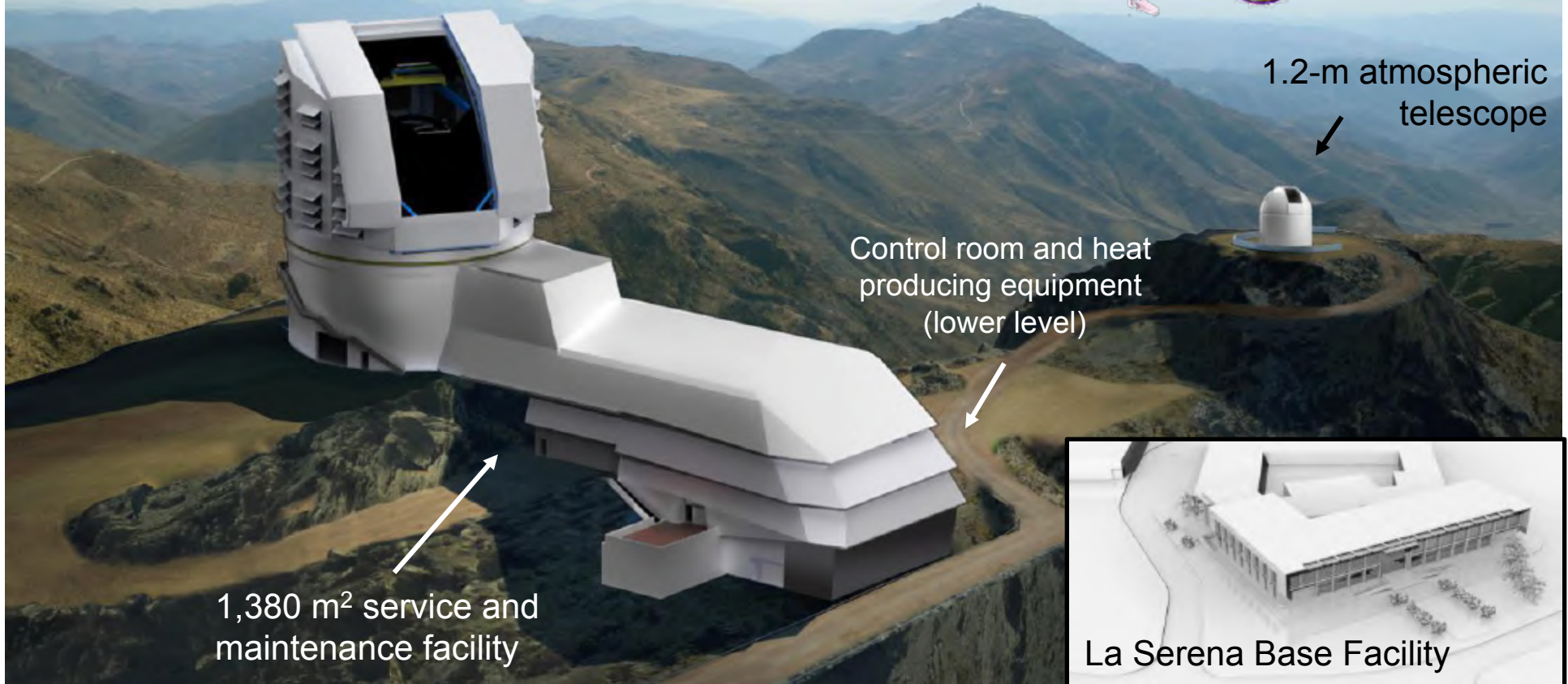
# Large Synoptic Survey Telescope



- 3.2 Gigapixel camera
- Imaging whole sky, every few nights, for 10 years
- Creating a movie of our ever changing Universe



8.4-m telescope



1.2-m atmospheric telescope

Control room and heat producing equipment (lower level)

1,380 m<sup>2</sup> service and maintenance facility



La Serena Base Facility



# LSST: Era of “Data Science”



## TRANSIENT SCIENCE

- >3 Terabytes per hour (reduced) that must be mined in real time for alerts.
- 20 billion objects will be monitored for important variations in real time.
- ~2 million events per night every night for 10 years

***New approaches must be developed for knowledge extraction in real time***

## NON-TRANSIENT SCIENCE

- >10<sup>10</sup> objects in a 20 PB final database catalog, backed by a 100 PB final image archive

***New approaches to data mining needed to sift through data to identify samples, or individual objects, of interest***



# Next Generation Instrumentation: LSST Follow up & Science Beyond



- KEY QUESTIONS

- What are the scientific drivers for projects beyond 2020?
  - Transient science
  - Follow up studies of large samples of objects
- What instruments do we need for those science cases?
  - Single object, high throughput, O/IR spectrographs
  - Multi-object spectroscopy

- FUNDAMENTAL QUESTION

- How do we re-optimize the local O/IR System of telescopes and instrumentation in the LSST era?
  - Not just for LSST follow up!
  - also for ALMA follow up, and to complement GMT



# One last comment: Threats to this bright future







# This Week: Also Celebrating the Chilean Commitment



REPÚBLICA DE CHILE  
MINISTERIO DEL MEDIO AMBIENTE

ESE, TÓMESE RAZÓN Y PUBLÍQUESE

ESTABLECE NORMA DE EMISIÓN PARA LA REGULACIÓN DE LA CONTAMINACIÓN LUMÍNICA, ELABORADA A PARTIR DE LA REVISIÓN DEL DECRETO SUPREMO N° 686, DE 1998, DEL MINISTERIO DE ECONOMÍA, FOMENTO Y RECONSTRUCCIÓN.

CONTRALORIA GENERAL  
COMISIÓN DE RAZÓN

28 MAR. 2013

EMISION

PART.	AMC
INDIC	2013
T.T.R.	

DECRETO N° 043

SEBASTIÁN PINERA ECHENIQUE  
Presidente de la República

SANTIAGO, 17 DIC. 2012

MINISTERIO DE ECONOMÍA FOMENTO Y TURISMO

PABLO LONGUEIRA MONTES  
Ministro de Economía, Fomento y Turismo

MINISTERIO DE ECONOMÍA, FOMENTO Y TURISMO  
DIVISIÓN JURÍDICA

MINISTERIO DEL MEDIO AMBIENTE

Maria Benítez  
MARIA IGNACIA BENÍTEZ PEREIRA  
Ministra del Medio Ambiente

MINISTRA

V1: 1998  
 V2: published 2013 May 5,  
 With spectral restrictions,  
 quantitative limits, and also  
 restrictions on luminous  
 signs



# The ~~End~~ Beginning!

