Uncovering the universe LSST

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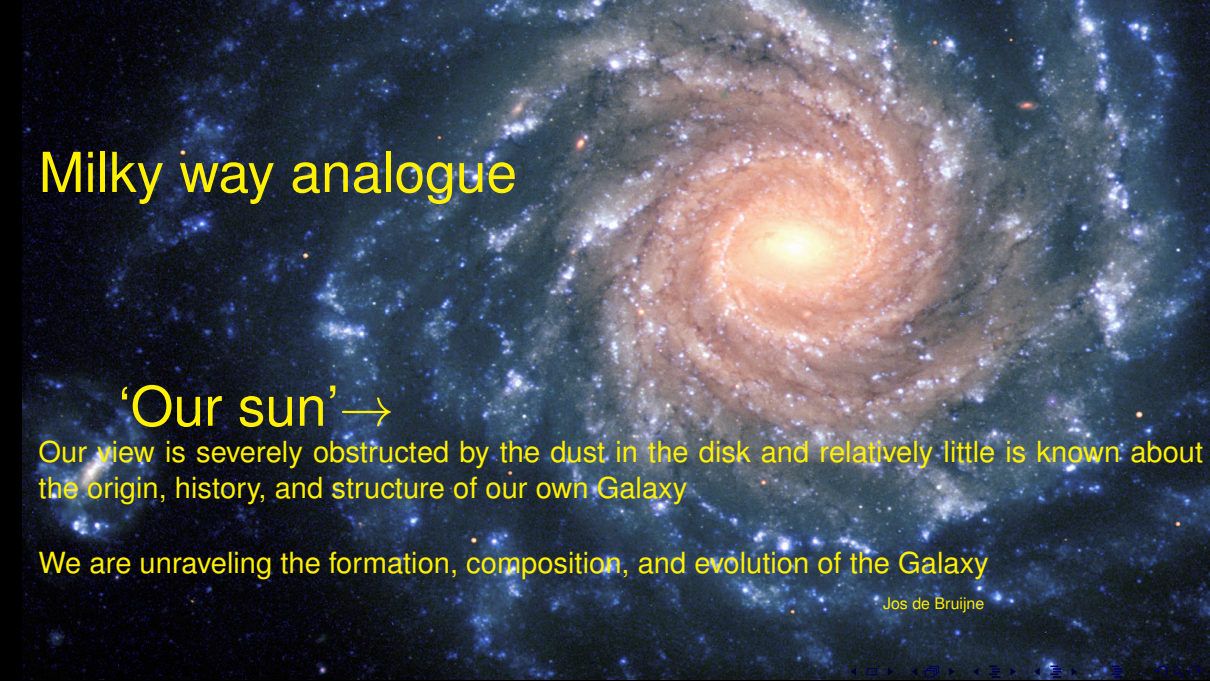
Data management
Large Synoptic Survey Telescope
Tucson, AZ USA

26th Sept 2018
LIneA
Rio, Brazil


The origin of the Milky Way
Jupiter
Hercules
Juno
(De Bruijn)
Tintoretto (1575, National Gallery, London)



Milky way analogue

‘Our sun’ $\rightarrow$

Our view is severely obstructed by the dust in the disk and relatively little is known about the origin, history, and structure of our own Galaxy

We are unraveling the formation, composition, and evolution of the Galaxy

Jos de Bruijne

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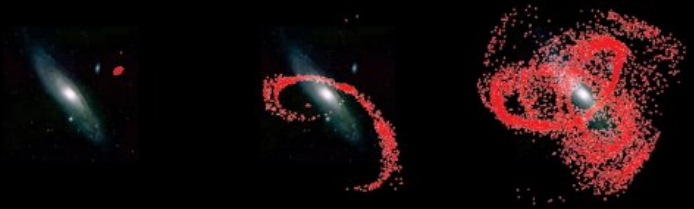

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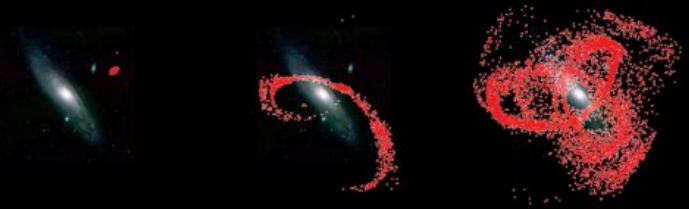
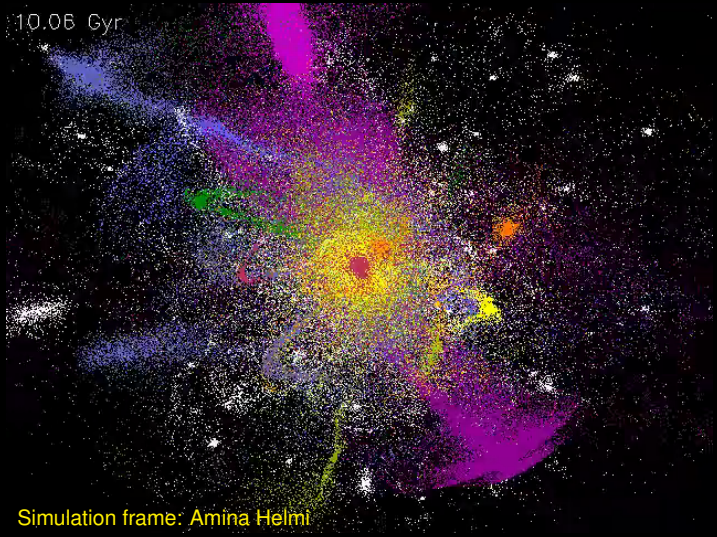


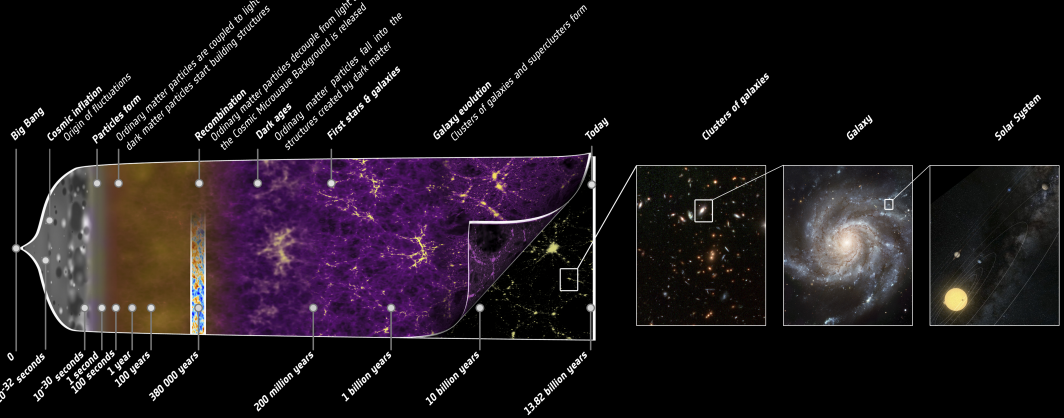
In such processes, stars got spread over the whole sky but their energy and (angular) momenta were conserved. Thus, it is possible to work out, even now, which stars belong to which merger and to reconstruct the accretion history of the halo (de Bruijne)

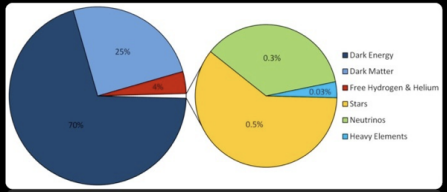
Origin of the Milky Way



Simulation frame: Amina Helmi

Image credit: R. Jay GaBany





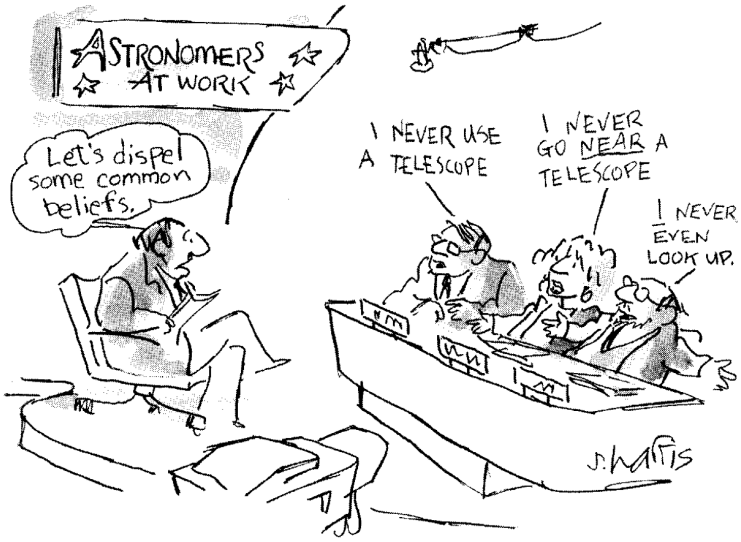
The modern cosmological models can explain all observations, but need to *postulate* dark matter and dark energy (though gravity model could be wrong, too)

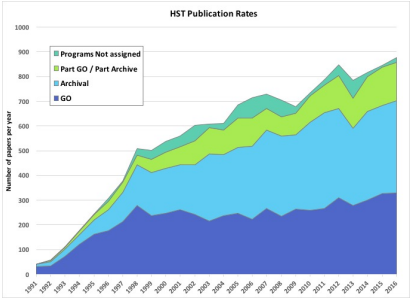
Killer asteroids: the impact probability is not 0!

LSST is the only survey capable of delivering completeness specified in the 2005 USA Congressional NEO mandate to NASA (to find 90% NEOs larger than 140m)

The Barringer Crater, Arizona: a 40m object 50,000 yr. ago

The Era Of Surveys





https://archive.stsci.edu/hst/bibliography/pubstat.html

. . . indicates archival research probably play an important role in the scientific success of XMM-Newton Ness et al. (2014)

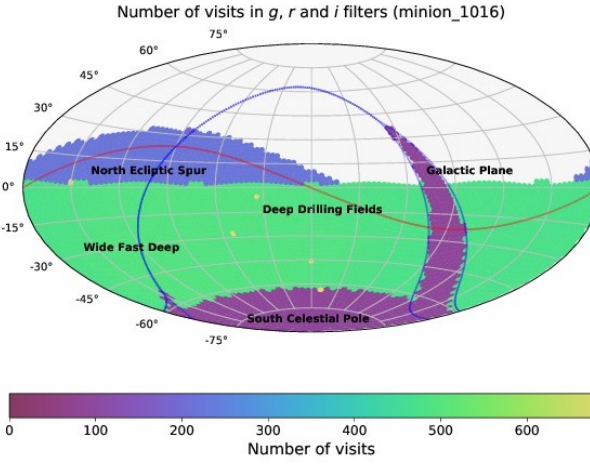
LSST:uniform sky survey

An optical/near-IR survey of half the sky in ugrizy bands to r 27.5 (36 nJy) based on 825 visits over a 10-year period: *deep wide fast*.

- 90% of time spent on uniform survey: every 3-4 nights, the whole observable sky scanned twice per night
- 100 PB of data: about a billion 16 Mpix images, enabling measurements for 40 billion objects!

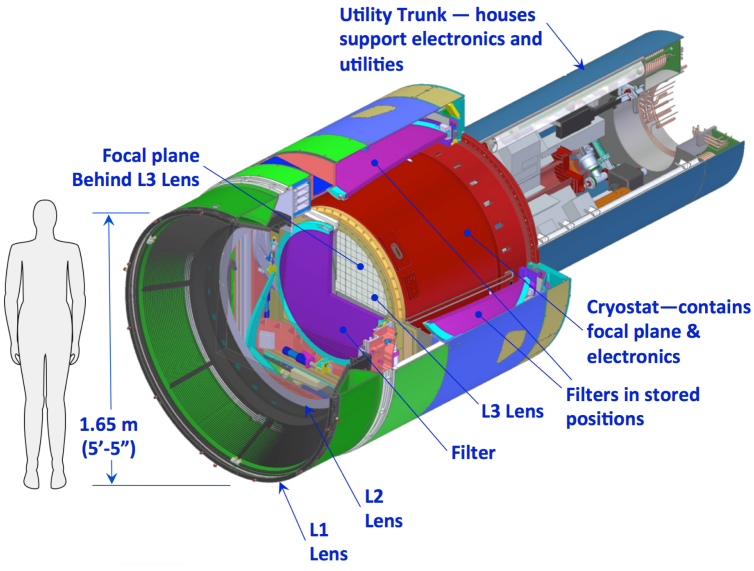
see also `http://www.lsst.org` and Ivezic et al. (2008)-arXiv:0805.2366

Call for white papers - `https://www.lsst.org/call-whitepaper-2018`



10-year simulation of LSST survey: number of visits in u,g,r band (Aitoff projection of eq. coordinates)

LSST Camera

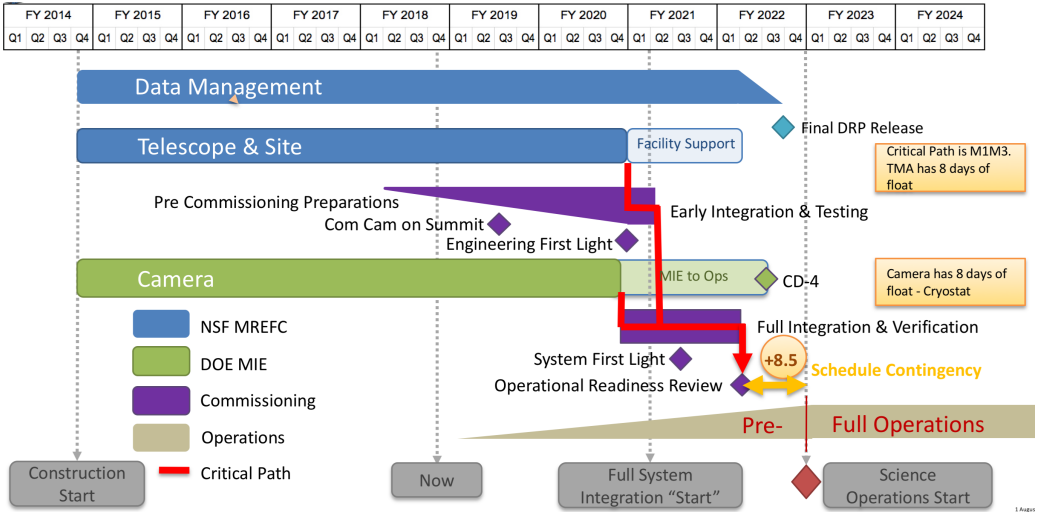


The largest astronomical camera:

- 2800 kg
- 3.2 Gpix

Site shaping up (July 2018)

LSST Project Schedule



Conclusion

- Current astronomical surveys are changing the way we do astronomy
- Gaia is having a huge impact on astronomy providing a statistically significant homogeneous data set - everywhere I go now I hear the Gaia reference frame in use
- LSST will soon follow perhaps ushering a complete change in how we approach end user data interaction
- Science missions are a mixture of innovative hardware, scientific algorithms, software and people
- Looking forward to the first LSST images !

Motto for the future from LSST Project Scientist:

Ask Not What Data You Need To Do Your Science,
Ask What Science You Can Do With Your Data.

Željko Ivezić

The END

Blast 20 Cerro Pachón April 2011.

http://www.lsst.org

Questions?

Gaia blast off on Soyuz December 2013

http://www.cosmos.esa.int/web/gaia

http://community.lsst.org

Acronyms I

Acronym	Description
AI	Action Item
AP	Alerts Production
API	Application Programming Interface
AURA	Association of Universities for Research in Astronomy
AVRO	Apache data serialization system
BBC	German shipping company
C	Specific programming language (also called ANSI-C)
CCD	Charge-Coupled Device
D	Deutschland (Germany)
D	Specific project phase (production; concluded by QR and FAR)
DAX	Data Access Services
DB	DataBase
DM	Data Management
DMTN	DM Technical Note
DMTR	Data Management Test Report
DRP	Data Release Production
DTN	Data Transfer Node
EFD	Engineering Facilities Database
EIA	Early Integration Activity
EIE	European Industrial Engineering - Italian engineering company (Dome)
FITS	Flexible Image Transport System
HSC	Hyper Suprime-Cam
IPAC	Infrared Processing and Analysis Center

Acronyms II

IR	Infra Red
ISR	Instrument Signal Removal
K	Kelvin; SI unit of temperature
KPM	Key Performance Metric
L1	Level 1 (ambiguous could mean milestone or processing)
L2	Level 2 (ambiguous could mean milestone or processing)
LDM	LSST Data Management (handle for controlled documents)
LPM	LSST Project Management (Document Handle)
LSE	LSST Systems Engineering (Document Handle)
LSST	Large Synoptic Survey Telescope
M2	Second mirror
MIA	Missing In Action
MN	Meeting Minutes
MOPS	Moving Object Pipeline System
N	Newton; SI unit of force
NASA	National Aeronautics and Space Administration (USA)
NCSA	National Center for Supercomputing Applications
NEO	Near-Earth Object
NSF	National Science Foundation
OCS	Observatory Control System
PB	PetaByte
PDAC	Prototype Data Access Center
PM	Project Manager
PS	Project Scientist
PSF	Point Spread Function
QA	Quality Assurance

Acronyms III

Qserv	Query Service, Proprietary LSST Database system
S	Strip (CCD chip along-scan coordinate identifier in focal plane)
SDSS	Sloan Digital Sky Survey
SPIE	the international society for optics and photonics
SUIT	Science User Interface and Tools
T&S	Telescope and Site
TB	TeraByte
US	United States
USA	United States of America
arcmin	arcminute, minute of arc (unit of angle)
kg	kilogram; SI unit of mass
s	second; SI unit of time

References

Ivezic, Z., et al., 2008, ArXiv e-prints (arXiv:0805.2366), ADS Link

Ness, J.U., Parmar, A.N., Valencic, L.A., et al., 2014, Astronomische Nachrichten, 335, 210 (arXiv:1311.5751), doi:10.1002/asna.201312001, ADS Link