The Dark Energy Survey in 10 mins

"**ONE OF THE MOST AMBITIOUS** astronomical surveys in history …"

Yuanyuan Zhang, Fermilab
Schramm postdoctoral fellow
New Perspectives 2016

Background credit: Reidar Hahn

The Dark Energy Survey in 10 mins

A gigantic sky "photography" project.

An extremely wide-field deep optical imaging survey using the Dark Energy Camera mounted on the Blanco telescope.

Background credit: Reidar Hahn

The Dark Energy Survey in 10 mins

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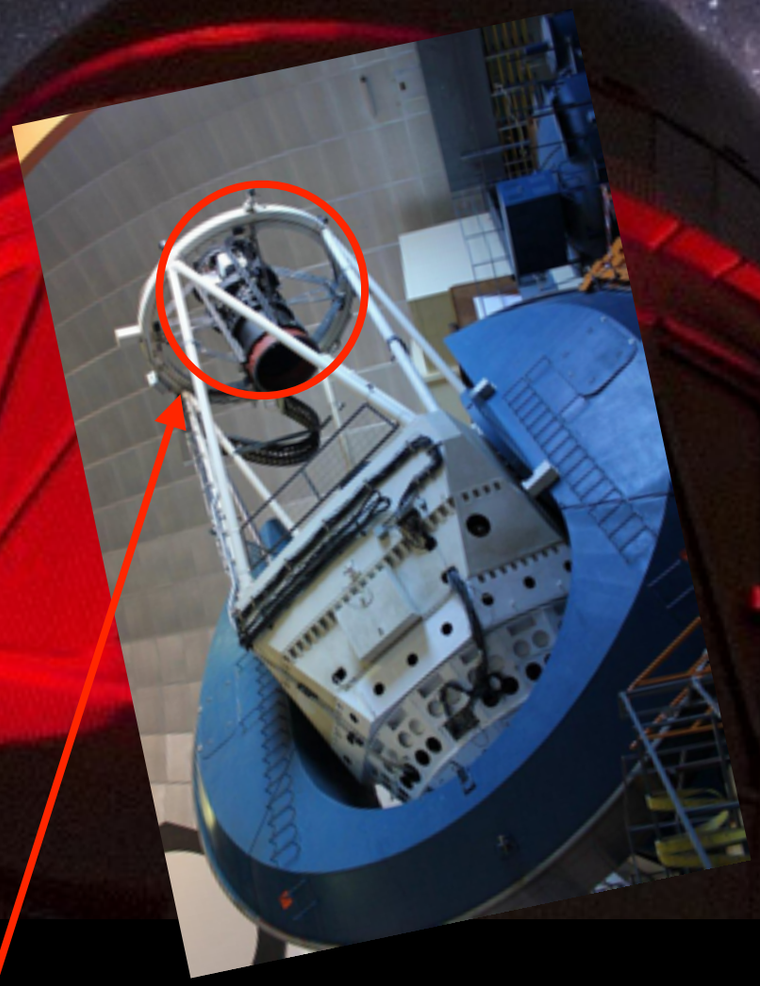

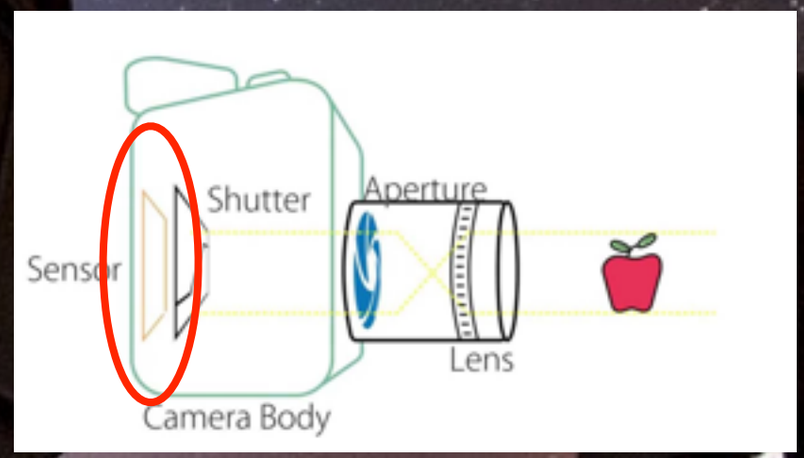

An extremely wide-field deep optical imaging survey using **the Dark Energy Camera** mounted on **the Blanco telescope**.

Background credit: Reidar Hahn

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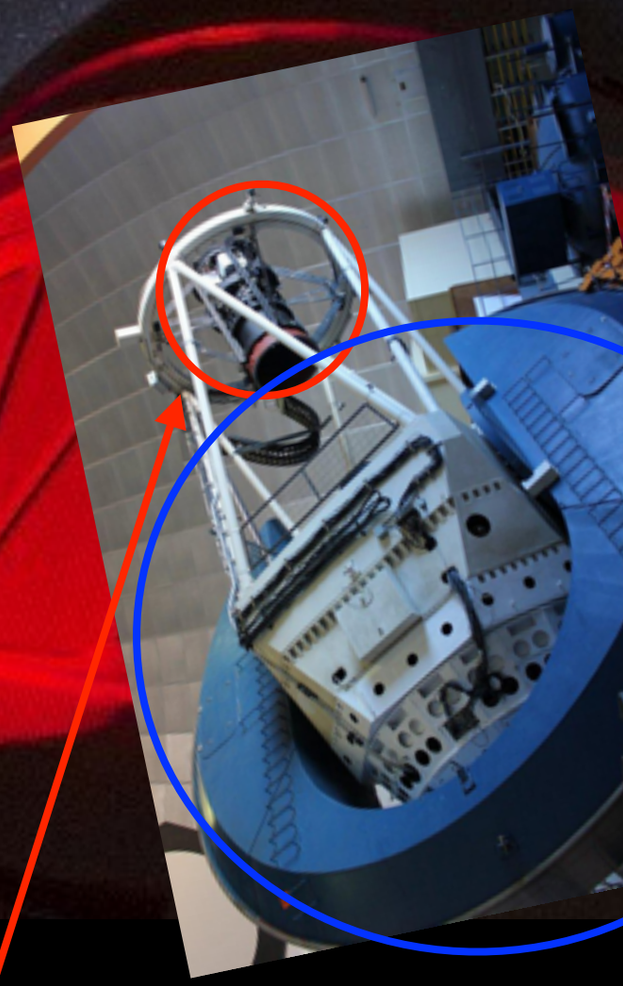

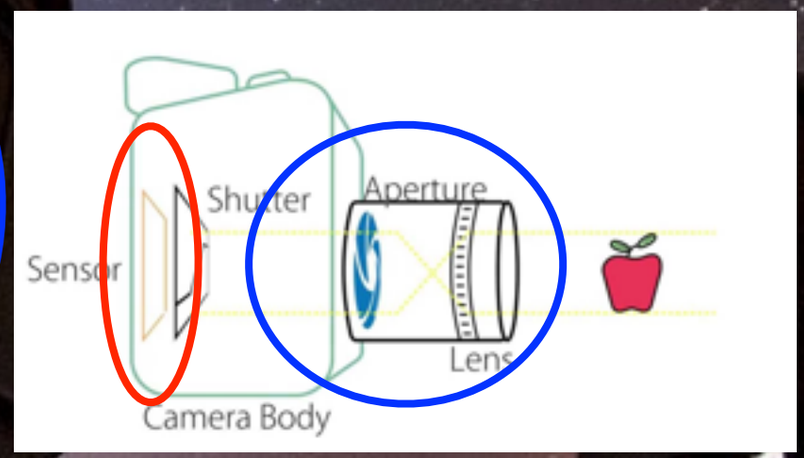

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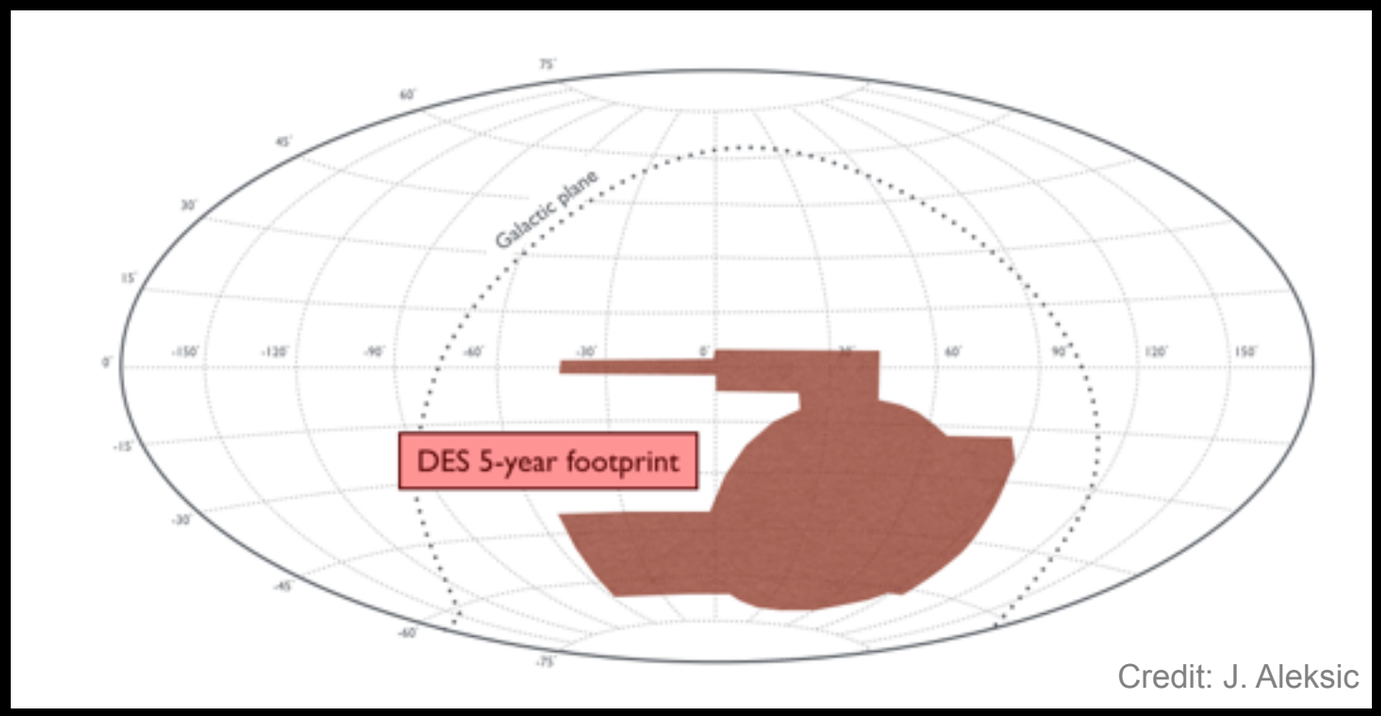


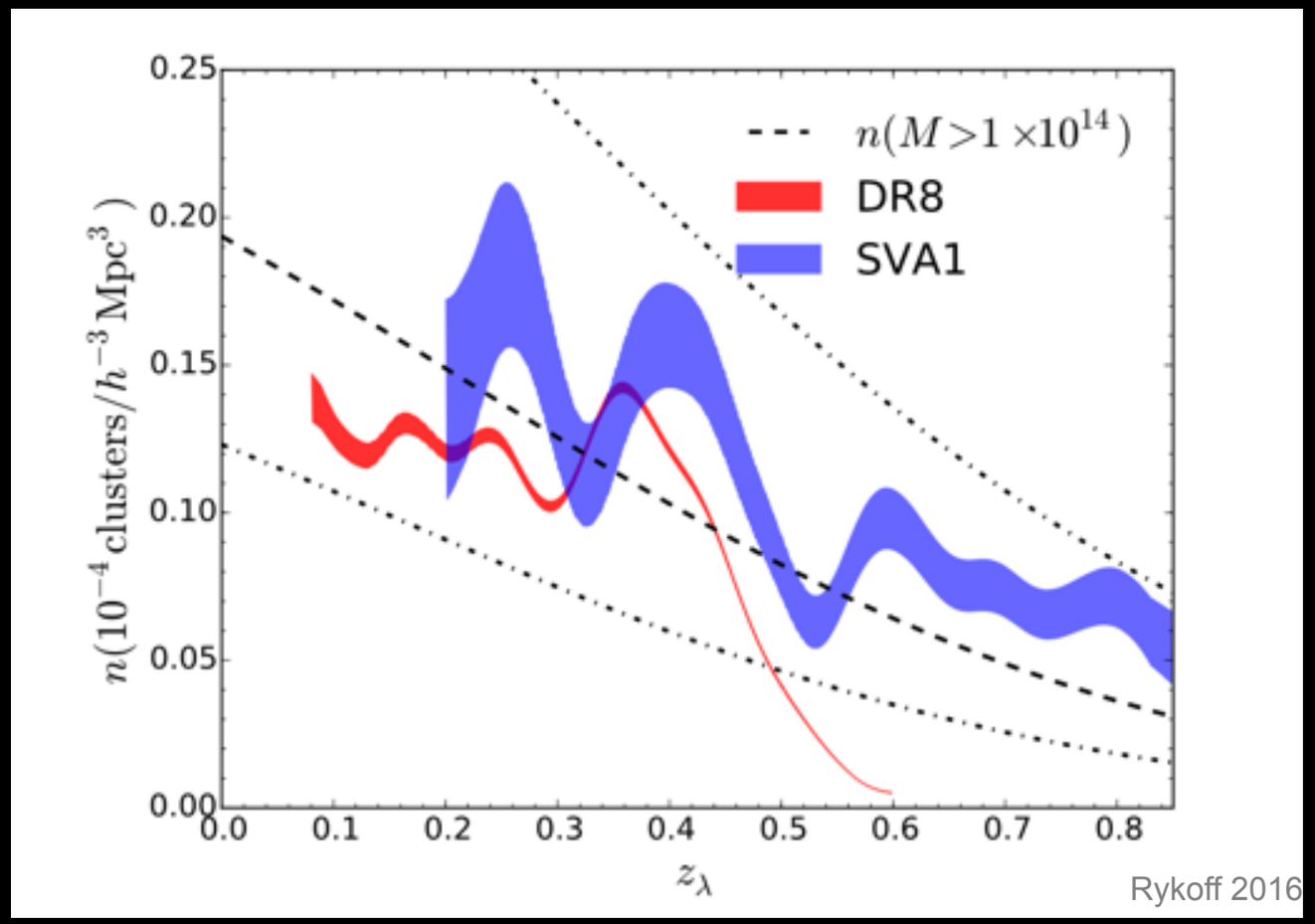
Credit: J. Aleksic

DES covers 5,000 deg^2 of the sky, which is made possible with DEcam's 3.0 deg^2 field of view.

An **extremely wide-field** deep optical imaging survey using the Dark Energy Camera mounted on the Blanco telescope.

The Dark Energy Survey in 10 mins

The depth and the wavelength range allow cosmological studies to z~1.



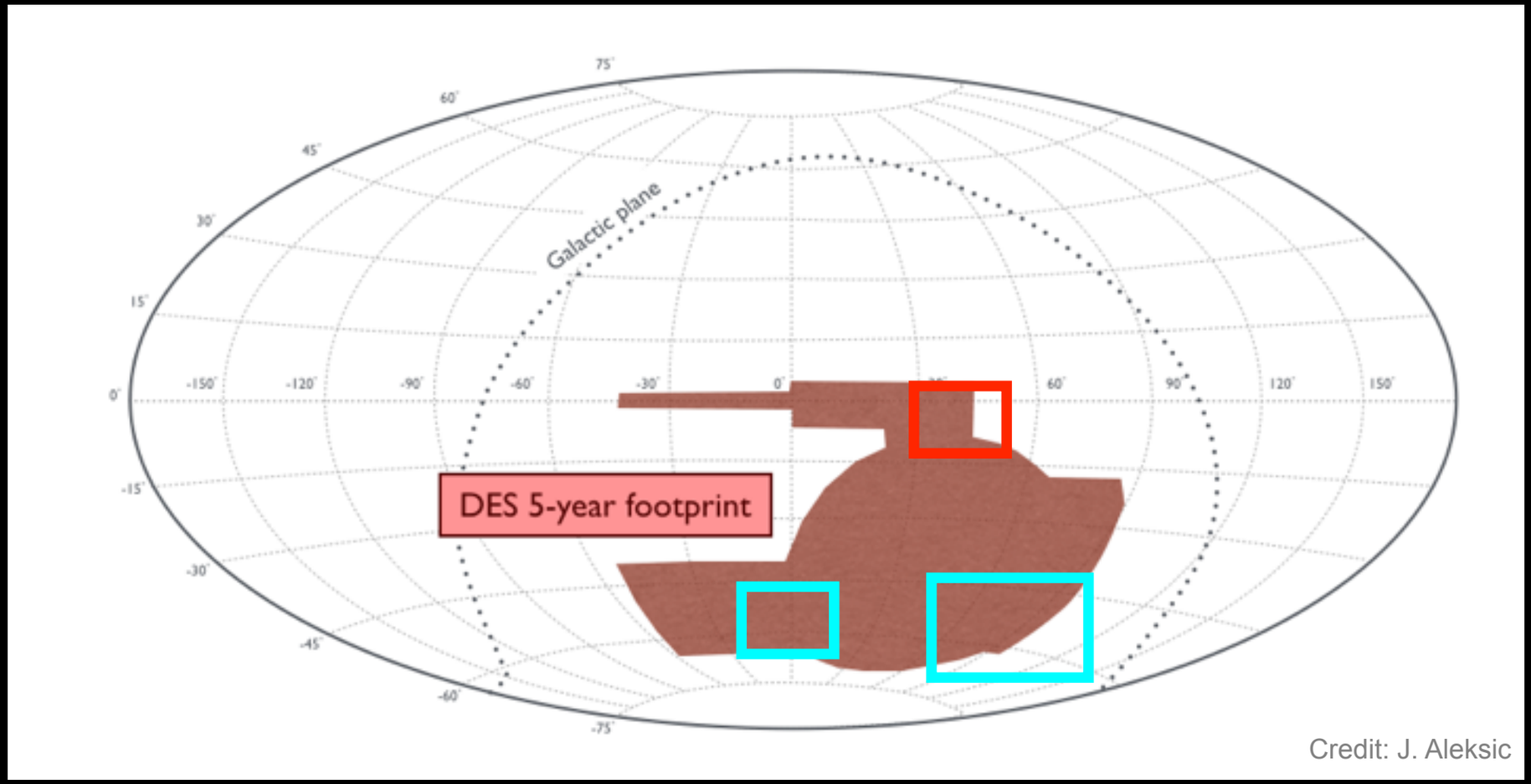
Rykoff 2016

An extremely wide-field **deep optical** imaging survey using the Dark Energy Camera mounted on the Blanco telescope.

The Dark Energy Survey in 10 mins

Data taking will continue for another two years, using ~500 nights in total.

- Science Verification 2012: small area, full depth, data released. 35+ papers.
- Official start in 2013: Data being processed. 9+ papers posted
- Supernovae survey: 30 deg^2, on sky since 2012. 9+ papers.



Credit: J. Aleksic

The Dark Energy Survey in 10 mins

Dark energy affects the distance-redshift relation.

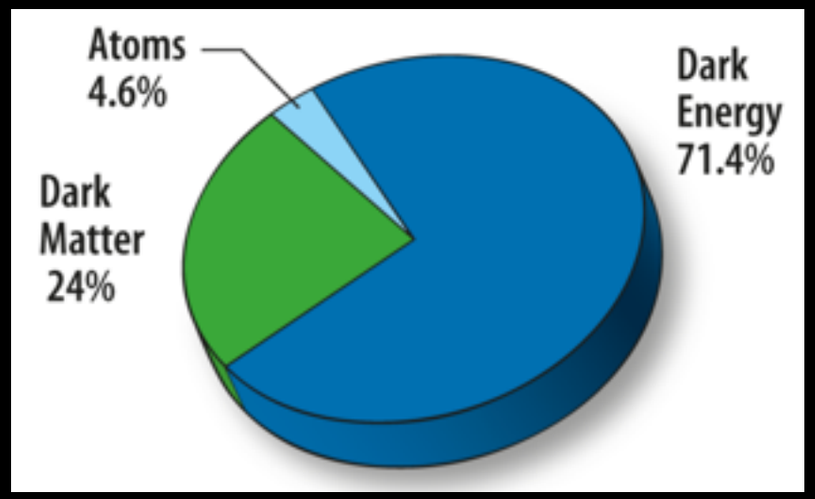
DES measures the “distance” via:

- Type Ia supernovae
- Baryon acoustic oscillation

Dark energy affects cosmic structure formation.

DES quantifies structure formation via:

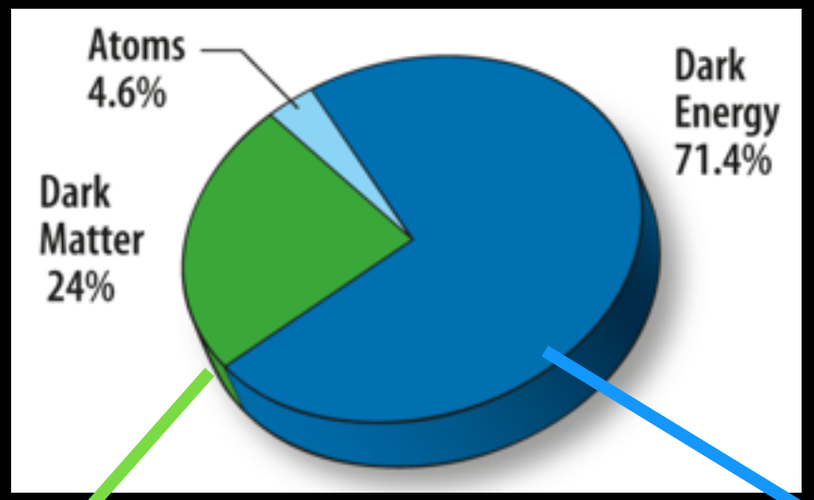
- weak lensing
- galaxy clusters



Credit: nasa.gov

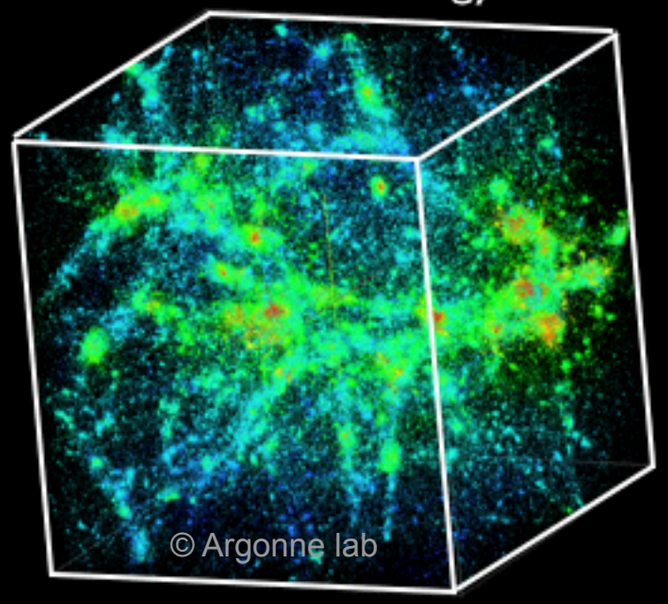
The Dark Energy **Survey** in 10 mins

Dark energy affects cosmic structure formation.

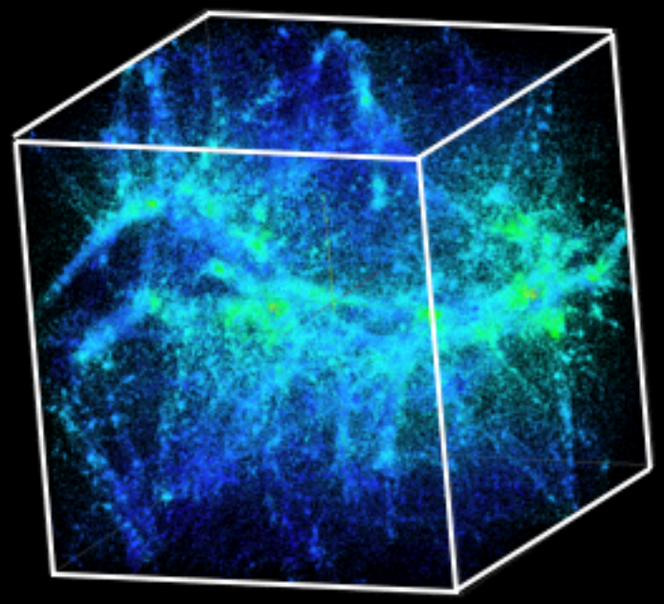


Credit: nasa.gov

No dark energy

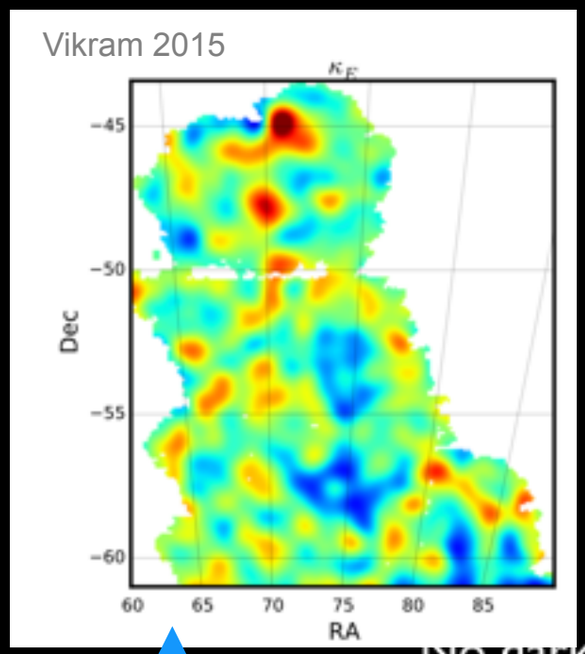


Standard Model



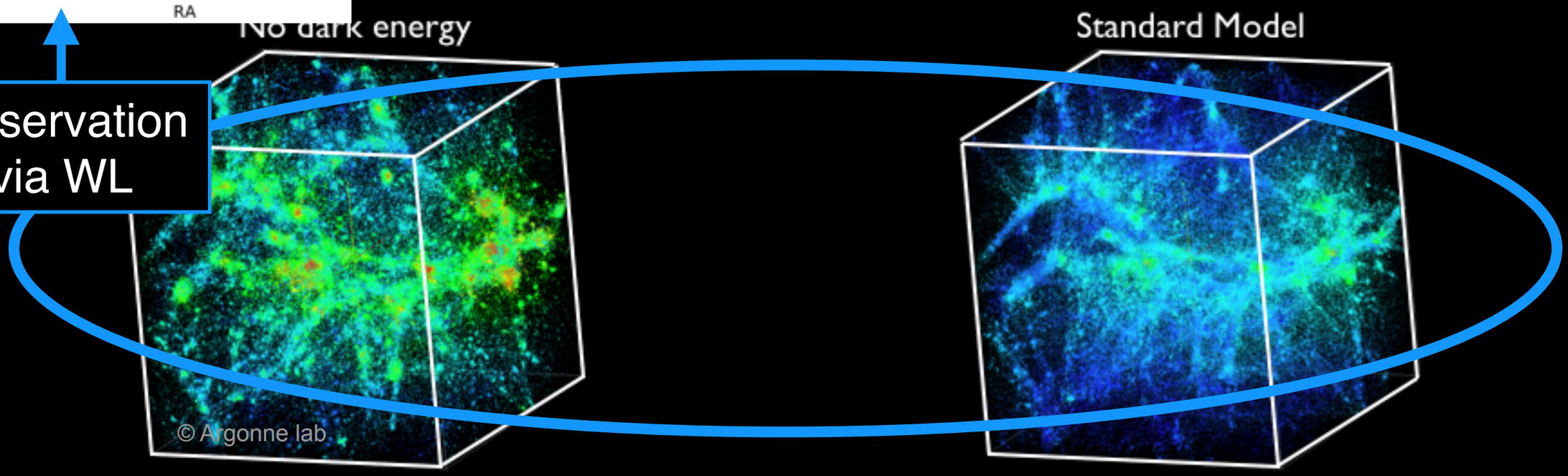
The Dark Energy Survey in 10 mins

DES quantifies the structure formation clumpiness with **weak lensing**.



Observation via WL

Hear more about weak lensing on Wednesday with Daniel Gruen.



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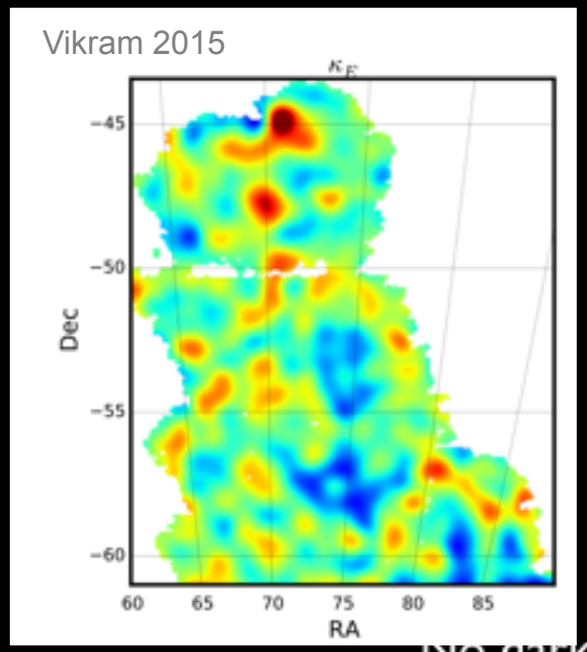
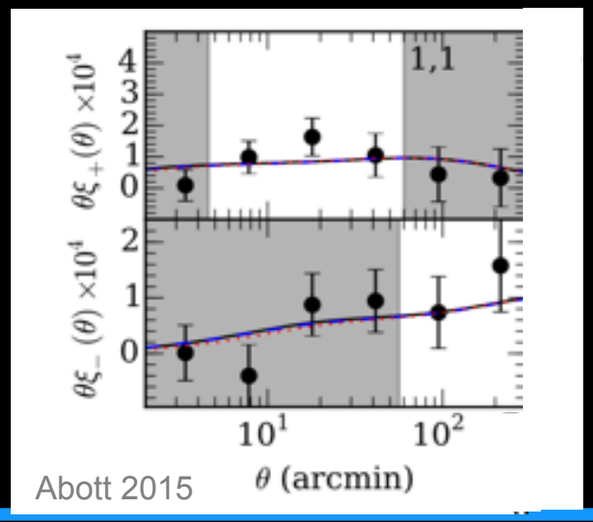
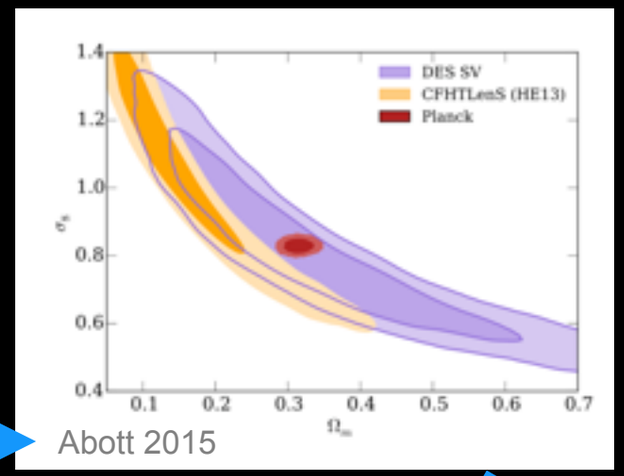
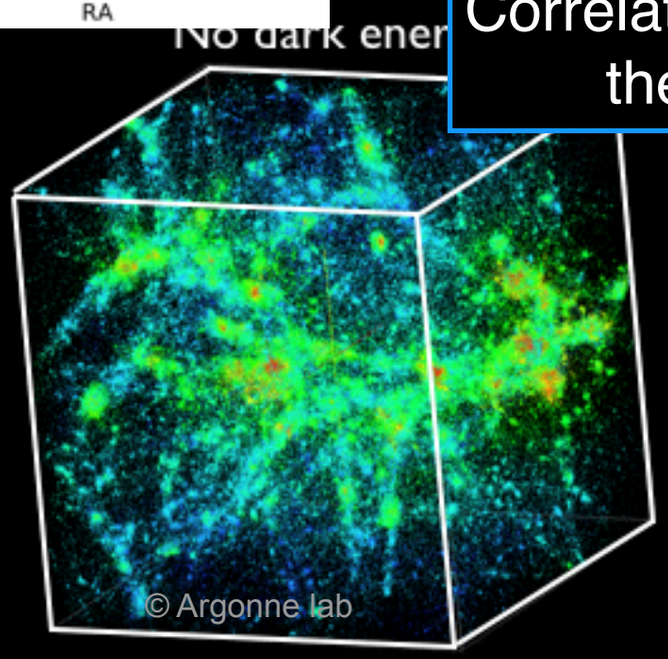
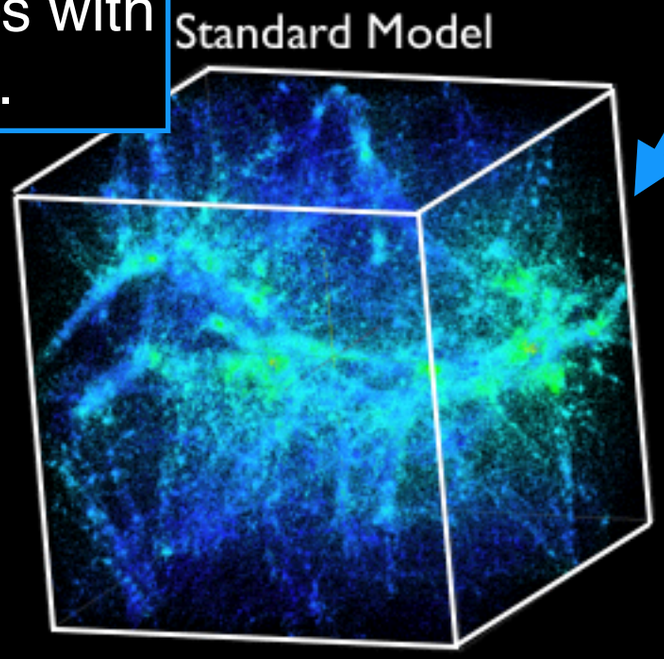






Correlation analysis agrees with the “standard model”.





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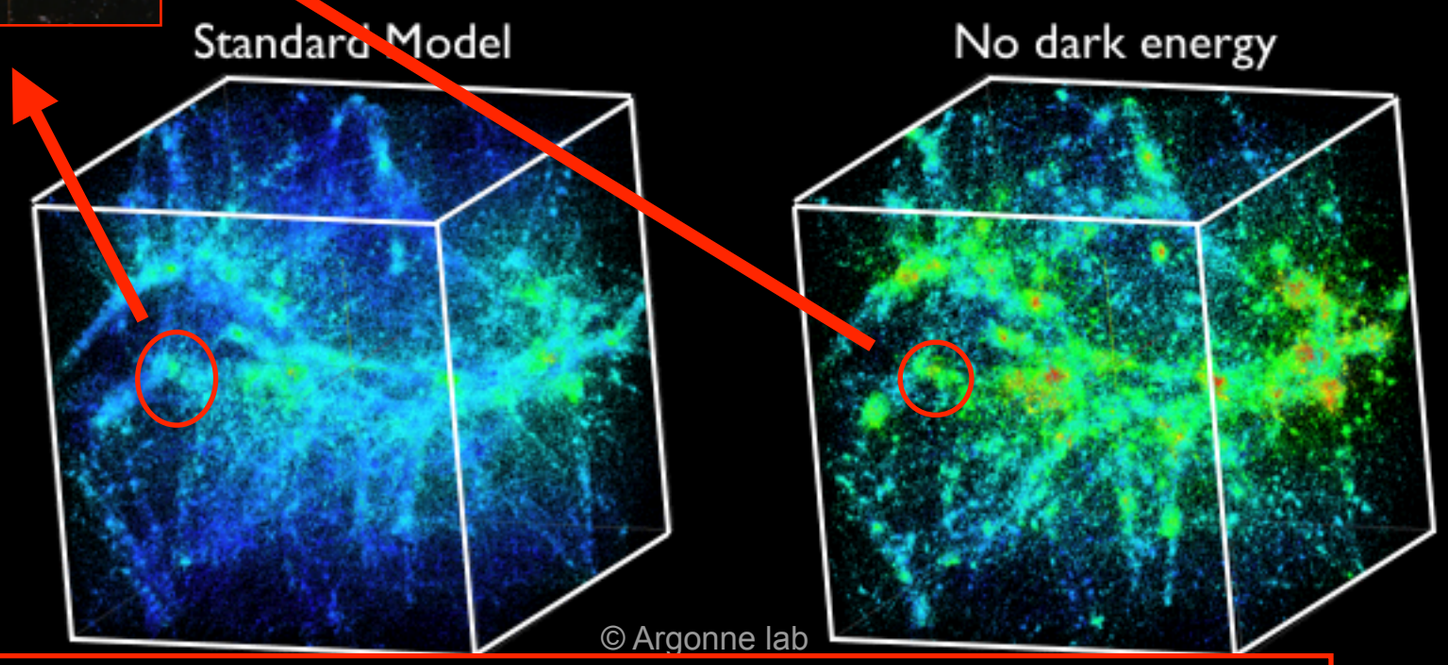
DES quantifies the structure formation clumpiness with **galaxy clusters**.

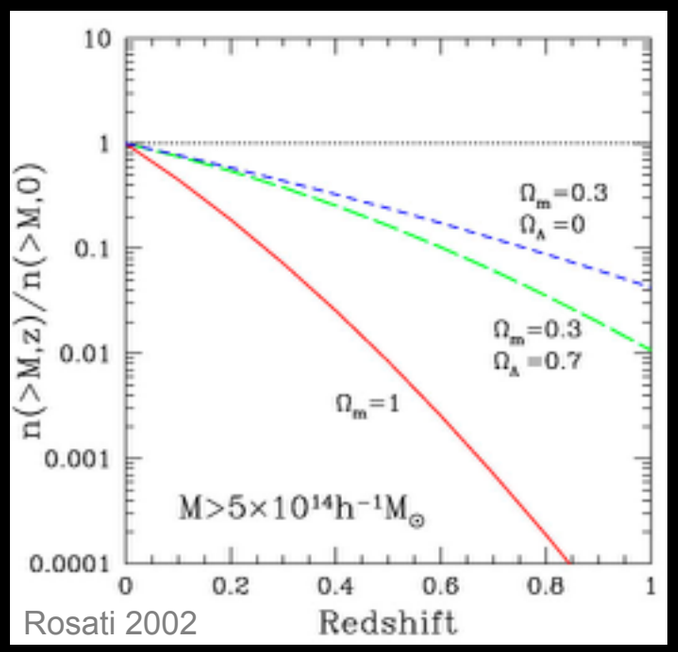


Galaxy Clusters are the peaks of the clumpy density field.

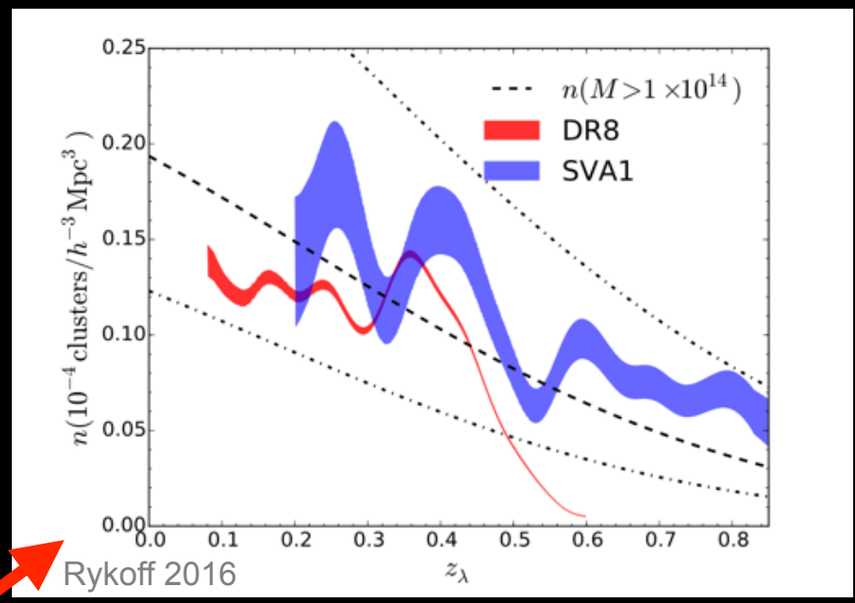
The Dark Energy Survey in 10 mins

DES quantifies the structure formation clumpiness with **galaxy clusters**.

Number densities sensitive to on cosmology models.



Rosati 2002



Rykoff 2016

DES observations in progress:
Clusters are identified (Rykoff 2016).
Calibration in progress (Saro 2015, 2016).

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Other than Dark Energy:

Discovery of rare objects:

- Milky Way satellite galaxies
  - **Two talks by Alex Drlica-Wagner.**
- Strong-lensing galaxy clusters
  - **One talk by Brian Nord, end of today.**
- Discovery of Kuiper Belt objects (planet nine?)

Big Data yield high statistical precision:

- Galaxy astrophysics processes.

Making use of DECam

- Follow up gravitational wave events (led by Fermilab).

Background credit: Reidar Hahn

The Collaboration

Fermilab — The Fermi National Accelerat Laboratory

Chicago — The University of Chicago

NOAO — The National Optical Astronomy Observatory

United Kingdom DES Collaboration

- UCL - University College London
- Cambridge - University of Cambridge
- Edinburgh - University of Edinburgh
- Portsmouth - University of Portsmouth
- Sussex - University of Sussex
- Nottingham - University of Nottingham

DES-Brazil Consortium

OSU — The Ohio State University

TAMU — Texas A&M University

Munich—Universitäts-Sternwarte München

- LMU Ludwig-Maximilians Universität
- Excellence Cluster Universe

UIUC/NCSA — The University of Illinois at Urbana-Champaign

LBNL — The Lawrence Berkeley National Laboratory

Spain DES Collaboration

- IEEC/CSIC - Instituto de Ciencias del Espacio,
- IFAE - Institut de Fisica d'Altes Energies
- CIEMAT - Centro de Investigaciones Energeticas, Medioambientales y Tecnologicas

Michigan — The University of Michigan

Pennsylvania — The University of Pennsylvania

ANL — Argonne National Laboratory

Santa Cruz-SLAC-Stanford DES Consortium

- Santa Cruz - University of California Santa Cruz
- SLAC - SLAC National Accelerator Laboratory
- Stanford - Stanford University

ETH-Zuerich — Eidgenoessische Technische Hochschule Zuerich