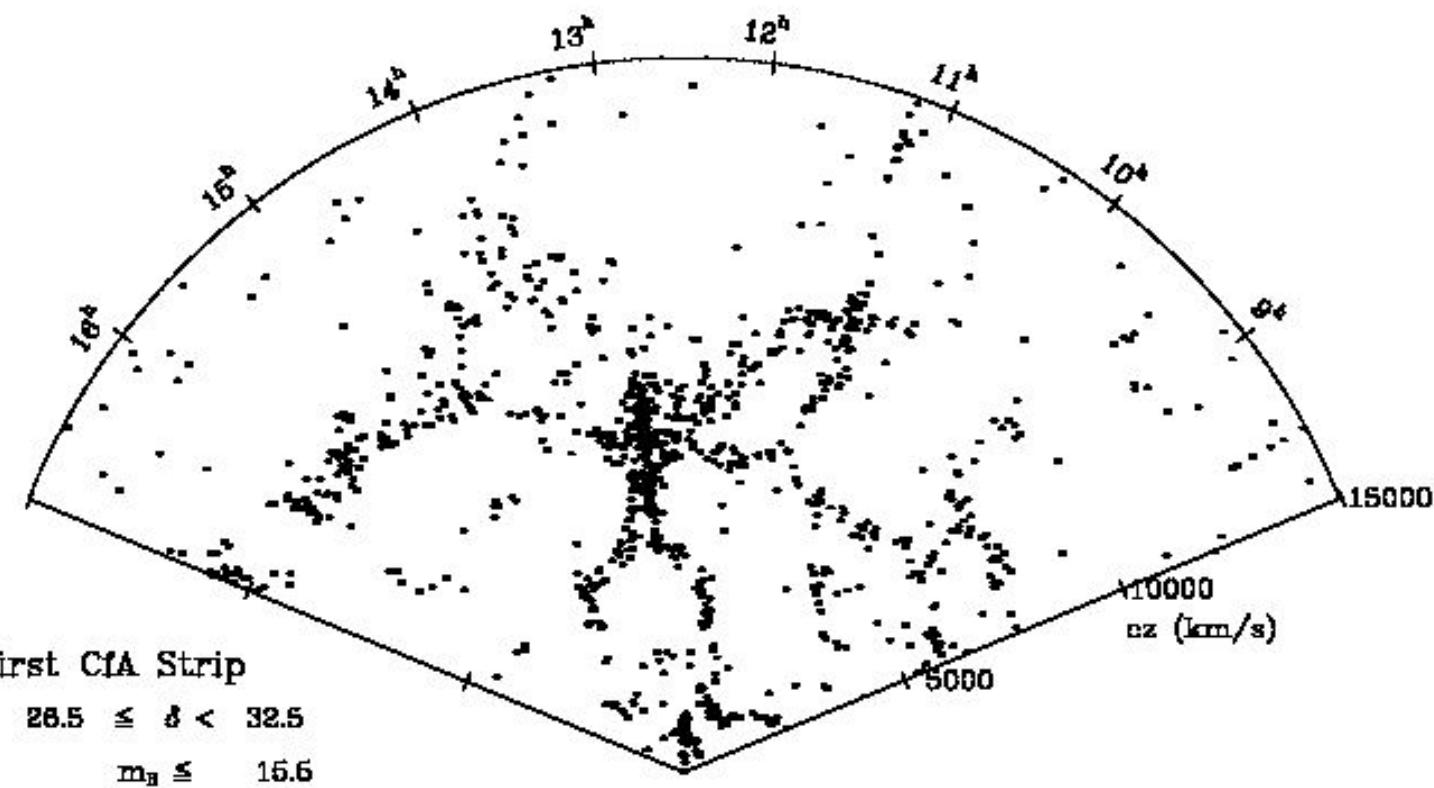
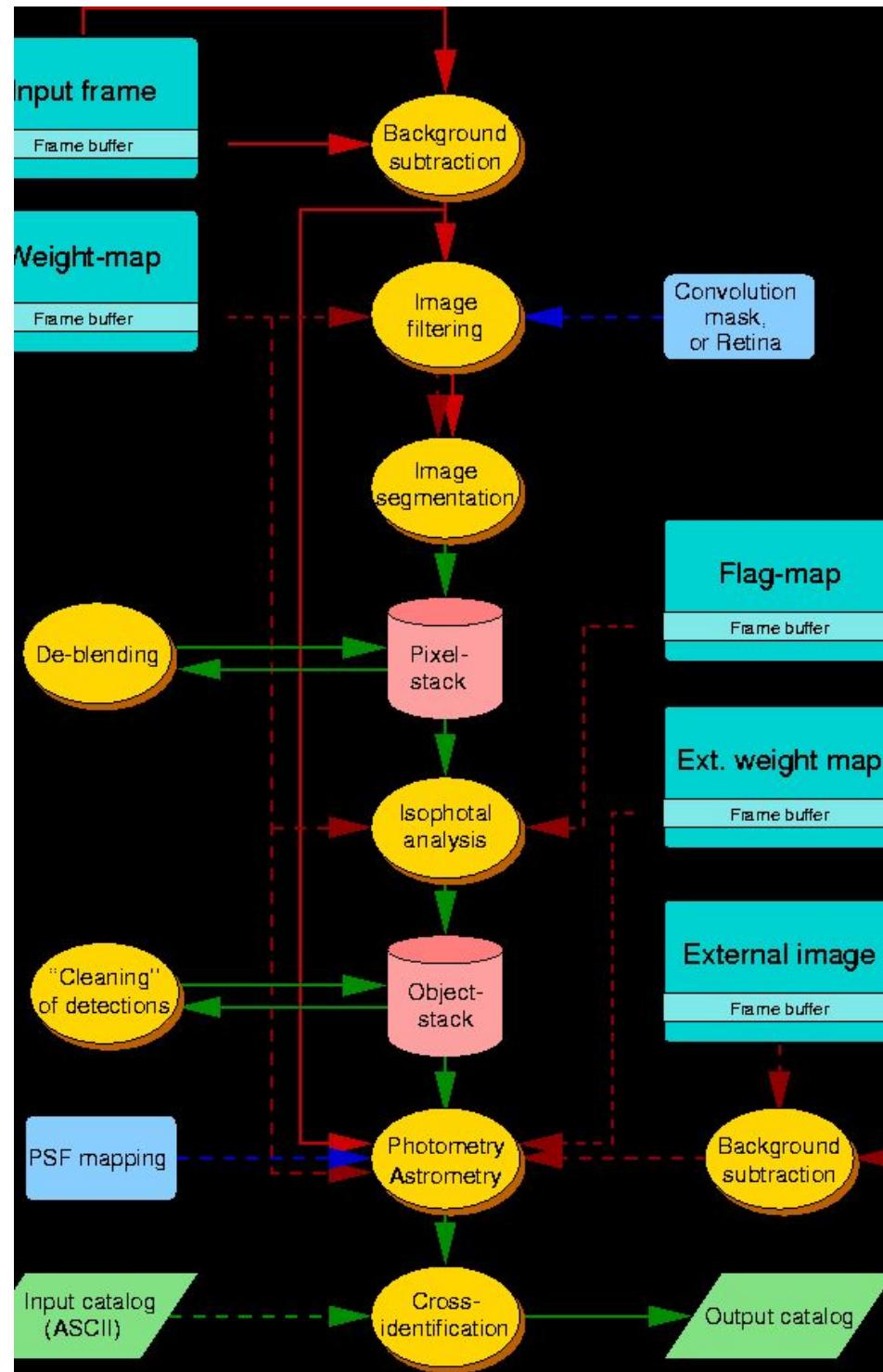


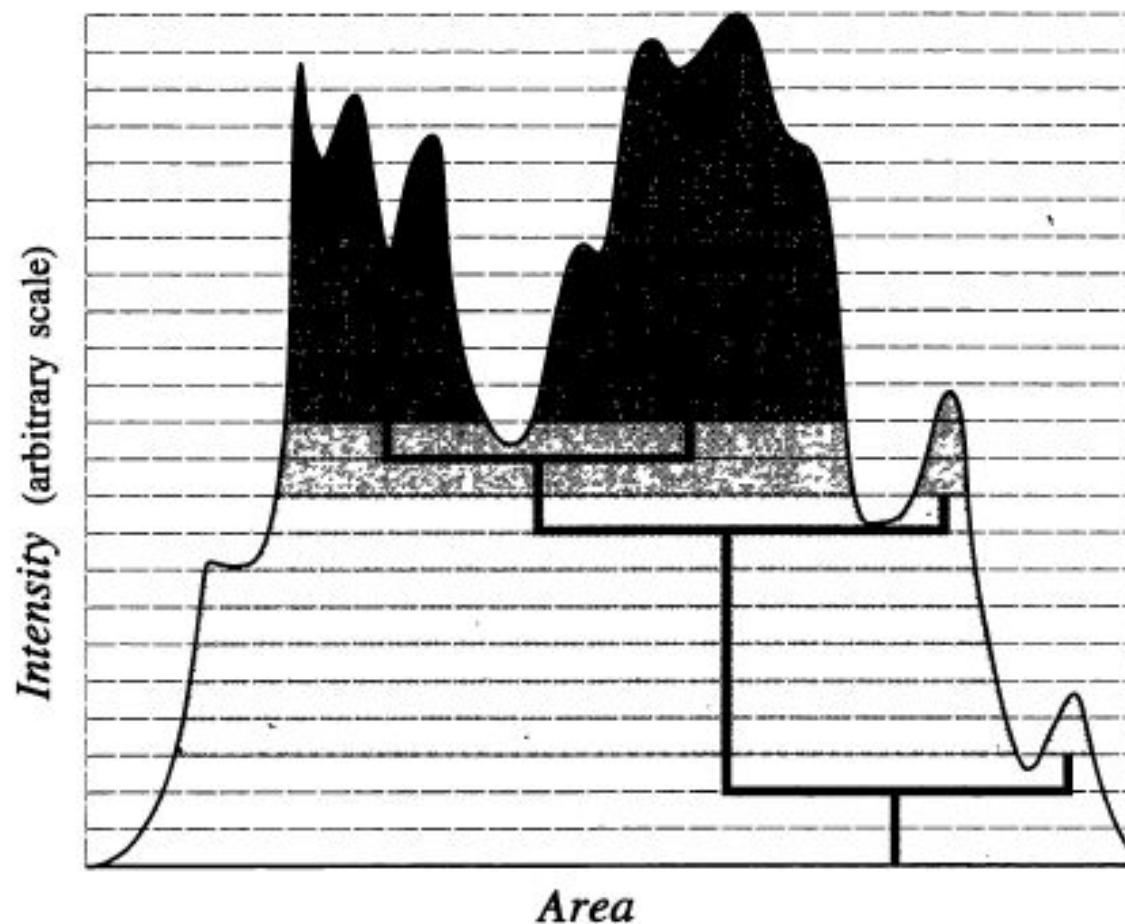
*The APM Galaxy Survey*  
*Maddox et al*



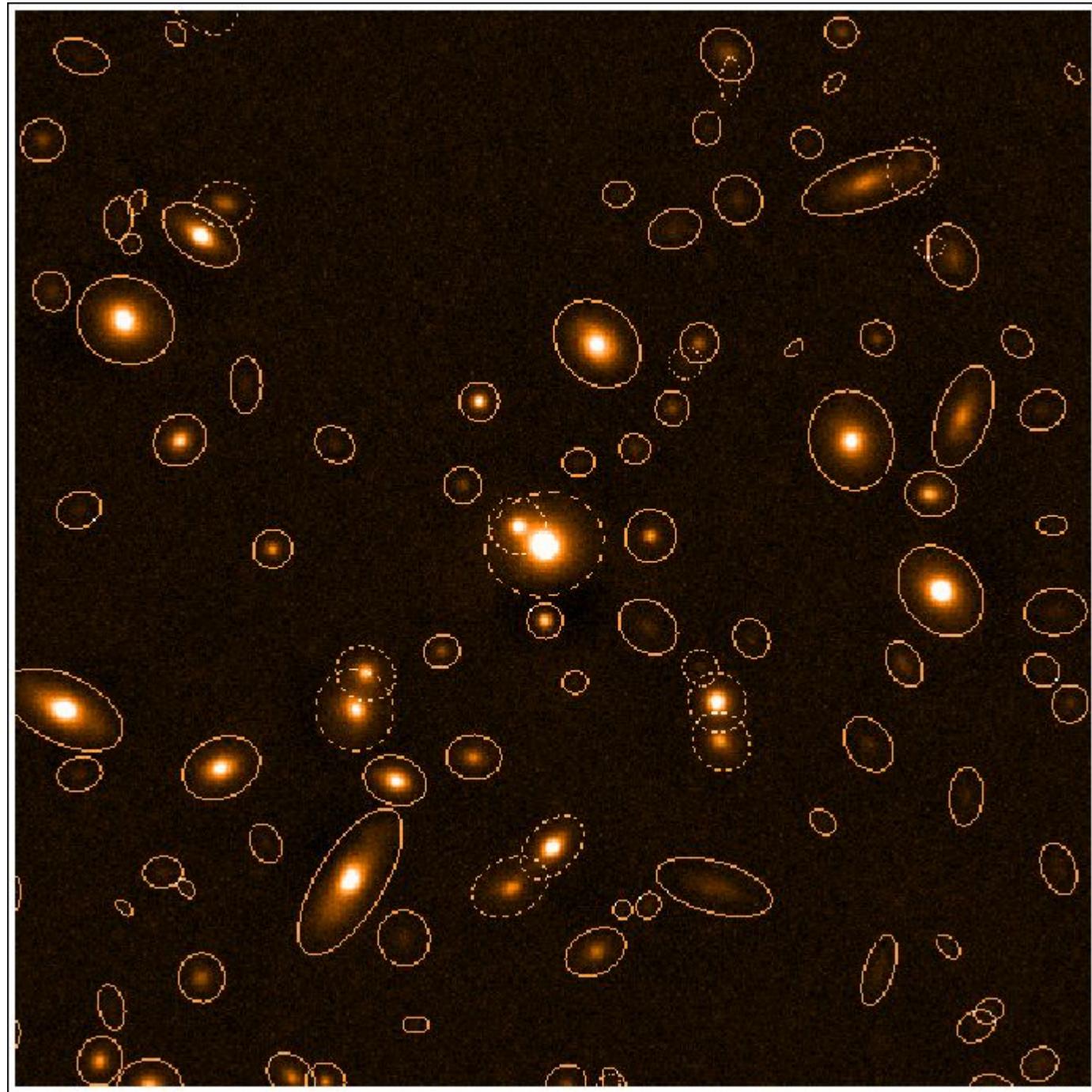
Copyright SAO 1998

# SExtractor

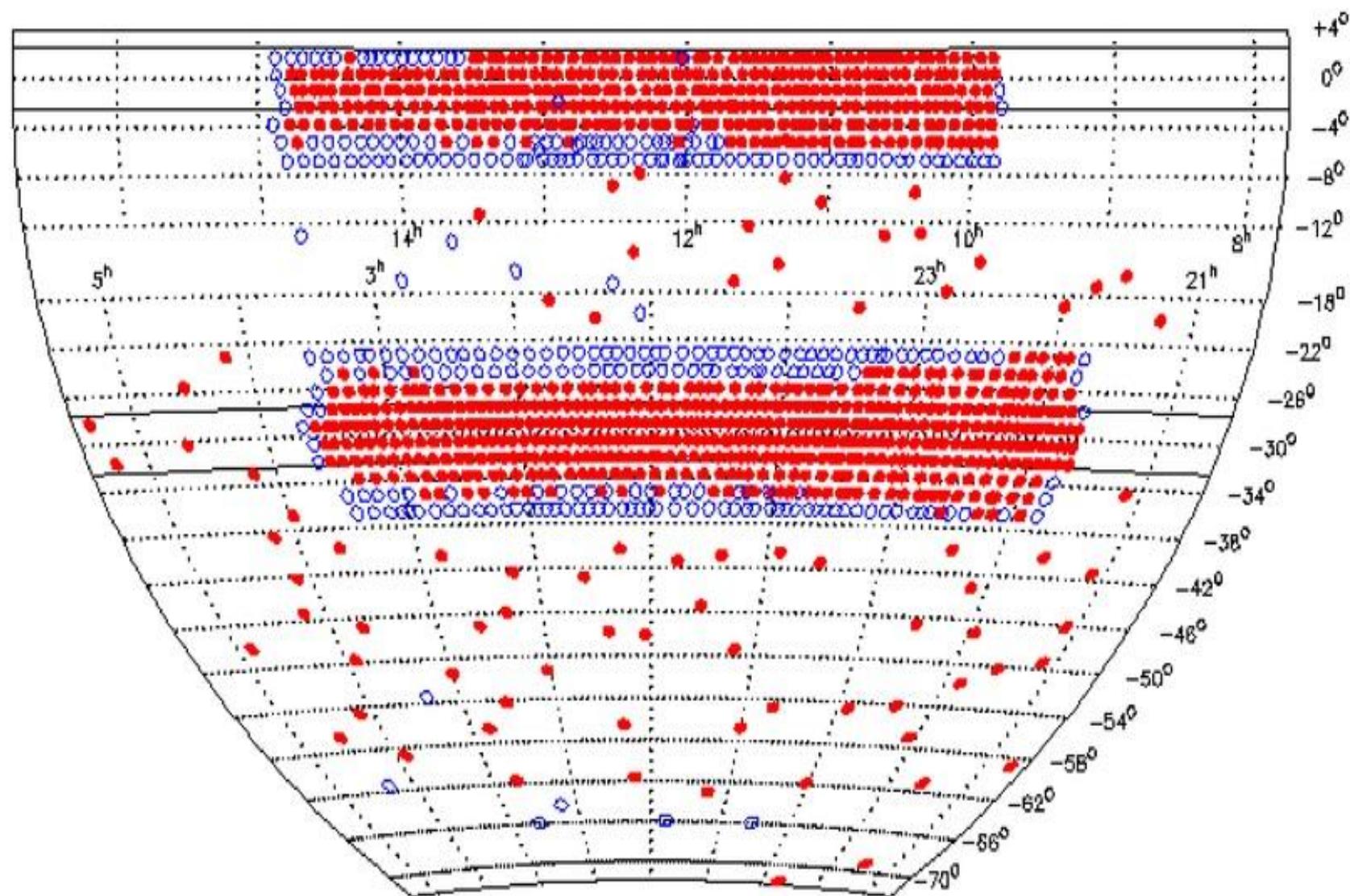


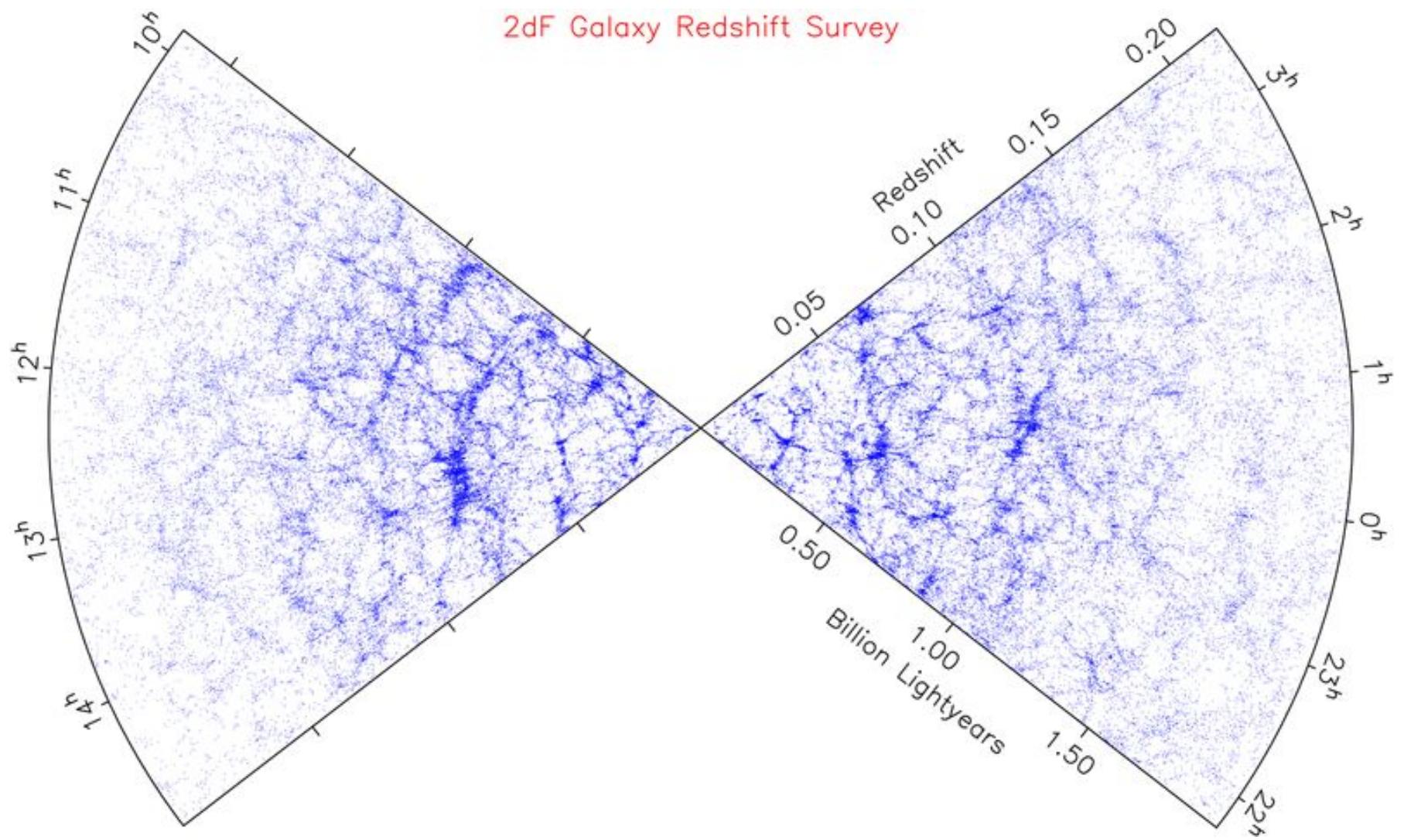


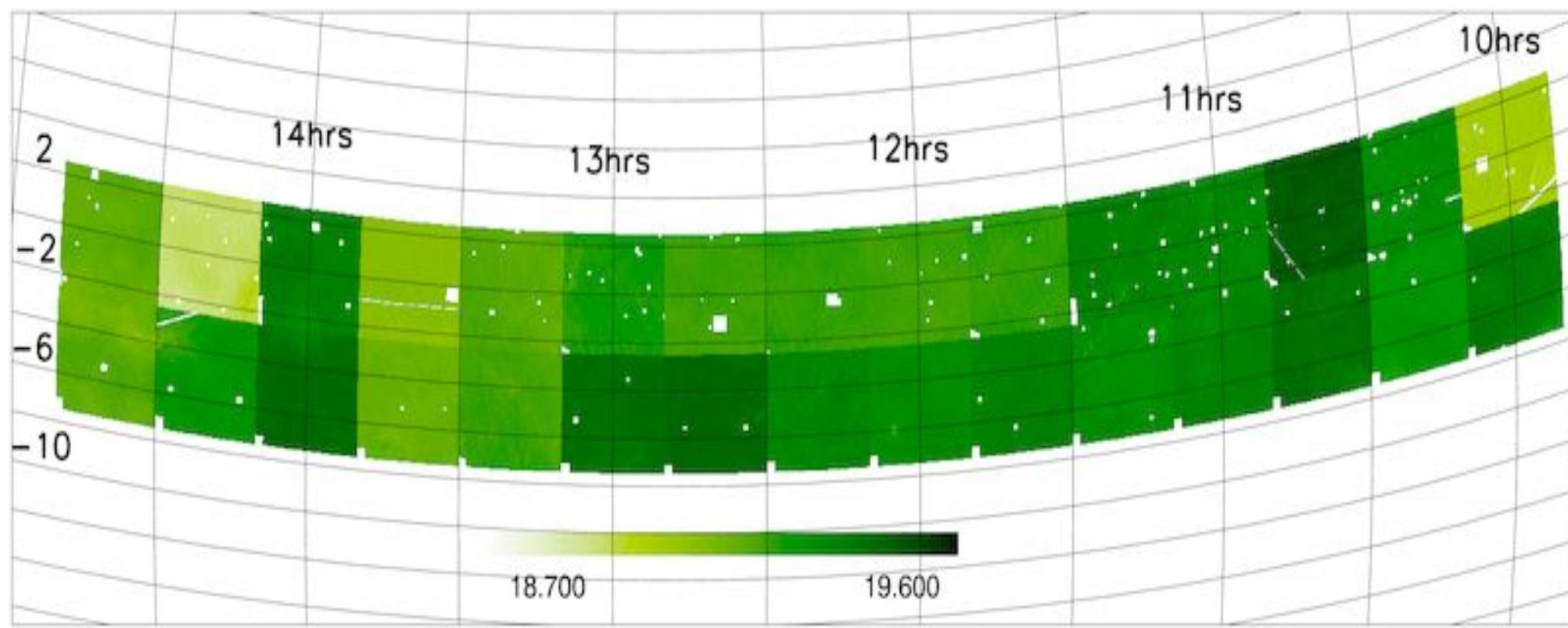
**Fig. 2.** A schematic diagram of the method used to deblend a composite object. The areal profile of the object (the smooth curve) can be described as a tree-structure (thick lines). The decision to regard a branch as a distinct object is determined according to its relative integrated intensity (tinted area). In the case above, the original object is split into two components A and B. Pixels lying below the separation threshold are assigned to their most credible “progenitor” afterwards

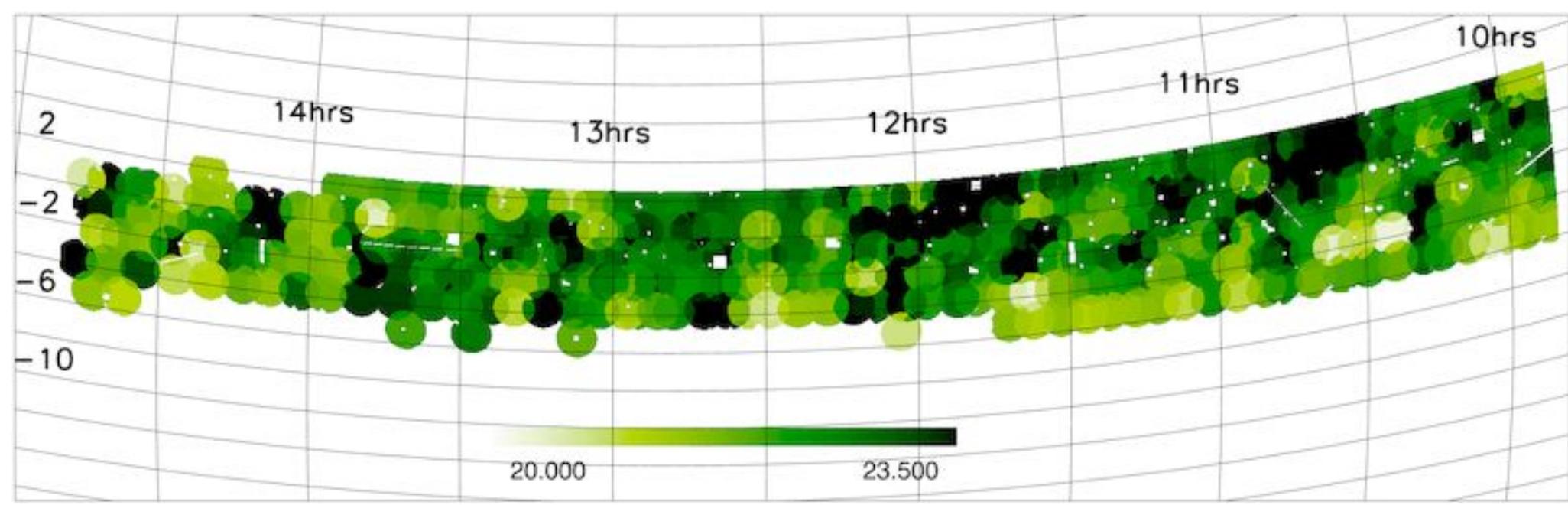


# 2dF



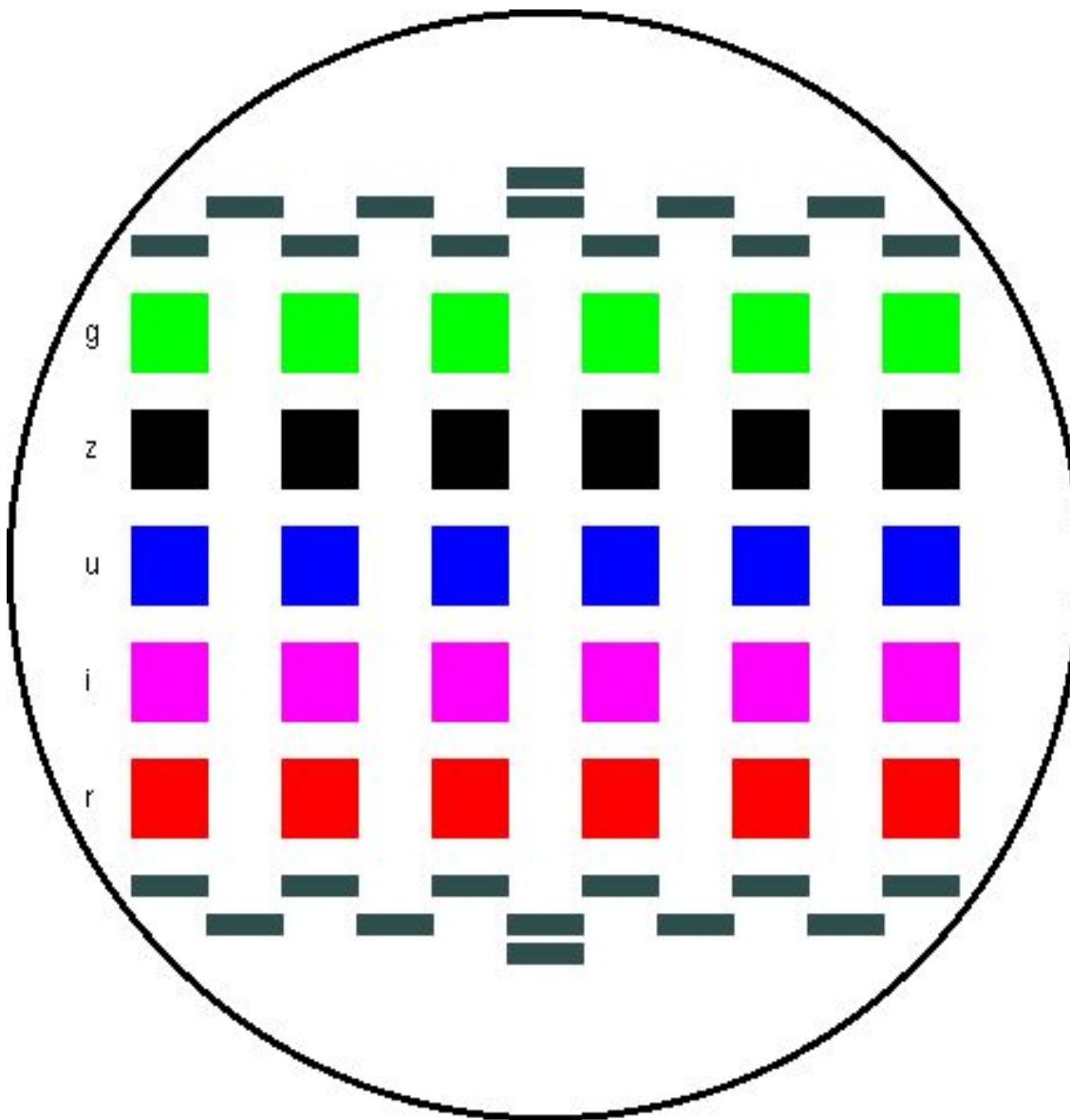




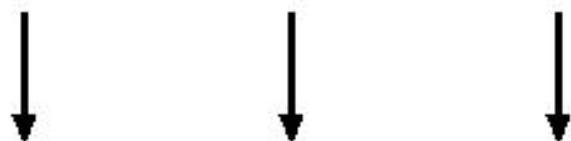


# SDSS

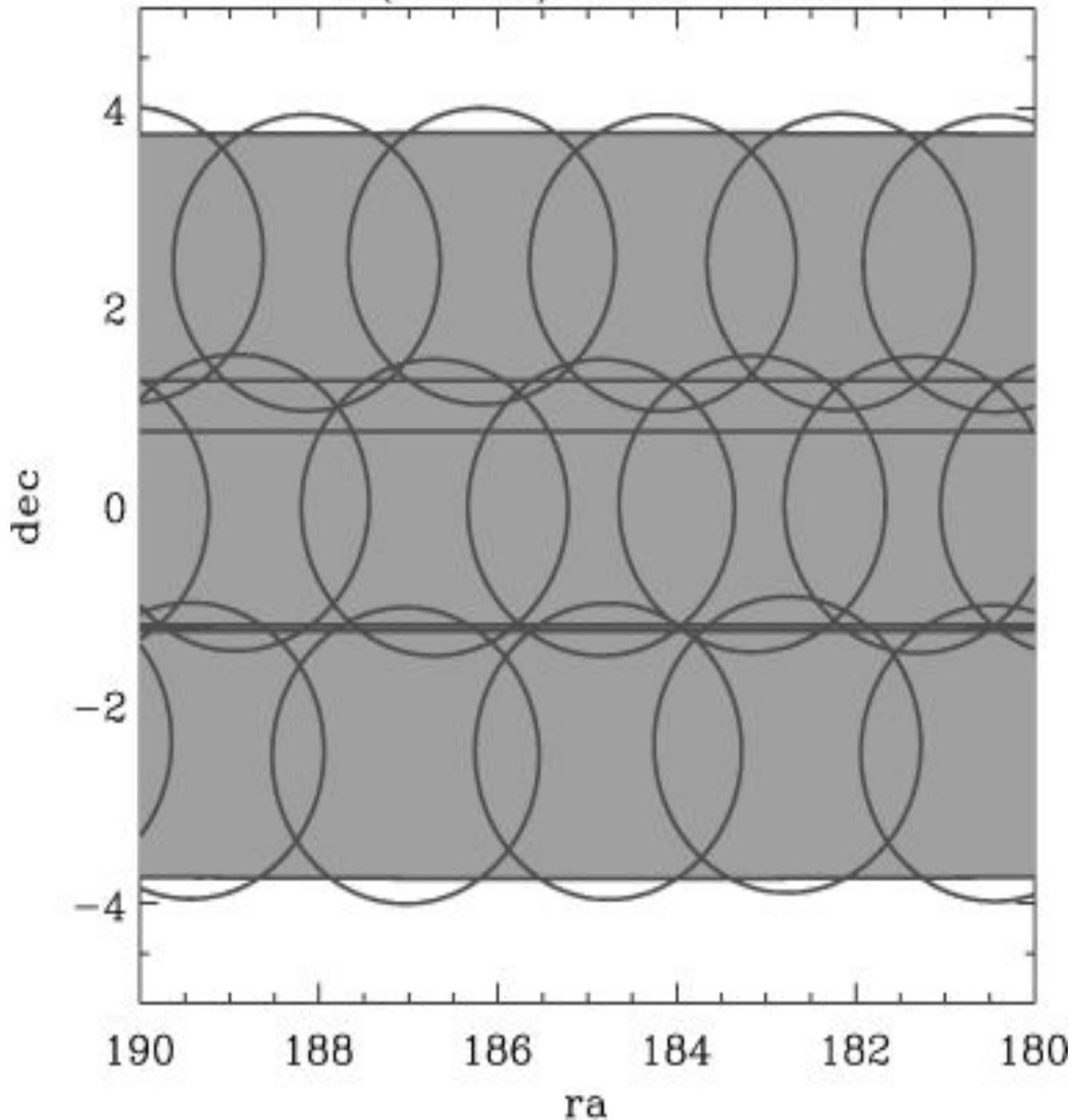


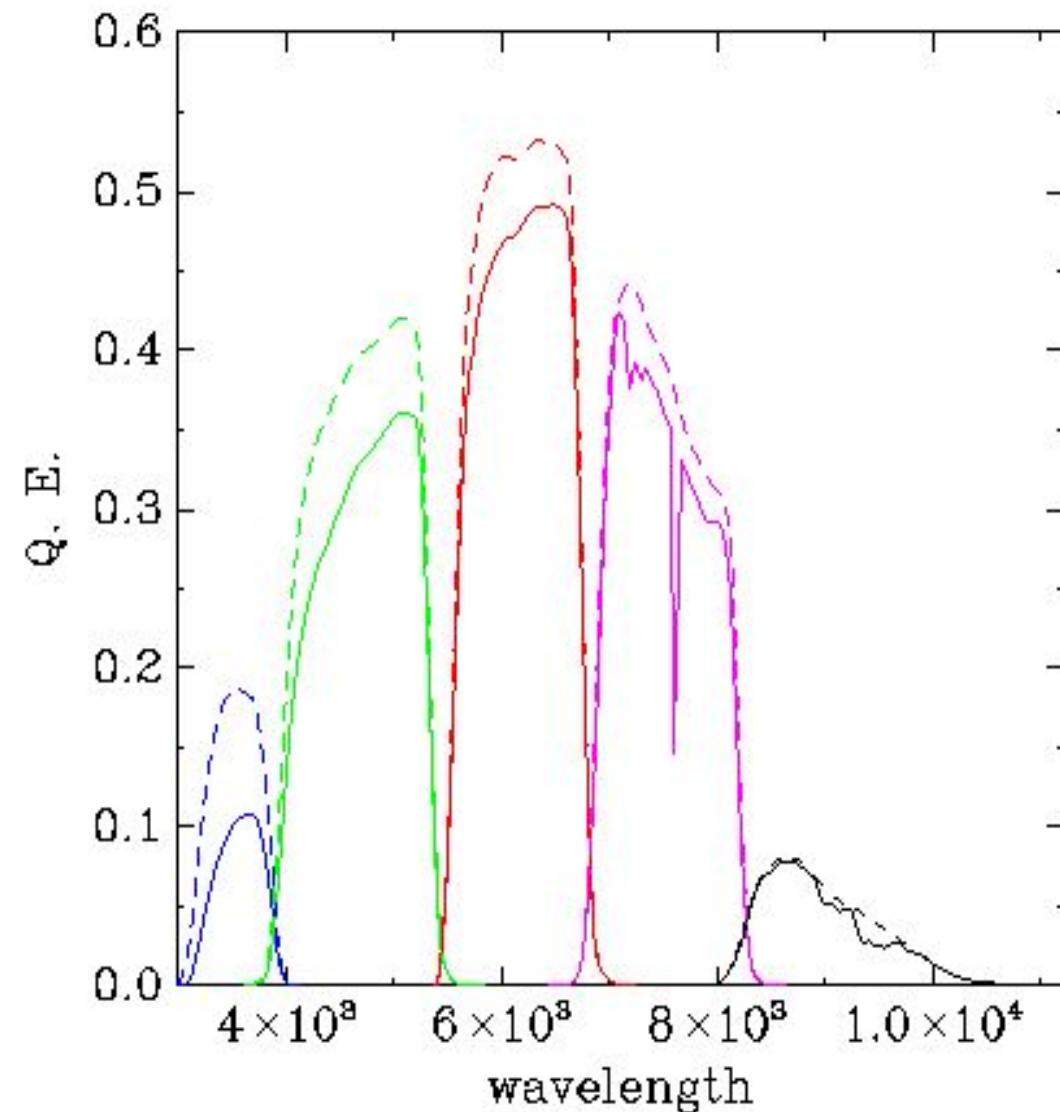


Camera scans this direction

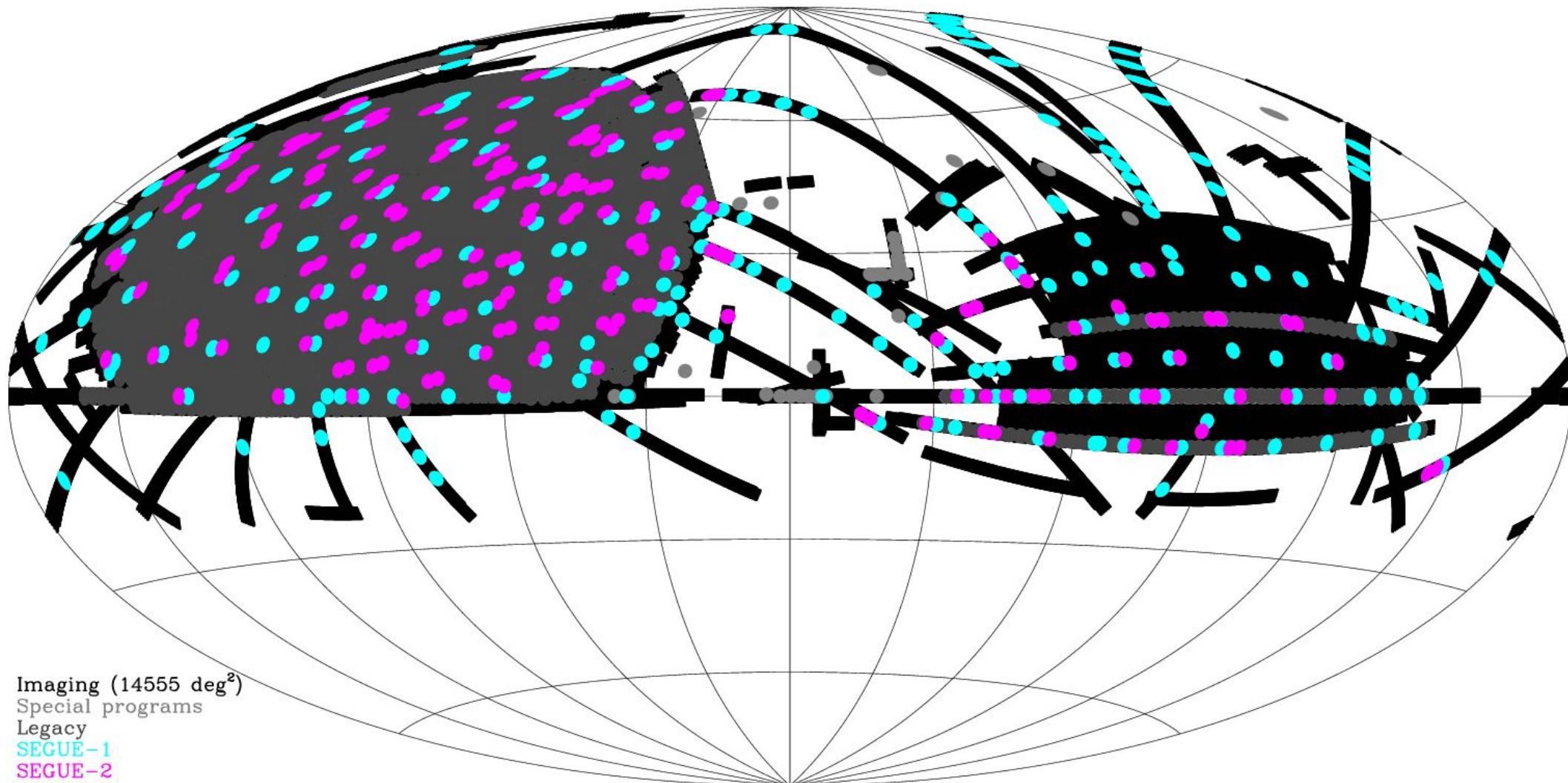


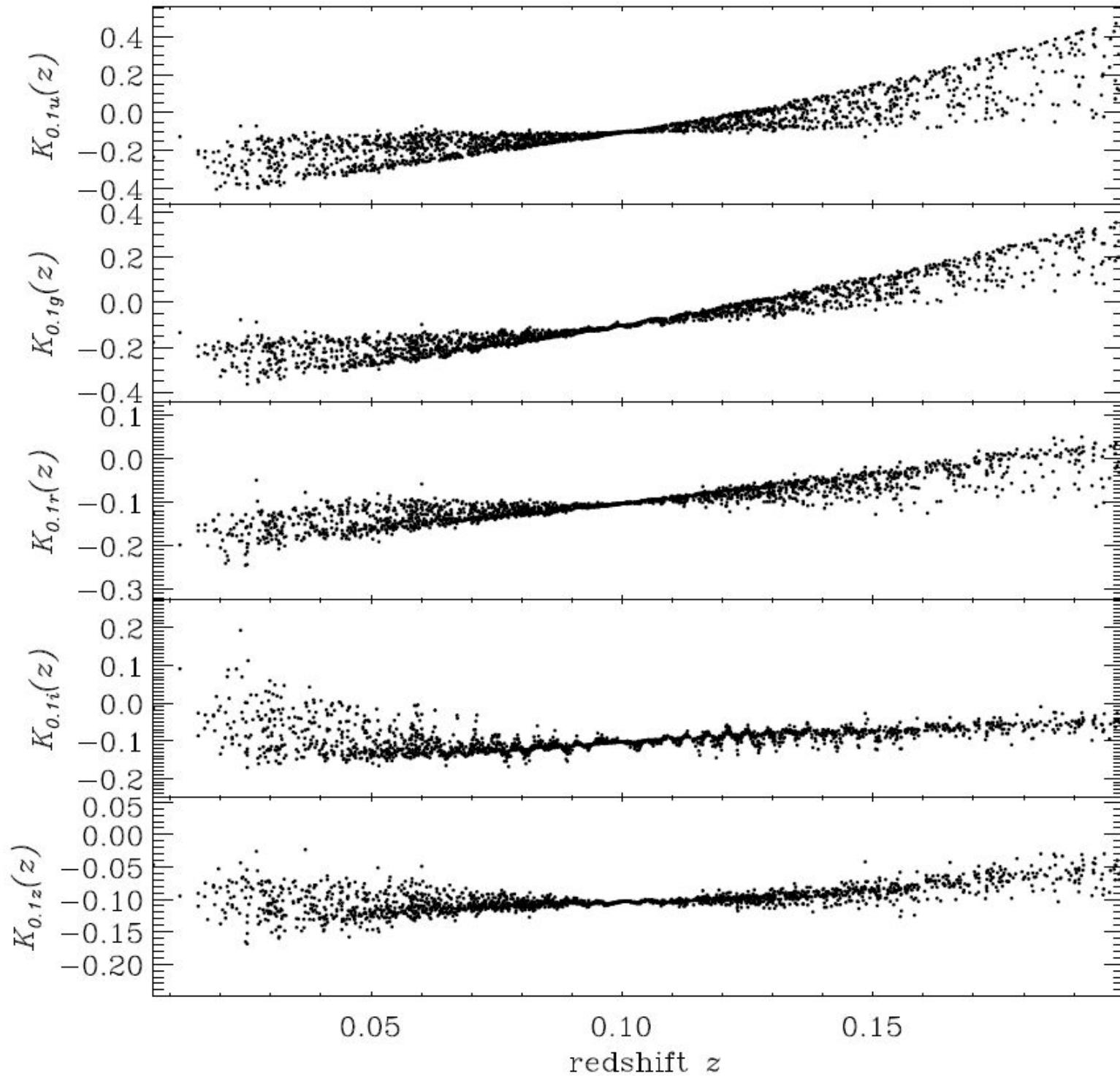
Final (as of DR1) Tiles and Boundaries





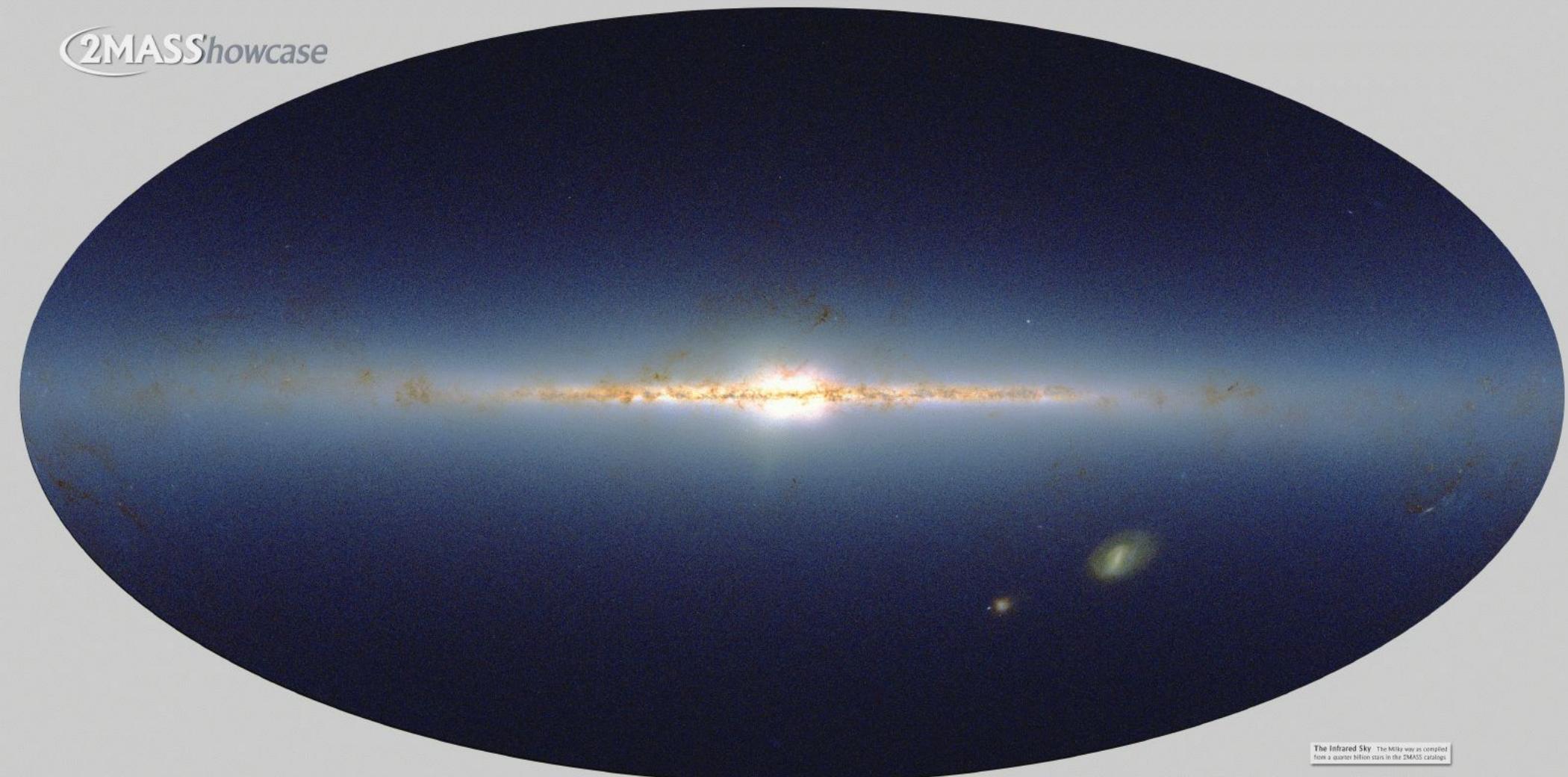
# DR12





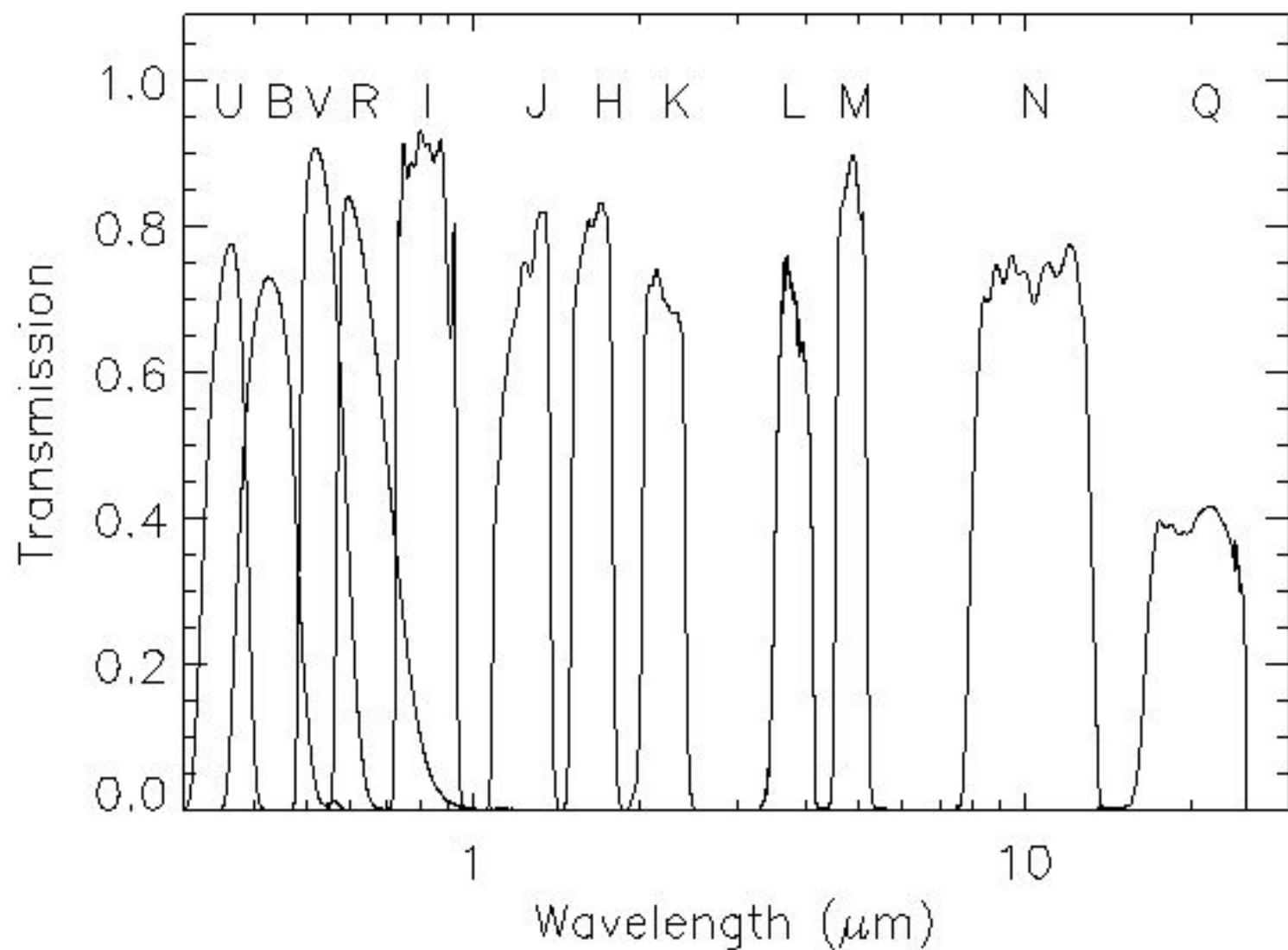
# 2MASS

2MASSShowcase



The Infrared Sky - The Milky way as compiled from a quarter billion stars in the 2MASS catalogs

Two Micron All Sky Survey Image Mosaic: Infrared Processing and Analysis Center/Caltech & University of Massachusetts



## THE 2MASS REDSHIFT SURVEY—DESCRIPTION AND DATA RELEASE

JOHN P. HUCHRA<sup>1,15</sup>, LUCAS M. MACRI<sup>2</sup>, KAREN L. MASTERS<sup>3,4</sup>, THOMAS H. JARRETT<sup>5</sup>, PERRY BERLIND<sup>1</sup>, MICHAEL CALKINS<sup>1</sup>, AIDAN C. CROOK<sup>6</sup>, ROC CUTRI<sup>4</sup>, PIRIN ERDOĞDU<sup>7</sup>, EMILIO FALCO<sup>1</sup>, TEDDY GEORGE<sup>8</sup>, CONRAD M. HUTCHESON<sup>9</sup>, OFER LAHAV<sup>7</sup>, JEFF MADER<sup>10</sup>, JESSICA D. MINK<sup>1</sup>, NATHALIE MARTIMBEAU<sup>11</sup>, STEPHEN SCHNEIDER<sup>12</sup>, MICHAEL SKRUTSKIE<sup>13</sup>, SUSAN TOKARZ<sup>1</sup>, AND MICHAEL WESTOVER<sup>14</sup>

<sup>1</sup> Harvard-Smithsonian Center for Astrophysics, 60 Garden Street, Cambridge, MA 02138, USA

<sup>2</sup> George P. and Cynthia Woods Mitchell Institute for Fundamental Physics and Astronomy, Department of Physics and Astronomy, Texas A&M University, 4242 TAMU, College Station, TX 77843, USA; [macri@tamu.edu](mailto:macri@tamu.edu)

<sup>3</sup> Institute for Cosmology and Gravitation, University of Portsmouth, Dennis Sciama Building, Burnaby Road, Portsmouth, PO1 3FX, UK; [karen.masters@port.ac.uk](mailto:karen.masters@port.ac.uk)

<sup>4</sup> SEPNet (South East Physics Network), UK

<sup>5</sup> Infrared Processing and Analysis Center, California Institute of Technology, 770 S Wilson Ave., Pasadena, CA 91125, USA

<sup>6</sup> Microsoft Corp., 1 Microsoft Way, Redmond, WA 98052, USA

<sup>7</sup> Department of Physics and Astronomy, University College London, London WC1E 6BT, UK

<sup>8</sup> Canada–France–Hawaii Telescope, 65-1238 Mamalahoa Hwy, Kamuela, HI 96743, USA

<sup>9</sup> Kavli Institute for Particle Astrophysics and Cosmology, Stanford University, Stanford, CA 94309, USA

<sup>10</sup> Keck Observatory, 65-1120 Mamalahoa Hwy, Kamuela, HI 96743, USA

<sup>11</sup> Planétarium de Montréal, 1000 rue Saint-Jacques, Montréal, Québec H3C 1G7, Canada

<sup>12</sup> Department of Astronomy, University of Massachusetts, Amherst, MA 01003, USA

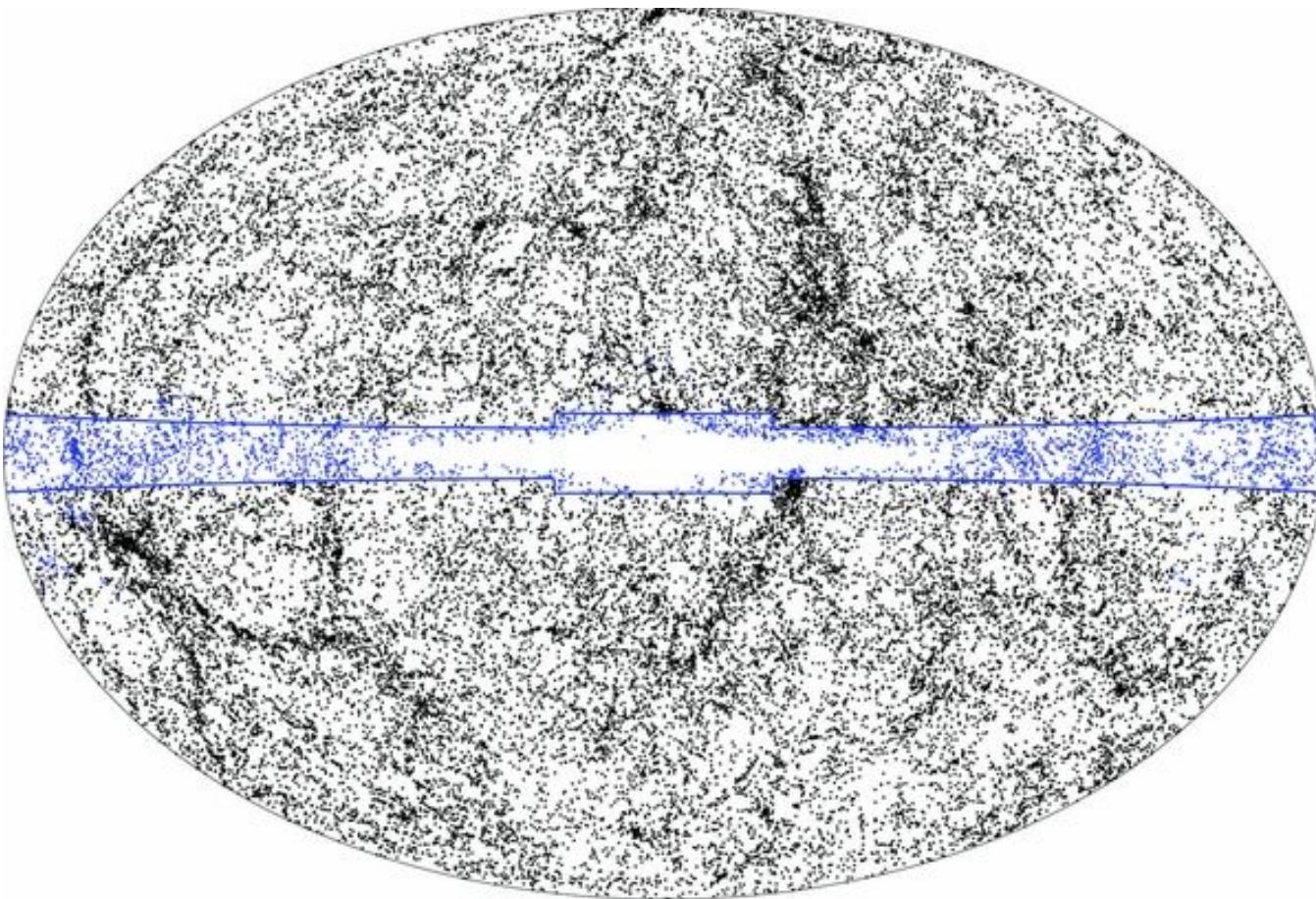
<sup>13</sup> Department of Astronomy, University of Virginia, Charlottesville, VA 22904, USA

<sup>14</sup> McKinsey & Co., 1420 Fifth Ave., Ste 3100, Seattle, WA 98101, USA

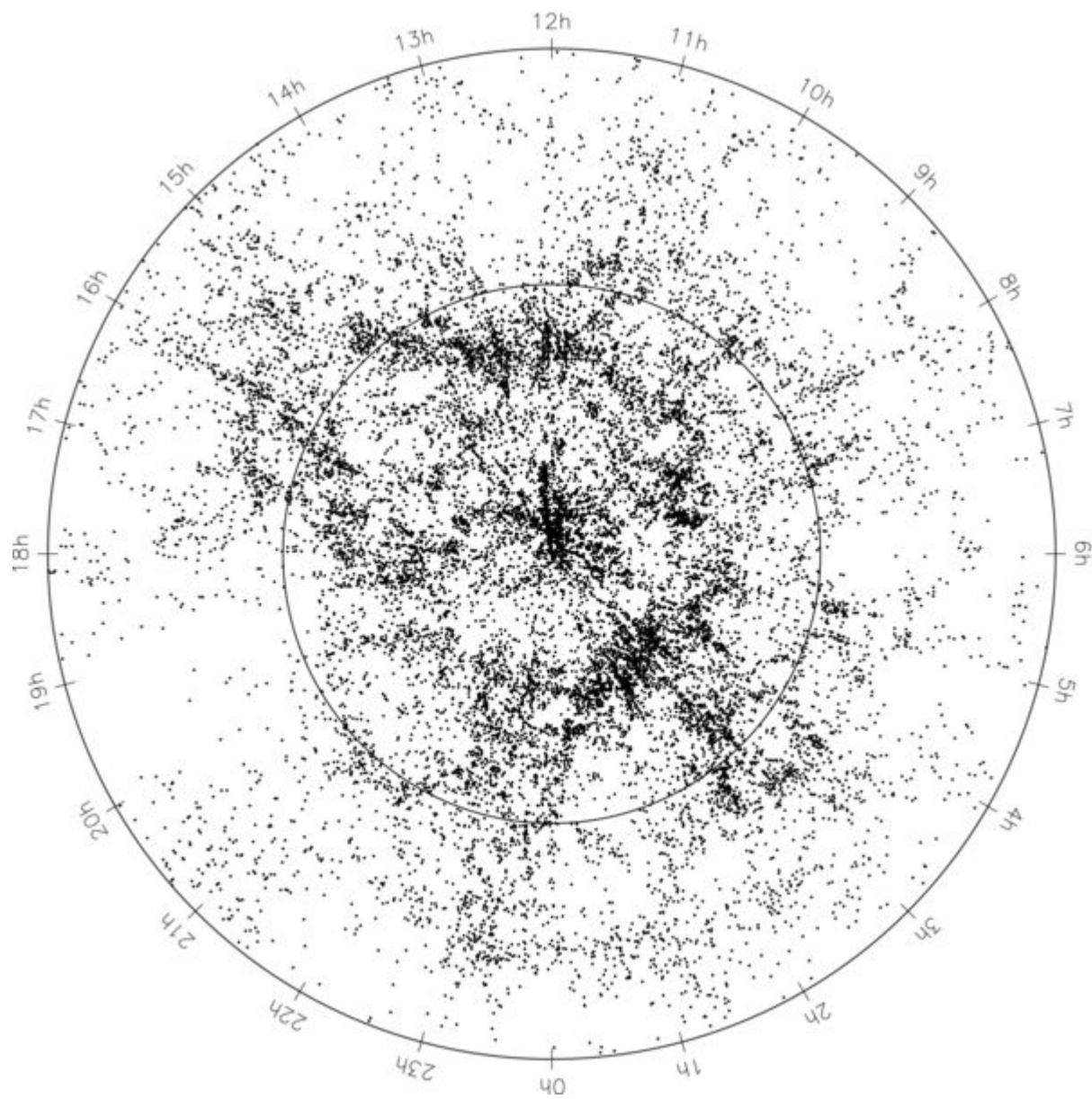
*Received 2011 July 29; accepted 2011 December 17; published 2012 March 14*

## ABSTRACT

We present the results of the 2MASS Redshift Survey (2MRS), a ten-year project to map the full three-dimensional distribution of galaxies in the nearby universe. The Two Micron All Sky Survey (2MASS) was completed in 2003 and its final data products, including an extended source catalog (XSC), are available online. The 2MASS XSC contains nearly a million galaxies with  $K_s \leq 13.5$  mag and is essentially complete and mostly unaffected by interstellar extinction and stellar confusion down to a galactic latitude of  $|b| = 5^\circ$  for bright galaxies. Near-infrared wavelengths are sensitive to the old stellar populations that dominate galaxy masses, making 2MASS an excellent starting point to study the distribution of matter in the nearby universe. We selected a sample of 44,599 2MASS galaxies with  $K_s \leq 11.75$  mag and  $|b| \geq 5^\circ$  ( $\geq 8^\circ$  toward the Galactic bulge) as the input catalog for our survey. We obtained spectroscopic observations for 11,000 galaxies and used previously obtained velocities for the remainder of the sample to generate a redshift catalog that is 97.6% complete to well-defined limits and covers 91% of the sky. This provides an unprecedented census of galaxy (baryonic mass) concentrations within 300 Mpc. Earlier versions of our survey have been used in a number of publications that have studied the bulk motion of the Local Group, mapped the density and peculiar velocity fields out to  $50 h^{-1}$  Mpc, detected galaxy groups, and estimated the values of several cosmological parameters. Additionally, we present morphological types for a nearly complete sub-sample of 20,860 galaxies with  $K_s \leq 11.25$  mag and  $|b| \geq 10^\circ$ .

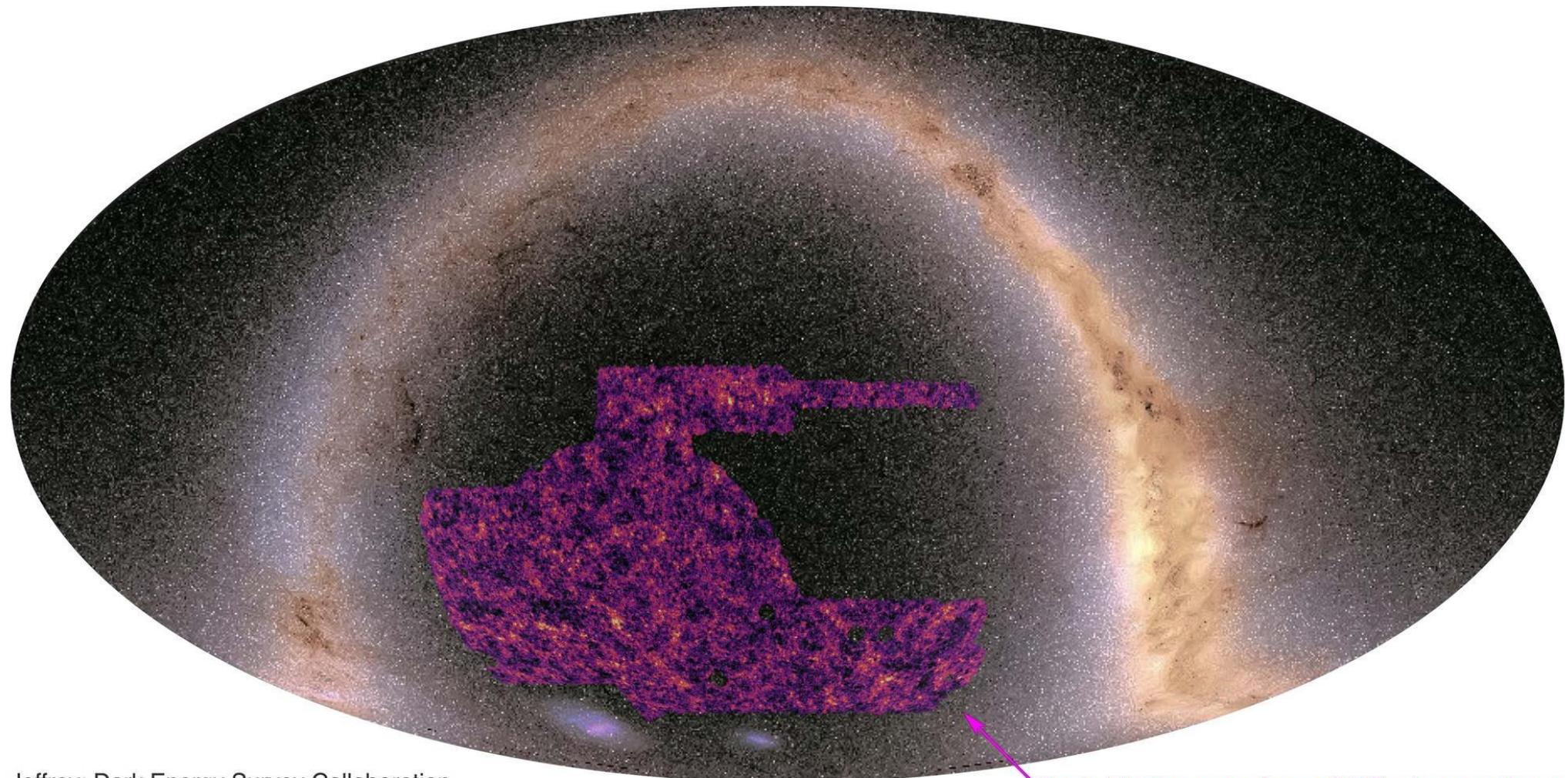


**Figure 1.** Distribution of 2MASS galaxies with  $K_s \leq 11.75$  mag in Galactic coordinates (Aitoff projection). Blue dots represent galaxies outside our survey area. Note that due to stellar confusion we cannot cover, even to this bright magnitude limit, the very central region of the galaxy, but we do cover  $\sim 91\%$  of the sky.



# DES: Dark Energy Survey

- Colaboración internacional
- Objetivo: mapear cientos de millones de galaxias y determinar los patrones de la estructura cósmica → Dark Energy
- Se inició en el sur en 2013 en Tololo (telescopio V. Blanco de 4 m)
- 758 noches durante 6 años. 5000 grados cuadrados en cinco filtros



N. Jeffrey; Dark Energy Survey Collaboration

Dark Matter map from DES observations

# DESI - Dark Energy Spectroscopic Instrument (Mayall 4-metros en Kitt Peak)

**Galaxias Brillantes** (BGs). DESI creará un mapa detallado de estos objetos hasta un desplazamiento al rojo de 0.4 e incluirá galaxias de magnitud 20.

**Galaxias Luminosas Rojas** (LRGs). El sondeo de galaxias llegará a desplazamientos al rojo de 1.

**Galaxias de Líneas de Emisión** (ELGs). DESI podrá detectarlas hasta un desplazamiento al rojo de 1.6.

**Cuásares.** DESI podrá detectarlas hasta desplazamientos al rojo de 3.5 y un poco más lejanas.

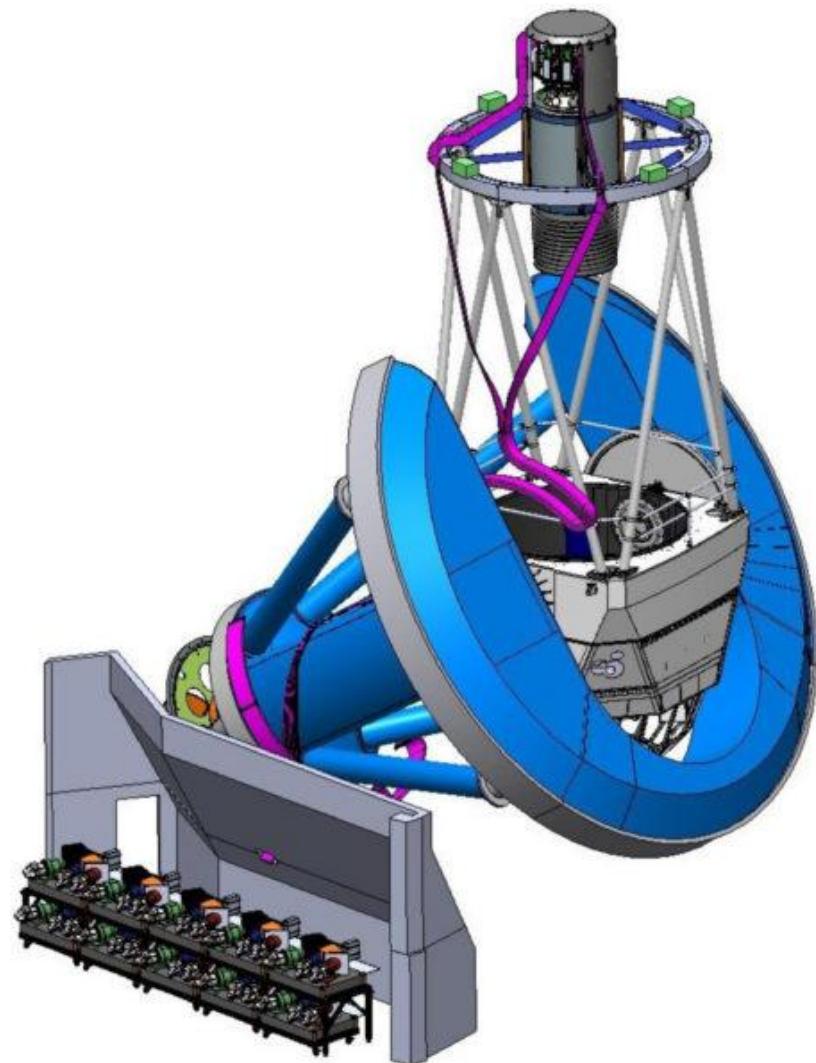
## The DESI Early Data Release by the numbers:

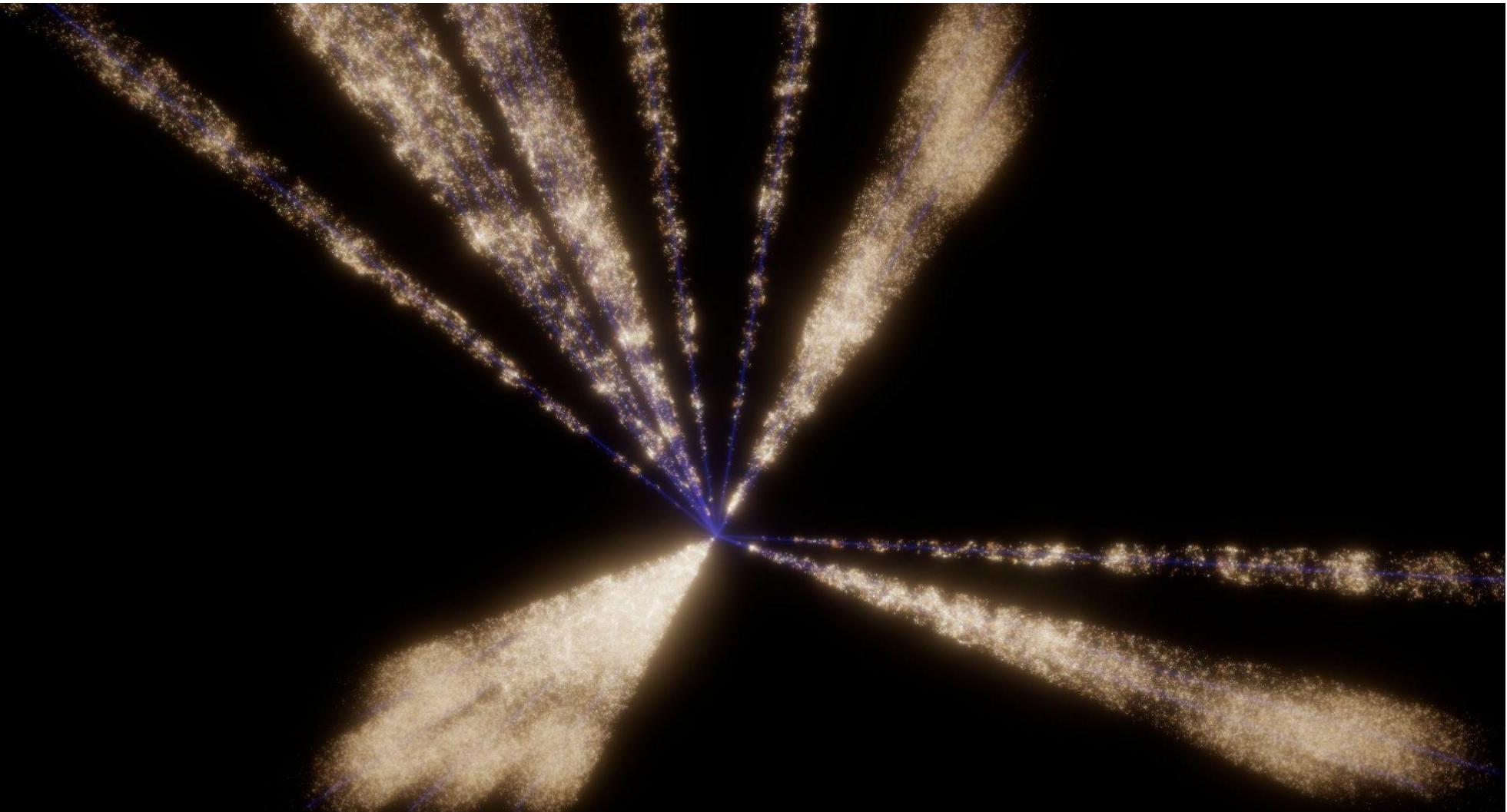
- Amount of data: 80 TB
- Exposures taken: 2,480
- Redshifts collected: 1.2 million extragalactic (galaxies and quasars)
- Objects in the Milky Way imaged: 496,000
- Quasars spotted: 90,000
- Time spent observing: 6 months
- Size compared to full DESI dataset: 2%

Próximo Release: 2025

Over its 5-year observing lifetime, DESI will measure the spectra of more than 30 million galaxies and quasars covering 14,000 square degrees. The DESI instrument will provide unprecedented multi-object spectroscopy incorporating a novel design.

DESI's new corrector optics provides a 3-degree-diameter field of view that feeds a focal plate containing 5,000 robotic positioners. The positioners can be reconfigured within 3 minutes to measure the spectra of a new set of galaxies. Optical fibers mounted to the positioners extend 50 meters down the telescope to feed 10 broad-band spectrographs, each containing three detectors.

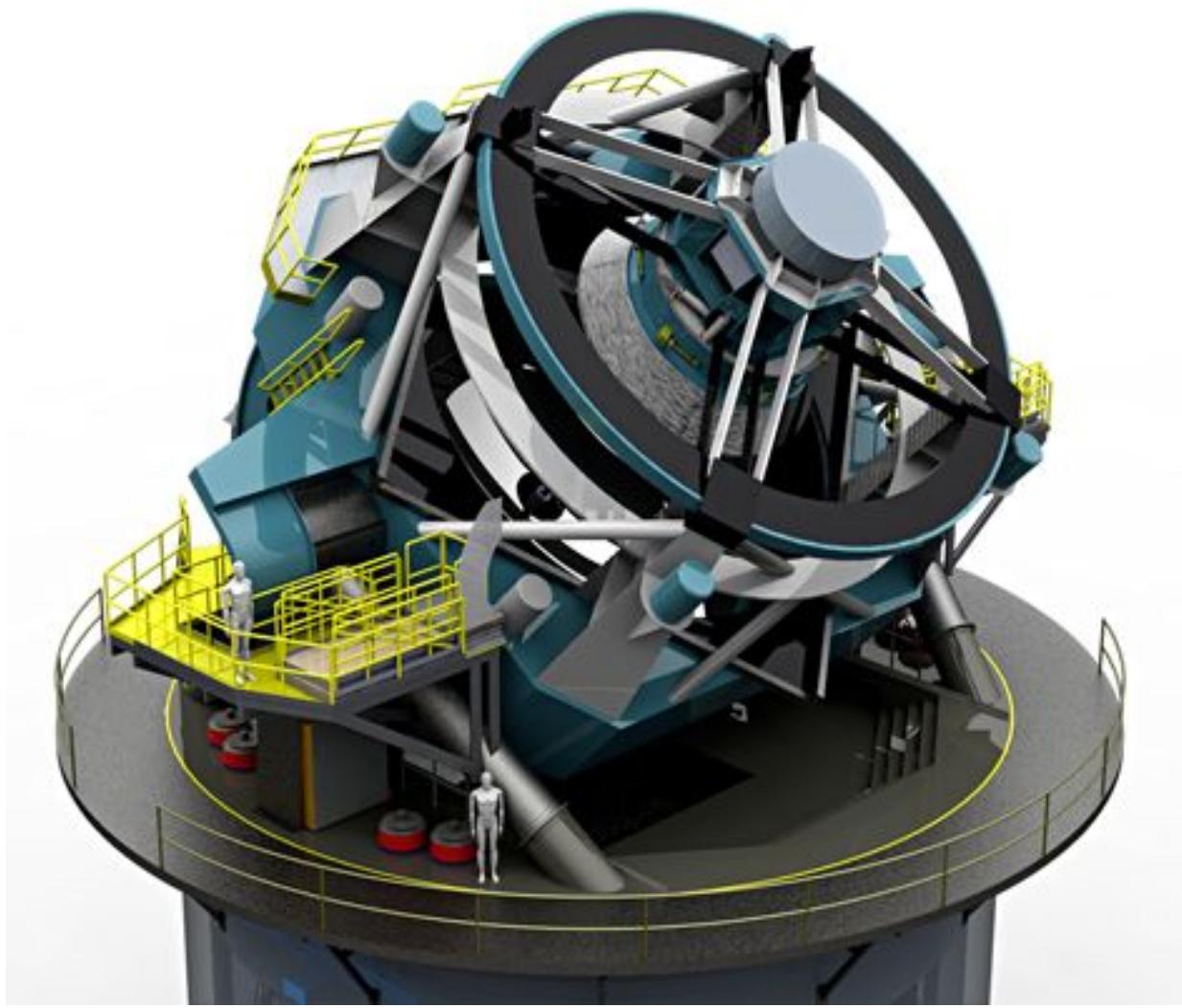




DESI Early Data Release: 1% Survey

# Futuro (casi presente): LSST (Large-aperture Synoptic Telescope → Legacy Survey of Space and Time). Rubin Observatory





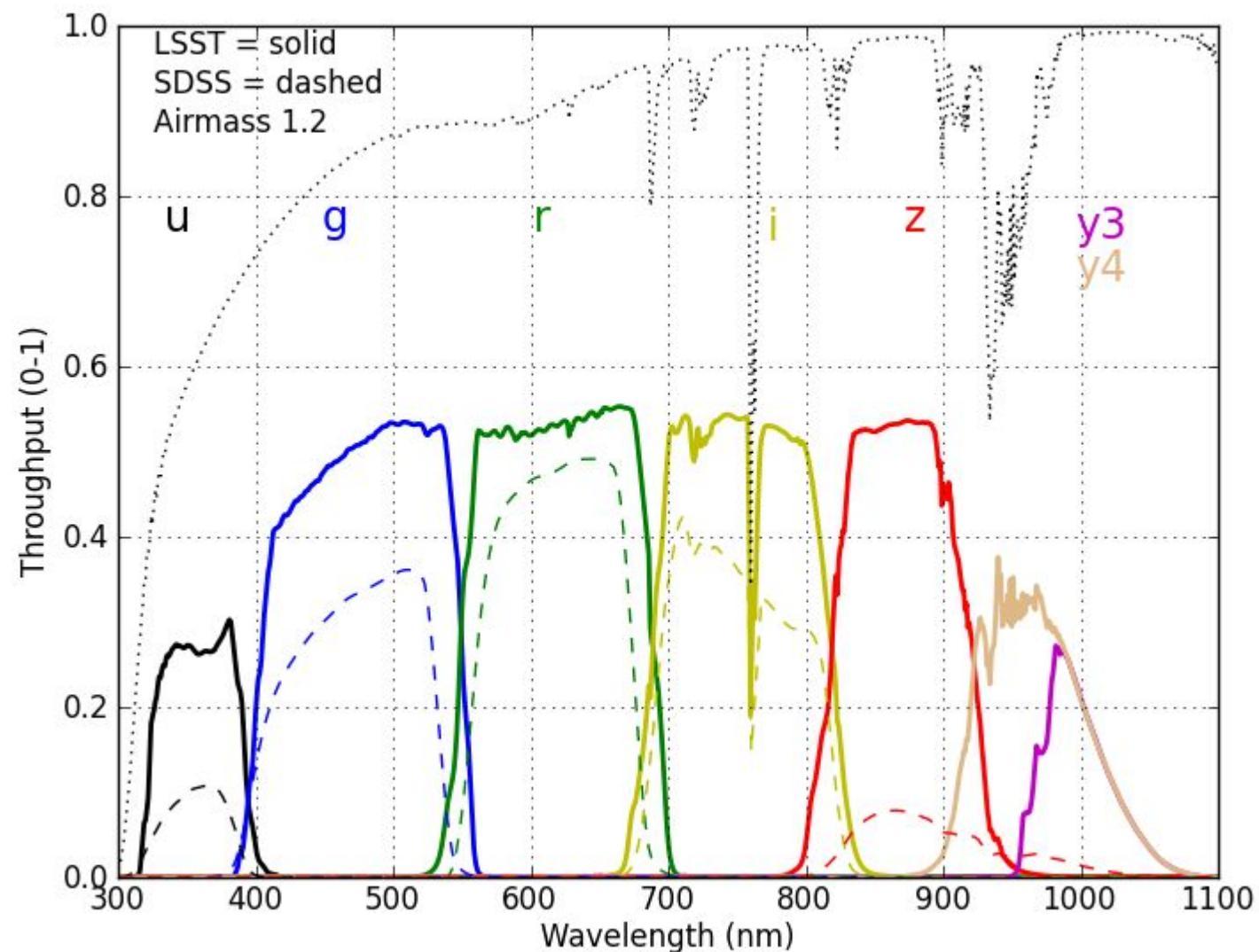
# LSST

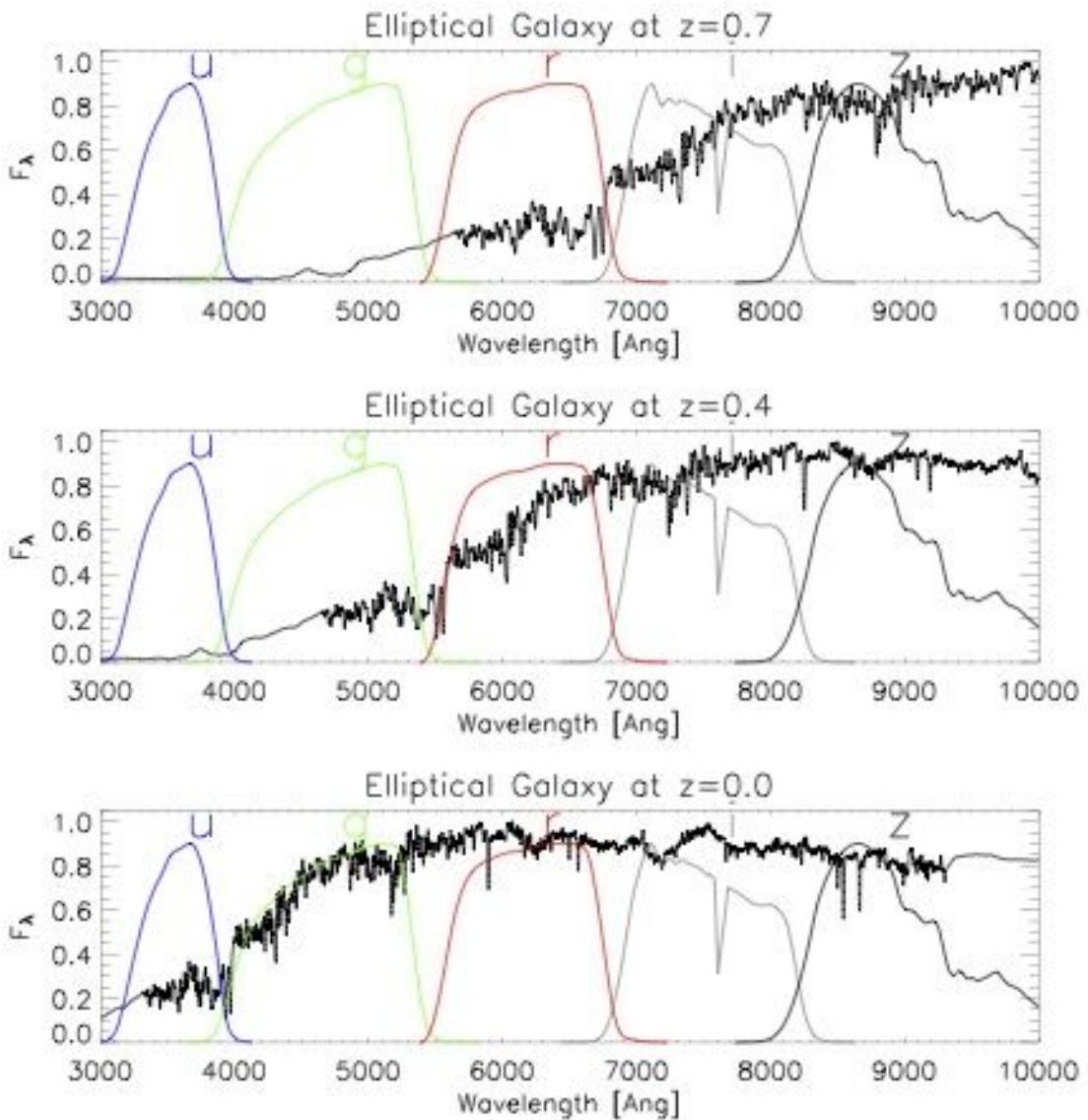
The Survey system will produce a 6-band (ugrizy) wide-field deep astronomical survey of over 20,000 square degrees of the southern sky using an 8.4-meter ground-based telescope. Each patch of sky will be visited about 1000 times in ten years. The LSST leverages innovative [technology](#) in all subsystems: the [camera](#) (3200 Megapixels, which will be the world's largest digital camera), [telescope](#) (simultaneous casting of the primary and tertiary mirrors; two aspheric optical surfaces on one substrate), a 9.6 square degree field of view with excellent image quality, and [data management](#) (30 terabytes of data nightly, nearly instant alerts issued for objects that change in position or brightness). This innovation on all fronts has attracted many [institutional members](#) and hundreds of [other scientists](#) in ten [science collaborations](#).

# LSST



The LSST image simulator produces 'end-to-end' image simulations to verify the scientific performance of the complete LSST system design. This color image, a composite of three individual frames with different filters, shows one 4Kx4K CCD (13 x 13 arcminutes of sky) out of 189 CCDs in the LSST focal plane. It corresponds to only 2.6 parts per million of LSST's ultimate sky coverage of 20,000 sq.deg.



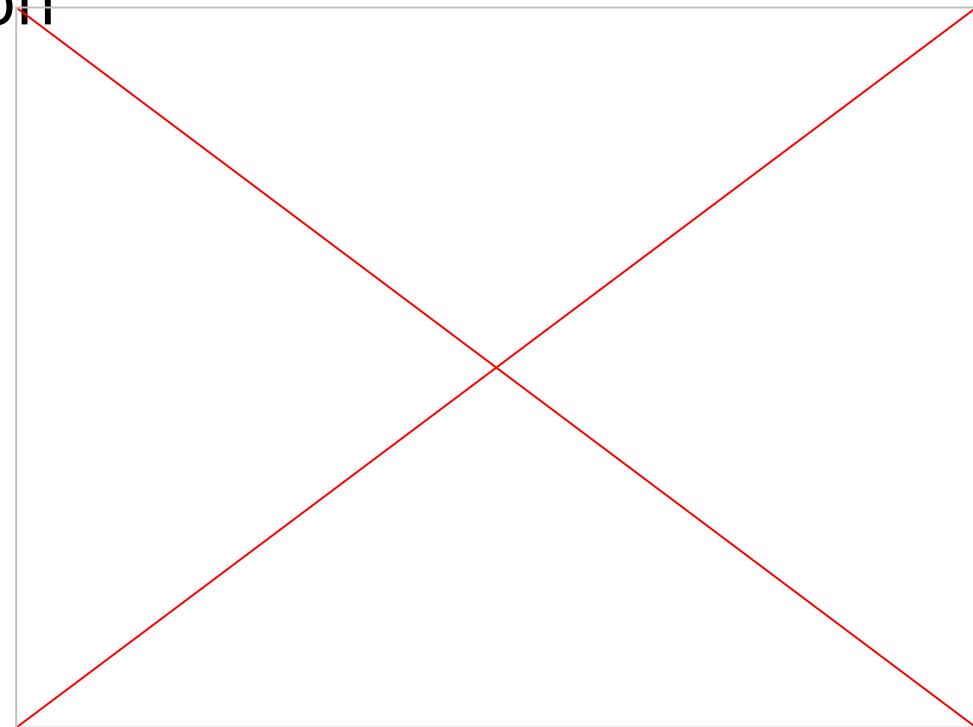


# Euclid (ESA) - 2023

Objetivo: medir la aceleración del Universo

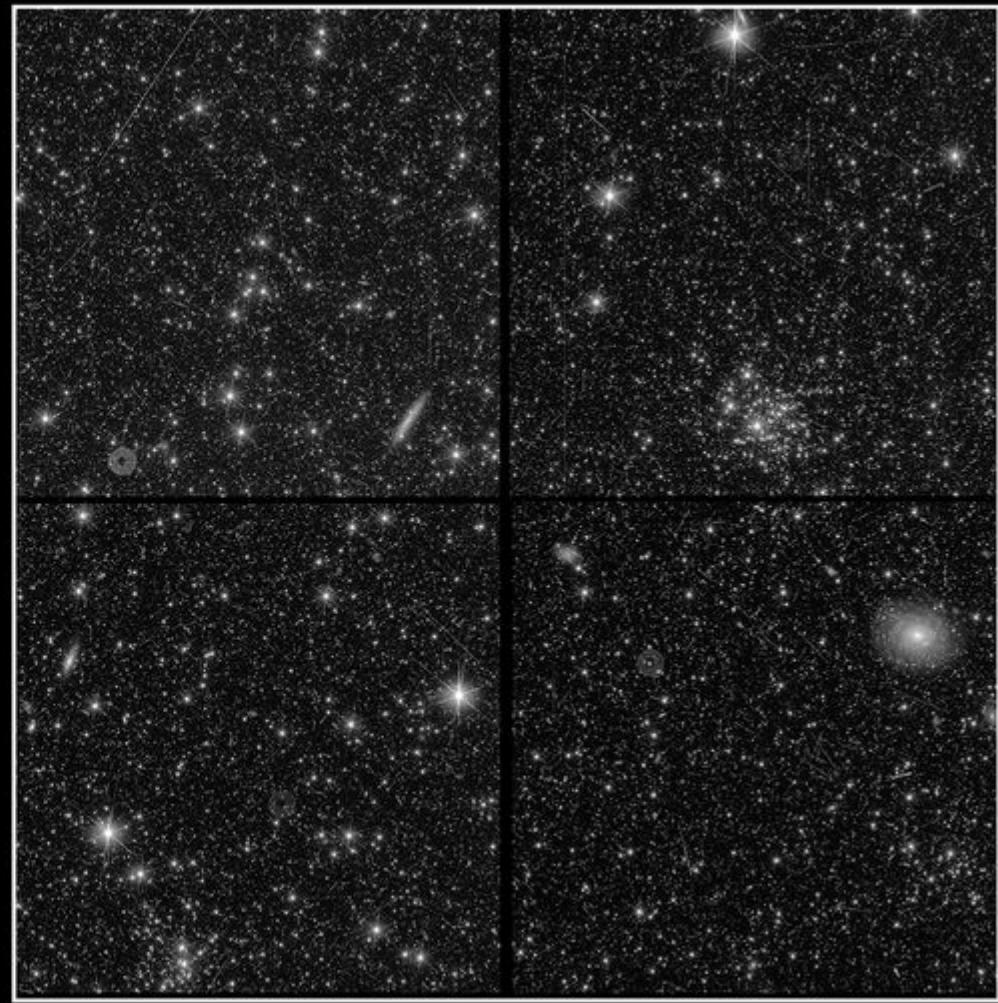
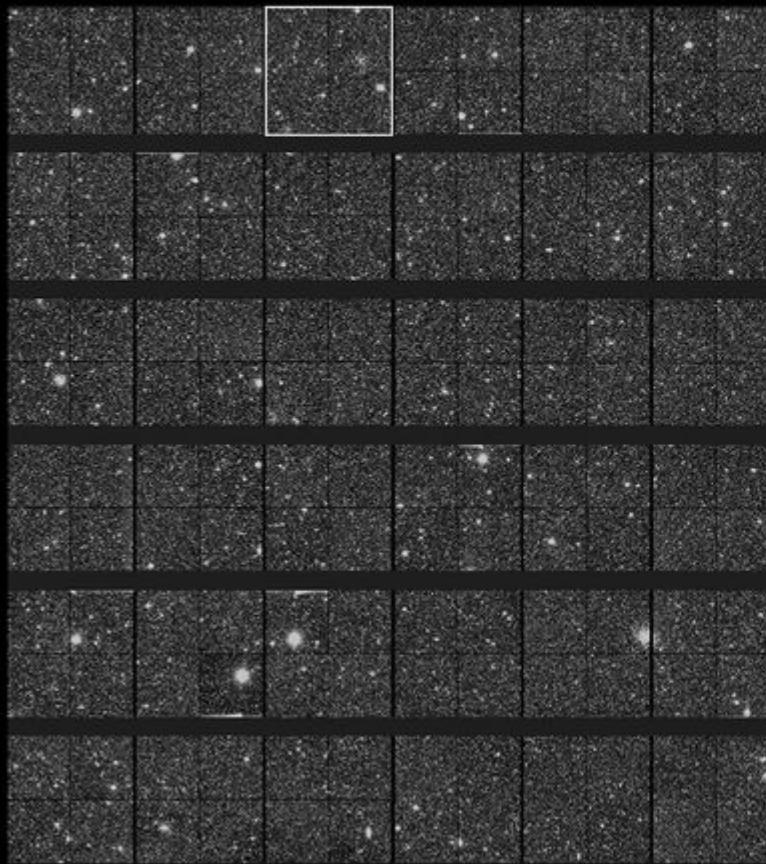
Telescopio espacial en L2

- Espejo de 1.2m
- Dos instrumentos: VIS en el visible y NISP en el infrarojo en dos modos (imagen y espectro)
- Obtendrá redshifts de forma masiva
- Actualmente en operación



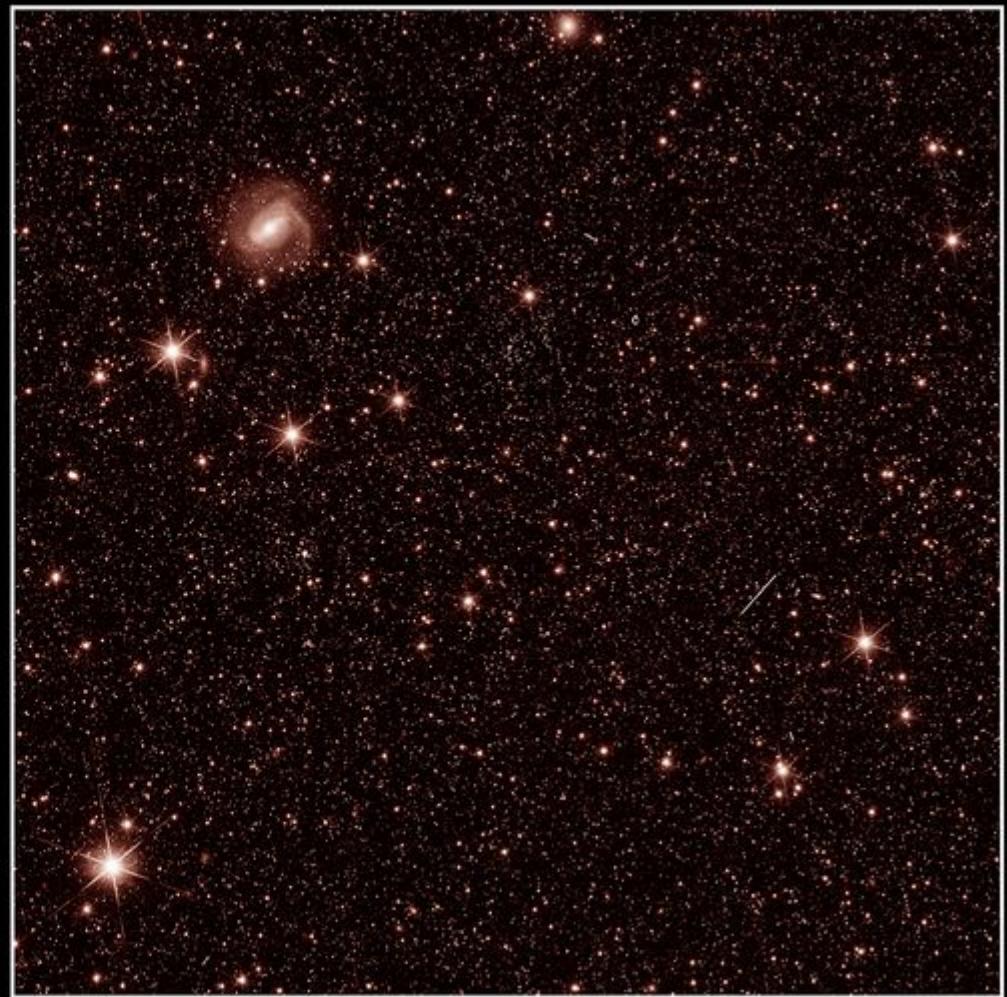
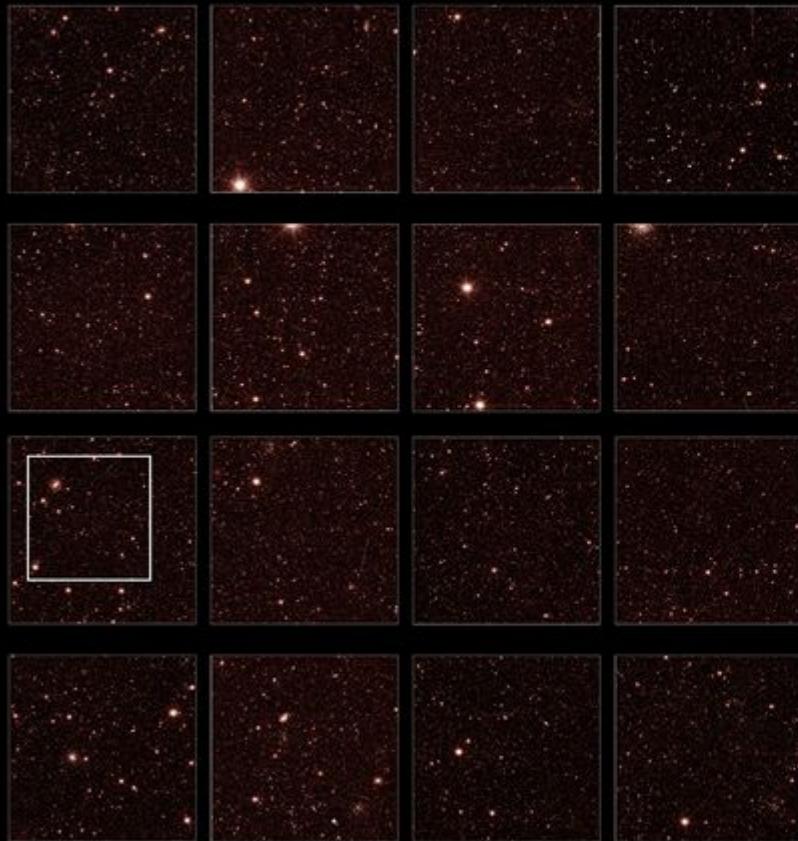
# Primeras imágenes (julio 2023)

EARLY COMMISSIONING TEST IMAGE, VIS INSTRUMENT

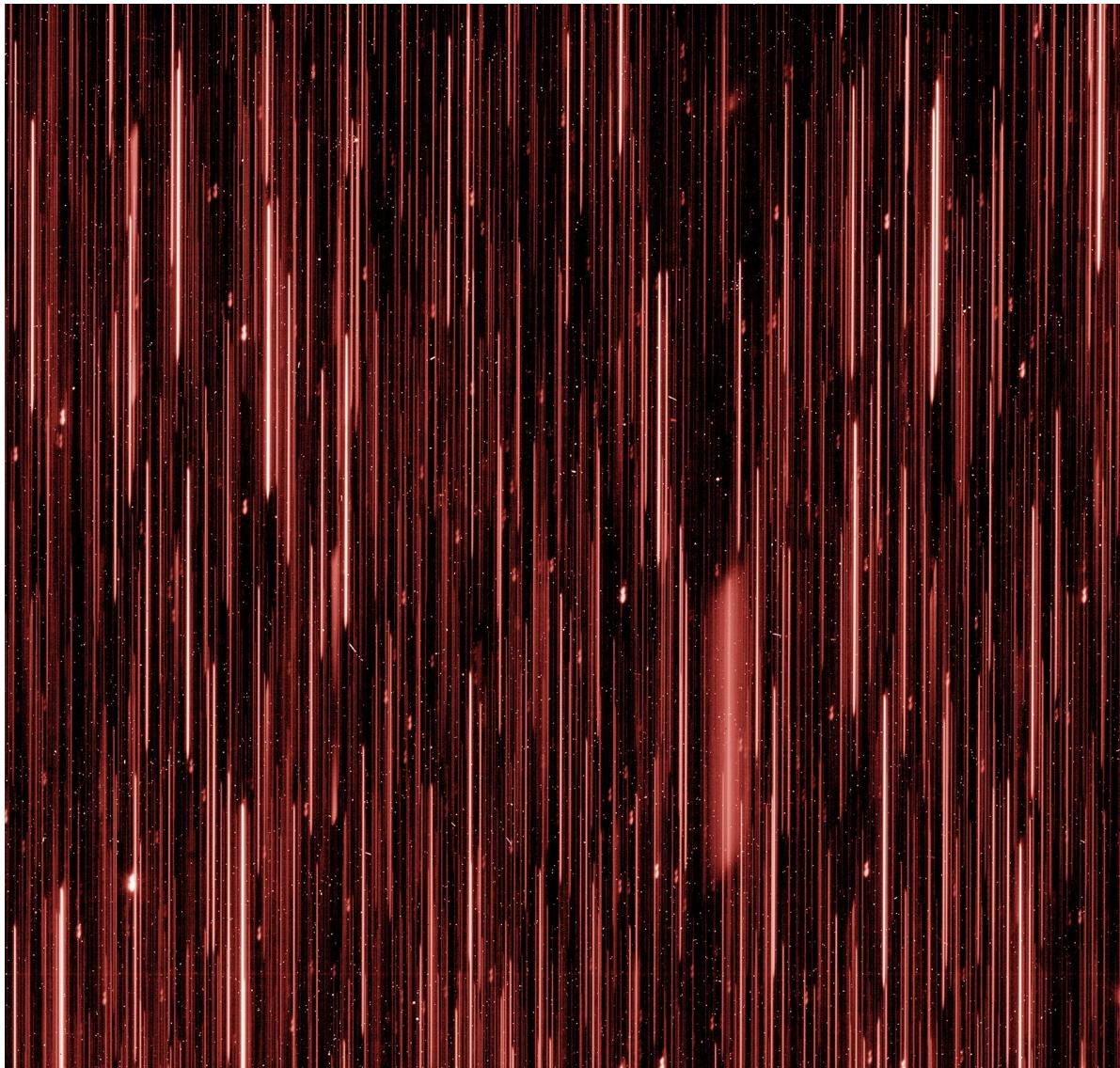


# Infrarrojo - modo imagen

EARLY COMMISSIONING TEST IMAGE, NISP INSTRUMENT



# Infrarrojo - modo grism (prisma+red)



Early commissioning test image, NISP instrument (grism mode)

# Relevamientos bidimensionales: MANGA (Mapping Nearby Galaxies at APO (MaNGA))

MaNGA obtained spectral measurements across the face of each of  $\sim$ 10,000 nearby galaxies thanks to 17 simultaneous “integral field units” (IFUs), each composed of tightly-packed arrays of optical fibers.

Dark-time observations

Fall 2014 – Summer 2020

17 science IFUs per 7 deg<sup>2</sup> plate

Wavelength: 360-1000 nm, resolution  $R\sim$ 2000

$\sim$ 10,000 galaxies across  $\sim$ 2700 deg<sup>2</sup>, redshift  $z\sim$ 0.03

roughly 3-hour dithered exposures

Spatial sampling of 1-2 kpc

Per-fiber S/N=4-8 (per angstrom) at 1.5 Re

