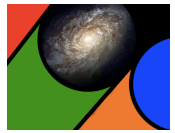
Astronomical Imaging Initiatives

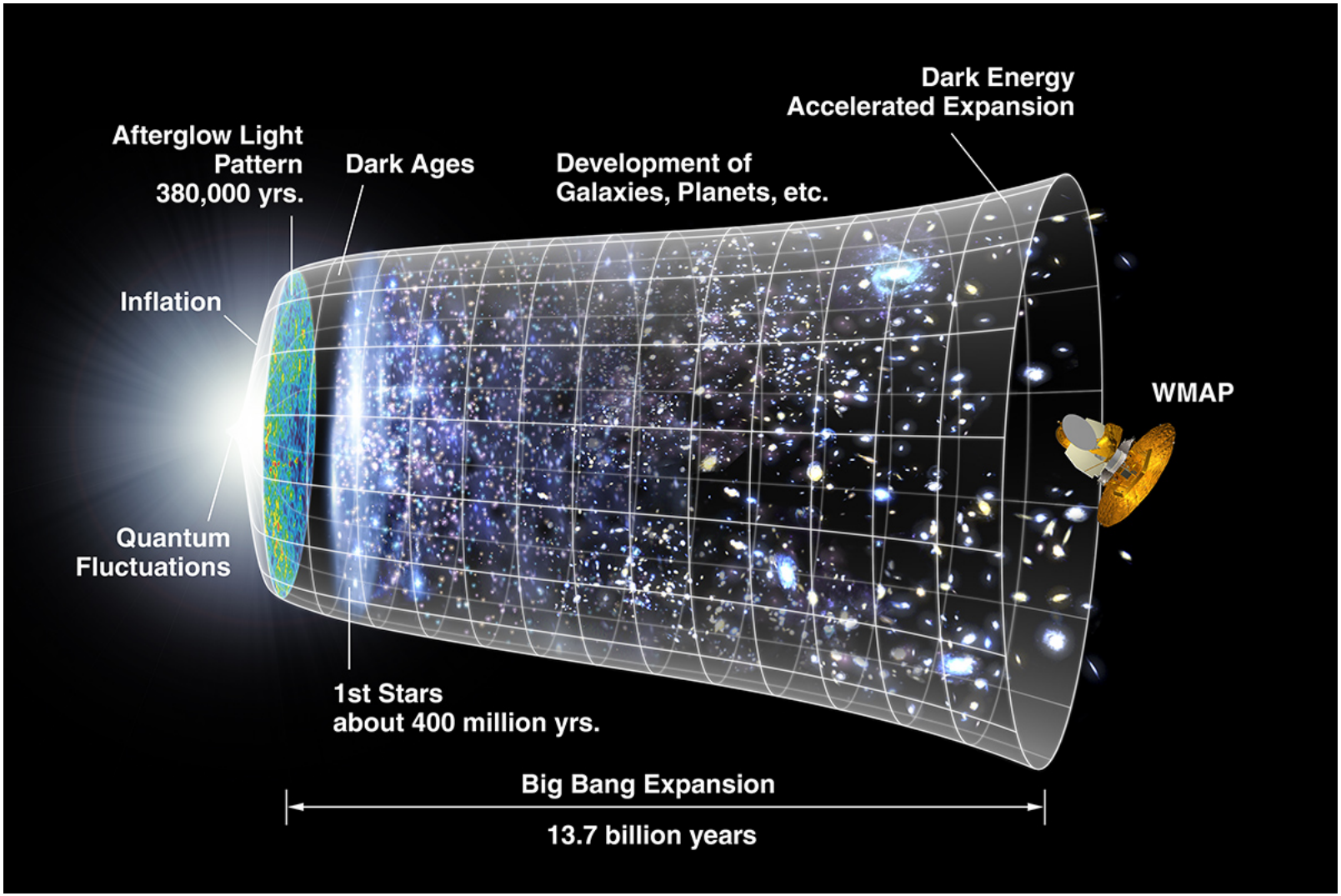
Jason McEwen
www.jasonmcewen.org
@jasonmcewen

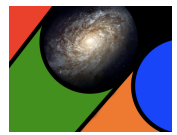
Mullard Space Science Laboratory (MSSL)
University College London (UCL)

BioImagingUK, June 2014

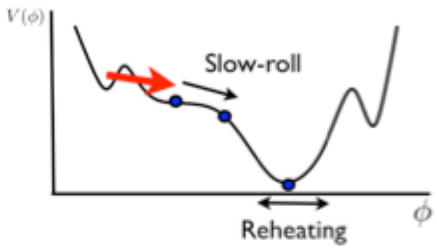


We have entered an era of concordance cosmology

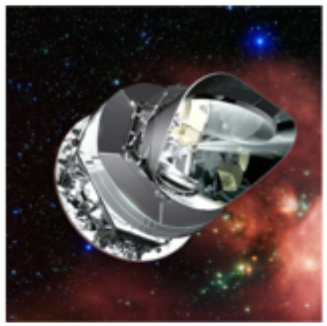




Theory, Data and Informatics



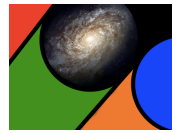
Theory



Data

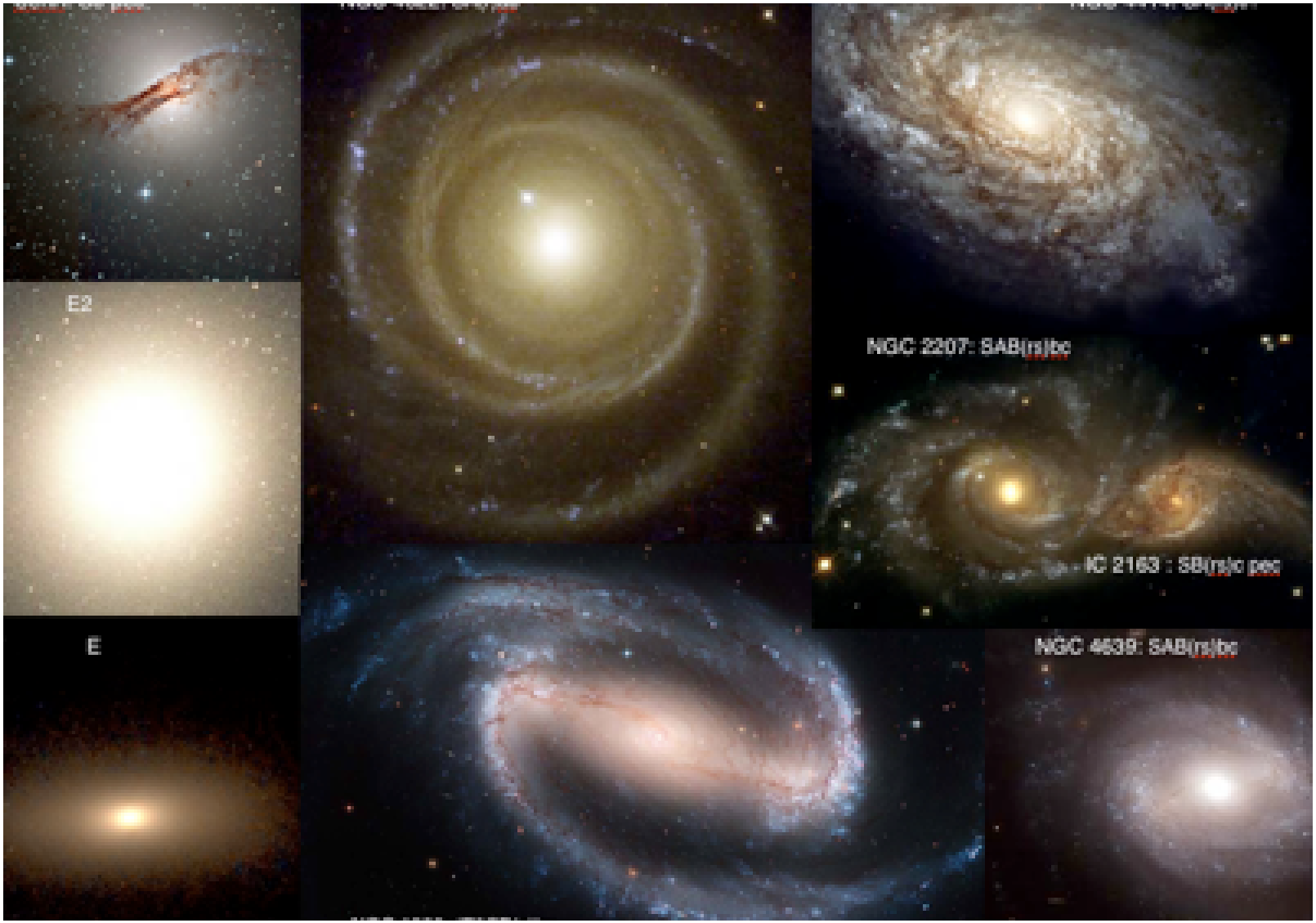
Astro

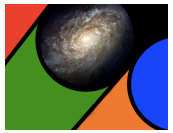
Informatics & Statistics



Astronomical & Cosmological Imaging

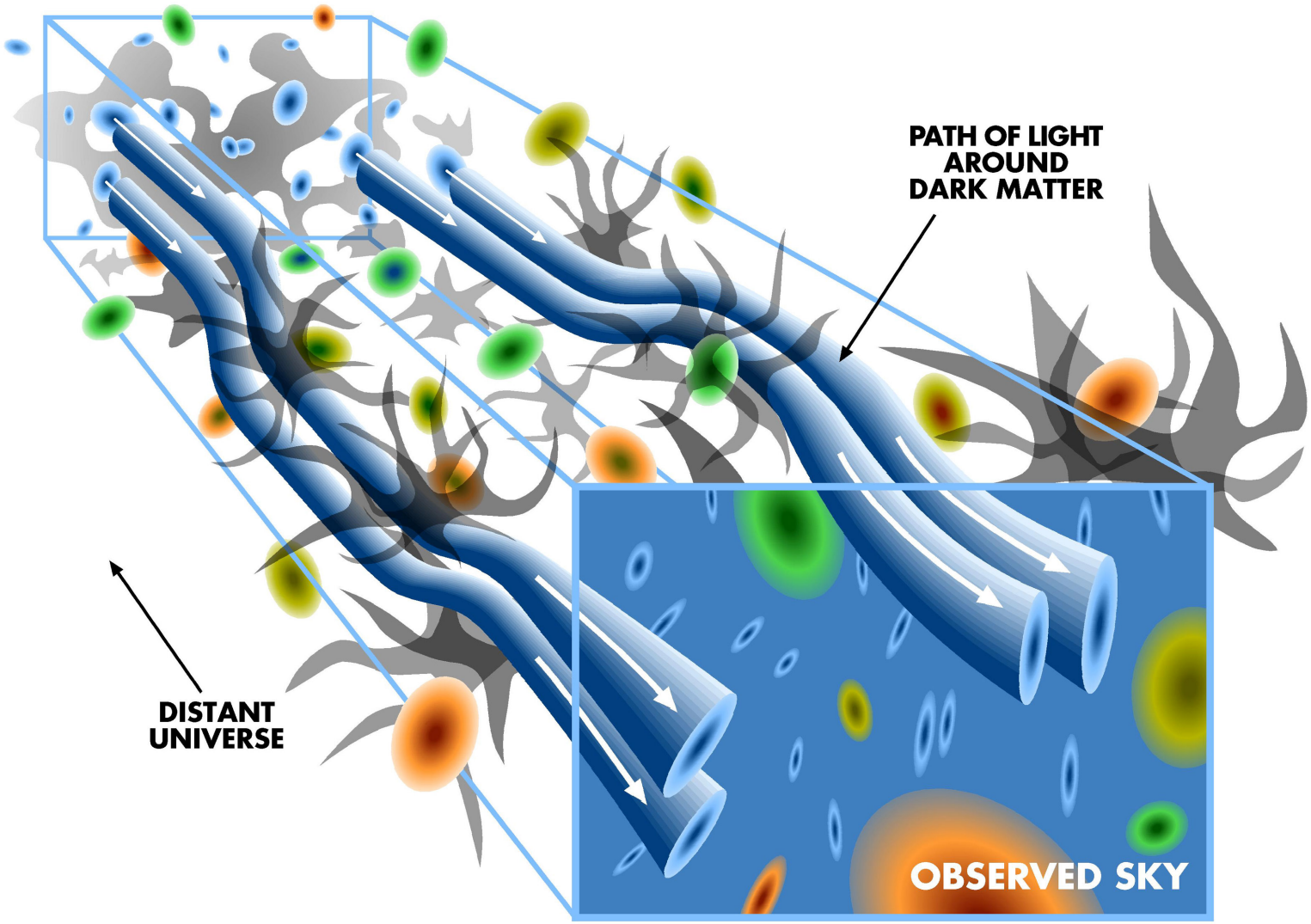
Galaxy Morphology

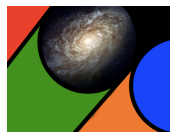




Astronomical & Cosmological Imaging

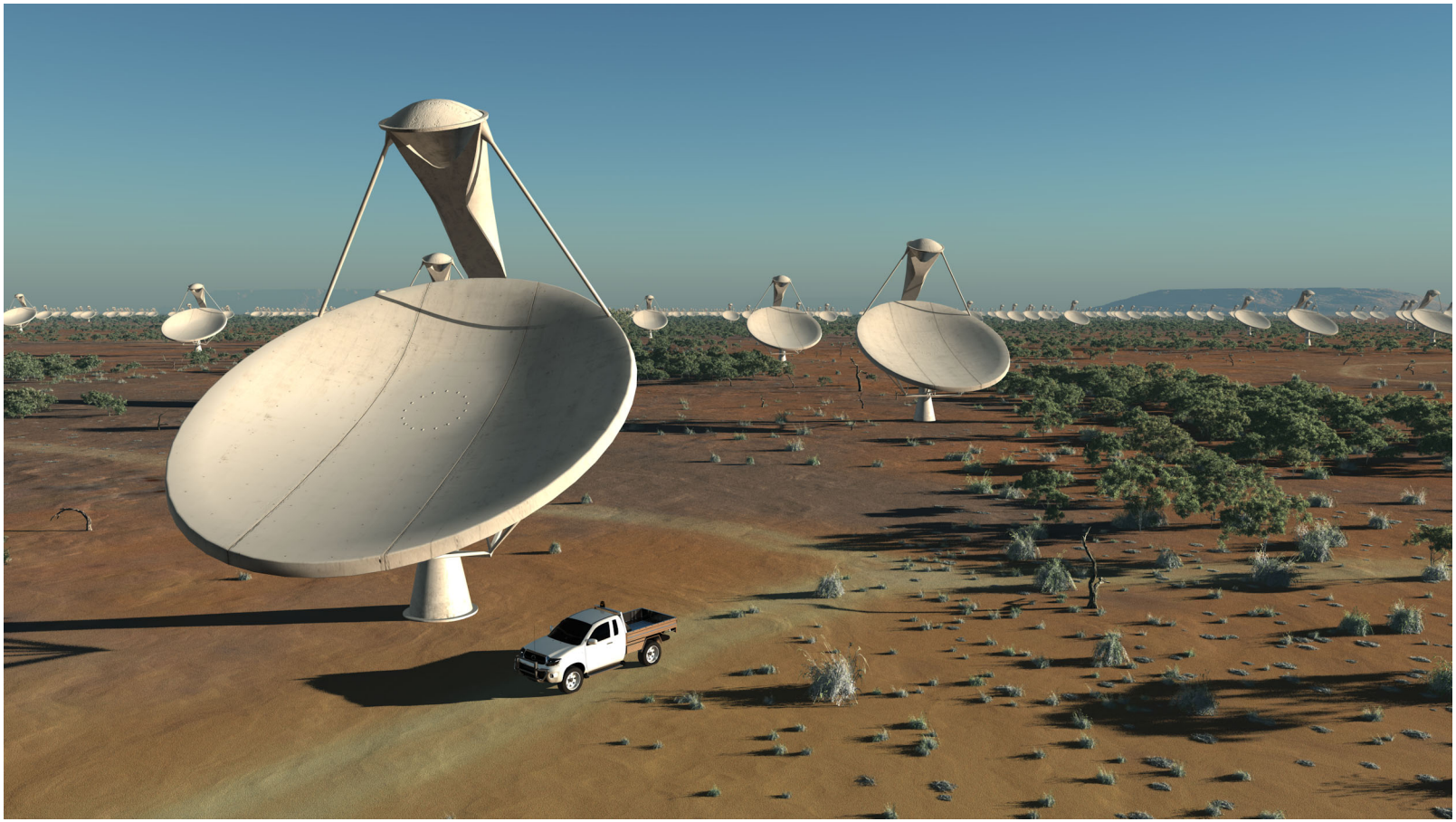
Weak Lensing & Galaxy Shape Estimation

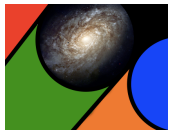




Astronomical & Cosmological Imaging

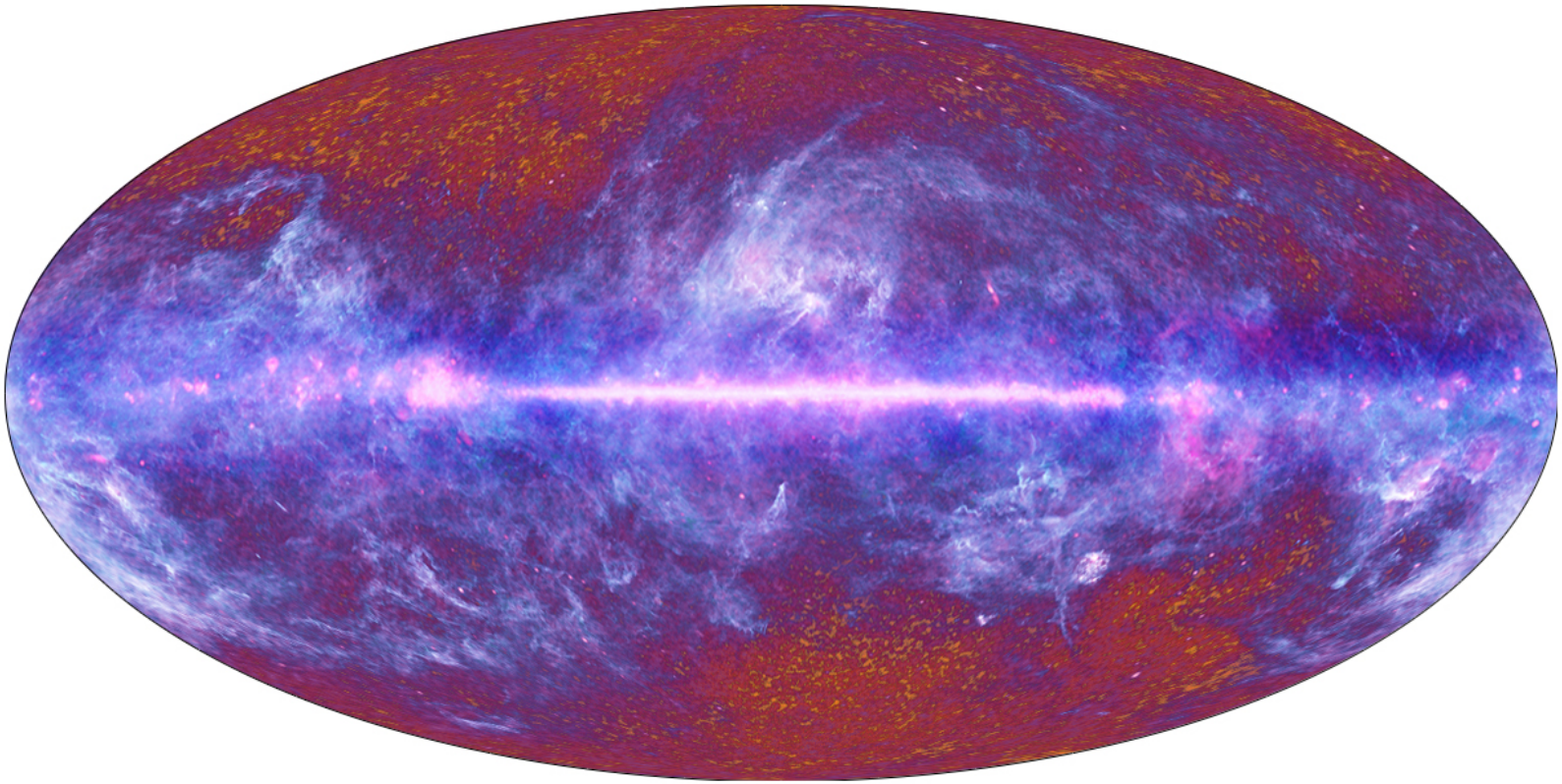
Radio Interferometric Imaging

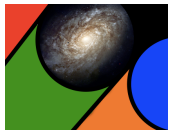




Astronomical & Cosmological Imaging

Cosmic Microwave Background (CMB) Component Separation





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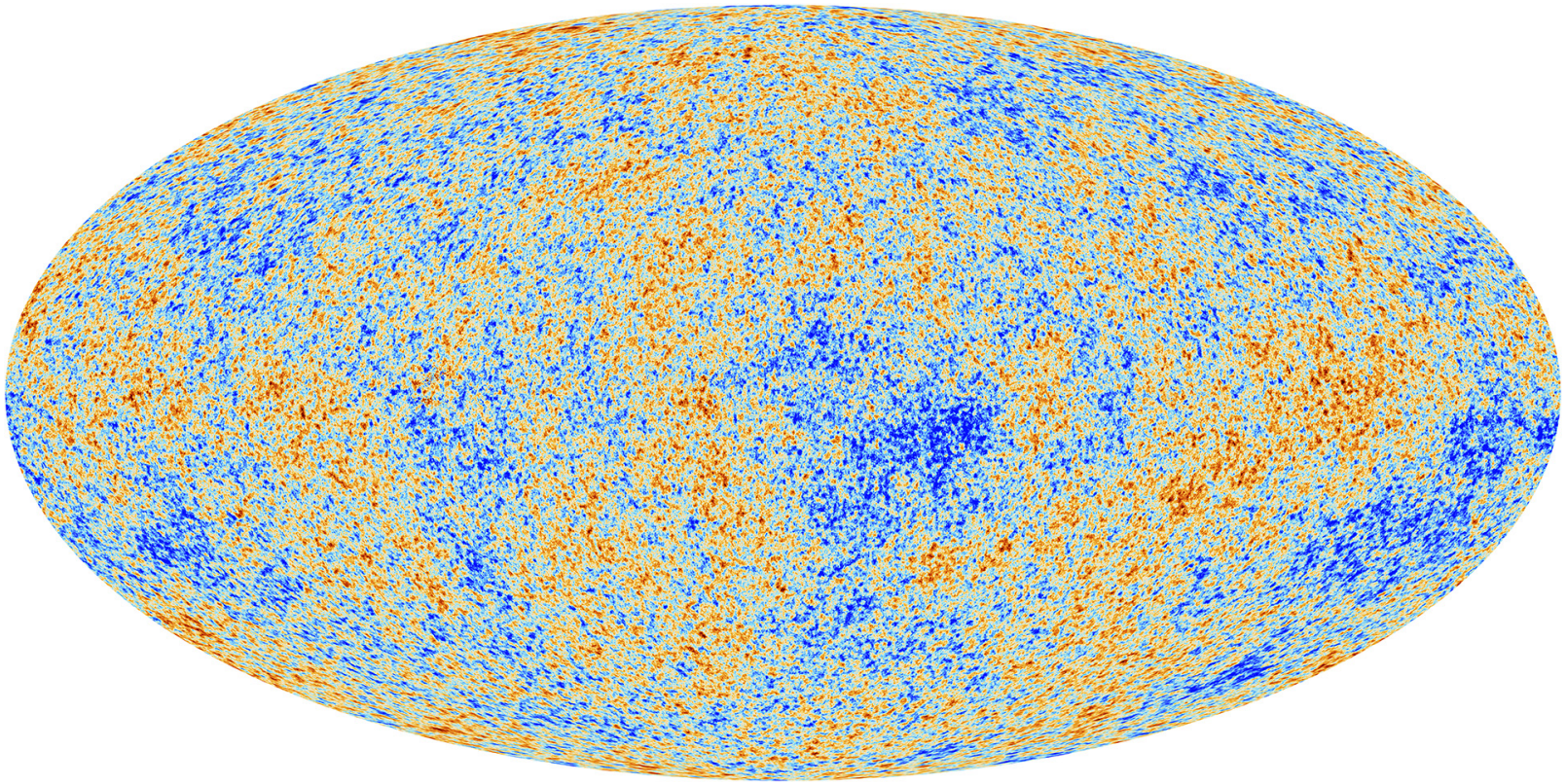
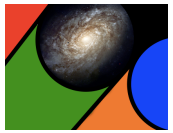
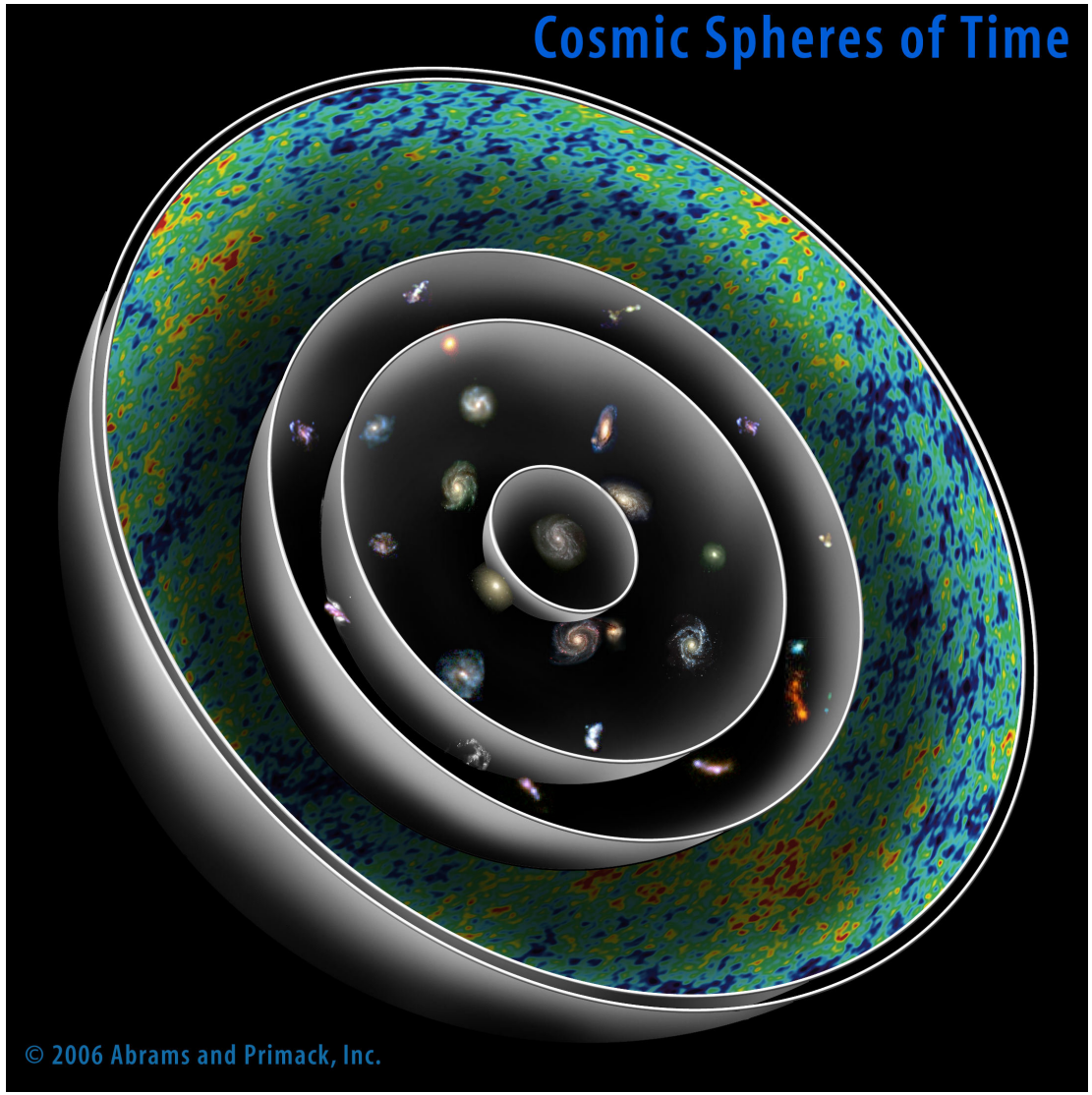
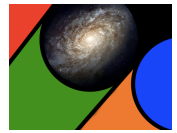


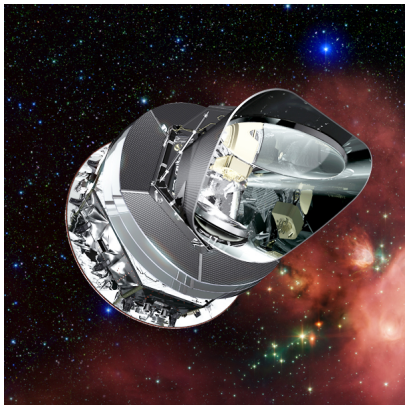


Observations on the Celestial Sphere

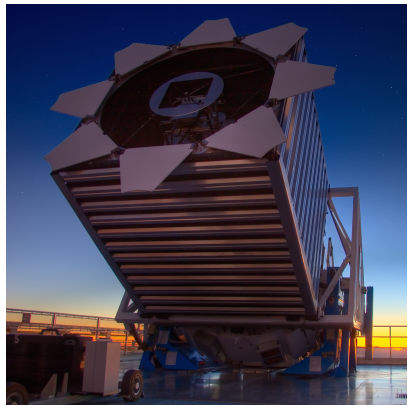




Open-Data

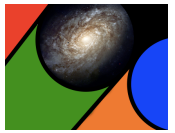


Open-data is becoming the norm

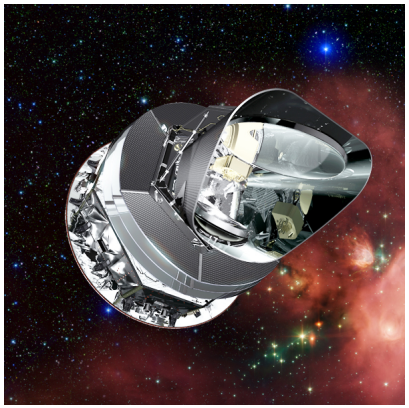


- SDSS: ∼100 collaboration publications; ∼10,000 community publications
- WMAP: ∼40 collaboration publications; ∼4,000 community publications

Community publications ∼100x that of collaboration



Open-Data



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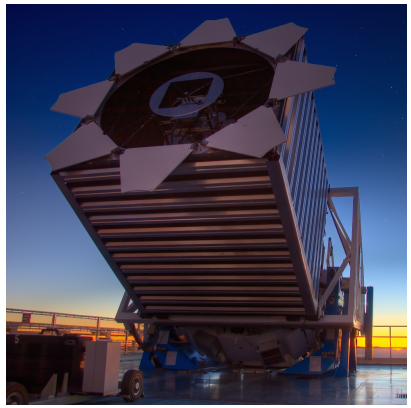

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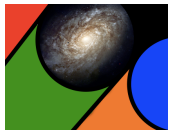
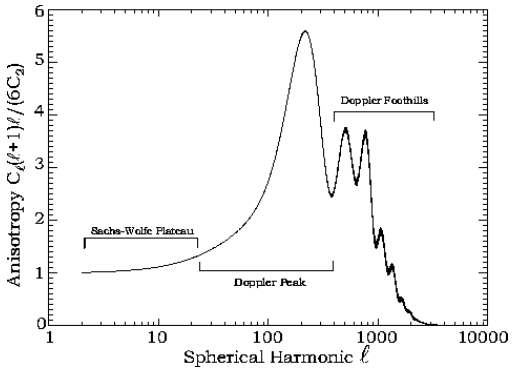


Open-Source



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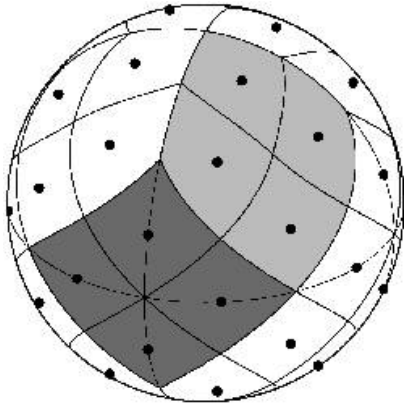
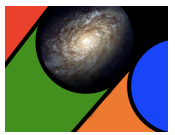
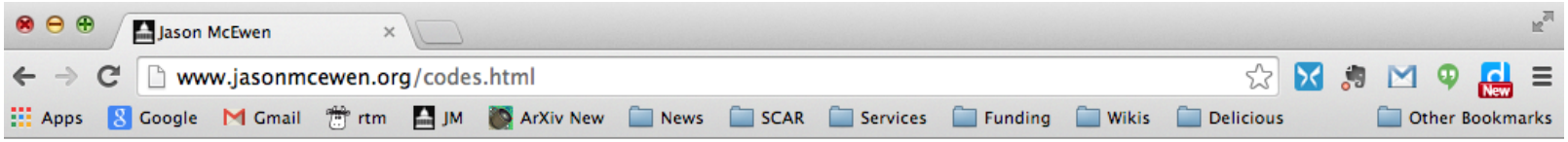


- Theory and simulations, e.g. CAMB
- Data manipulation and analysis, e.g. Healpix
- Informatics and statistical analysis techniques, e.g. CosmoMC, S2LET



Open-Source

www.jasonmcewen.org/codes.html



Home | Publications | Talks | Codes | Teaching | Research Opportunities | Blogs | CV

Jason McEwen

academic webpage

Quick links

- **AniCosmo**: Bayesian analysis of anisotropic cosmologies
- **BIANCHI**: Bianchi VIIh simulations
- **BIANCHI2**: Dark Bianchi VIIh simulations
- **COMB**: Compact embedded object simulations
- **FastCSWT**: Fast directional continuous spherical wavelet transform
- **FLAG**: Exact Fourier-Laguerre transform on the ball
- **FLAGLET**: Exact wavelets on the ball
- **PURIFY**: Next generation radio interferometric imaging
- **S2**: Functions on the sphere
- **S2DW**: Steerable scale discretised wavelets on the sphere
- **S2FIL**: Optimal filtering on the sphere
- **S2LET**: Fast wavelets on the sphere
- **SIC**: Sparse inpainting code
- **SOPT**: Sparse optimisation
- **SSHT**: Spin spherical harmonic

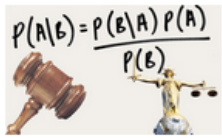
Codes

In the course of my research I have written a number of scientific codes and software packages. In the spirit of **reproducible research** I make these codes available publicly here.

In many cases these codes have been developed in collaboration with other researchers. Careful attention has also been paid to the design of these software packages. Please see the webpage accompanying each code for further information.

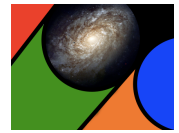
To receive a copy of any code please click on the download icon and complete the download form. The requested software packages will then be automatically e-mailed to you. All codes are released under the **GNU General Public License** unless otherwise stated. If you use any of the codes in work that results in publication, we kindly request that you reference the appropriate code webpage and papers. Thanks!

AniCosmo: Bayesian analysis of anisotropic cosmologies



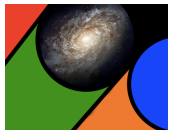
The AniCosmo code provides functionality to perform a Bayesian analysis of anisotropic cosmologies. It was used to study Bianchi models of universal rotation it our papers: **Bayesian analysis of anisotropic cosmologies: Bianchi VII_h and WMAP**; **Planck 2013 results: Background geometry and topology of the Universe**. AniCosmo is under intensive ongoing development. It is not yet publicly available but will be made available in future.

BIANCHI: Bianchi VIIh simulations



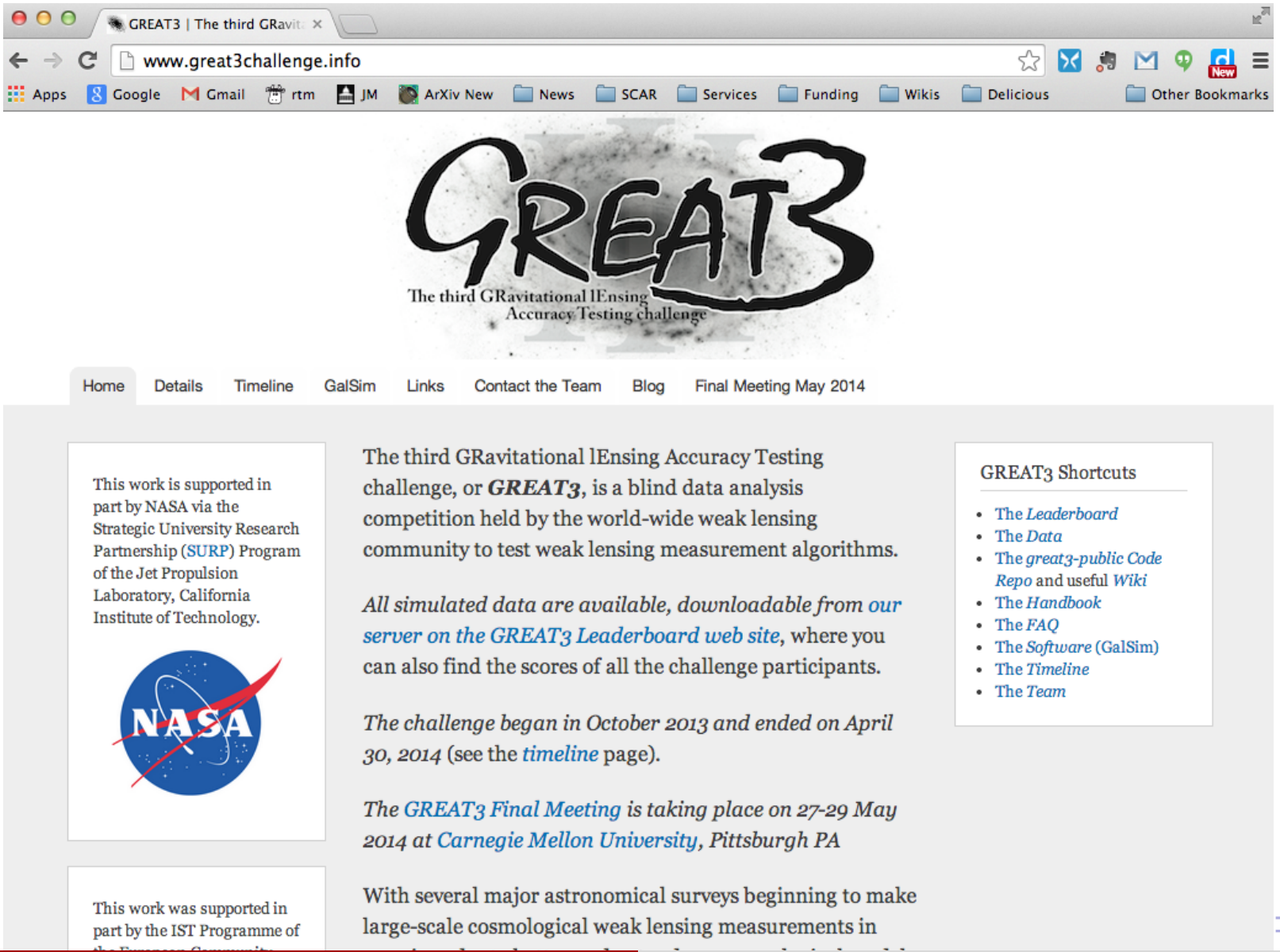
Open-Source

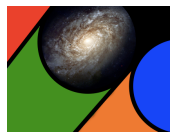
Wavelets on the sphere (w w w . s 2 l e t . o r g)



Community Challenges

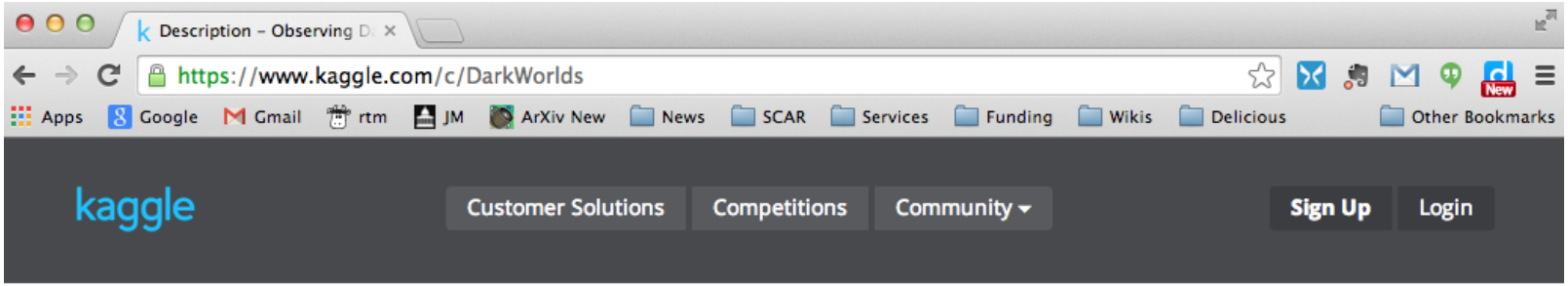
GREAT: GRavitational lEnsing Accuracy Testing (www.great3challenge.info)





Community Challenges

www.kaggle.com



Observing Dark Worlds

Finished

Friday, October 12, 2012 — $20,000 • 353 teams — Sunday, December 16, 2012

Dashboard

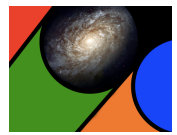
- Home
- Data
- Information
  - Description
  - Evaluation
  - Rules
  - Prizes
  - About the Sponsor
  - An Introduction to Ellipticity
  - Getting Started (with code)
  - Submission Instructions
  - Winners
- Forum
- Leaderboard
  - Public

Can you find the Dark Matter that dominates our Universe? Winton Capital offers you the chance to unlock the secrets of dark worlds.

There is more to the Universe than meets the eye. Out in the cosmos exists a form of matter that outnumbers the stuff we can see by almost 7 to 1, and we don't know what it is. What we do know is that it does not emit or absorb light, so we call it ***Dark Matter***.

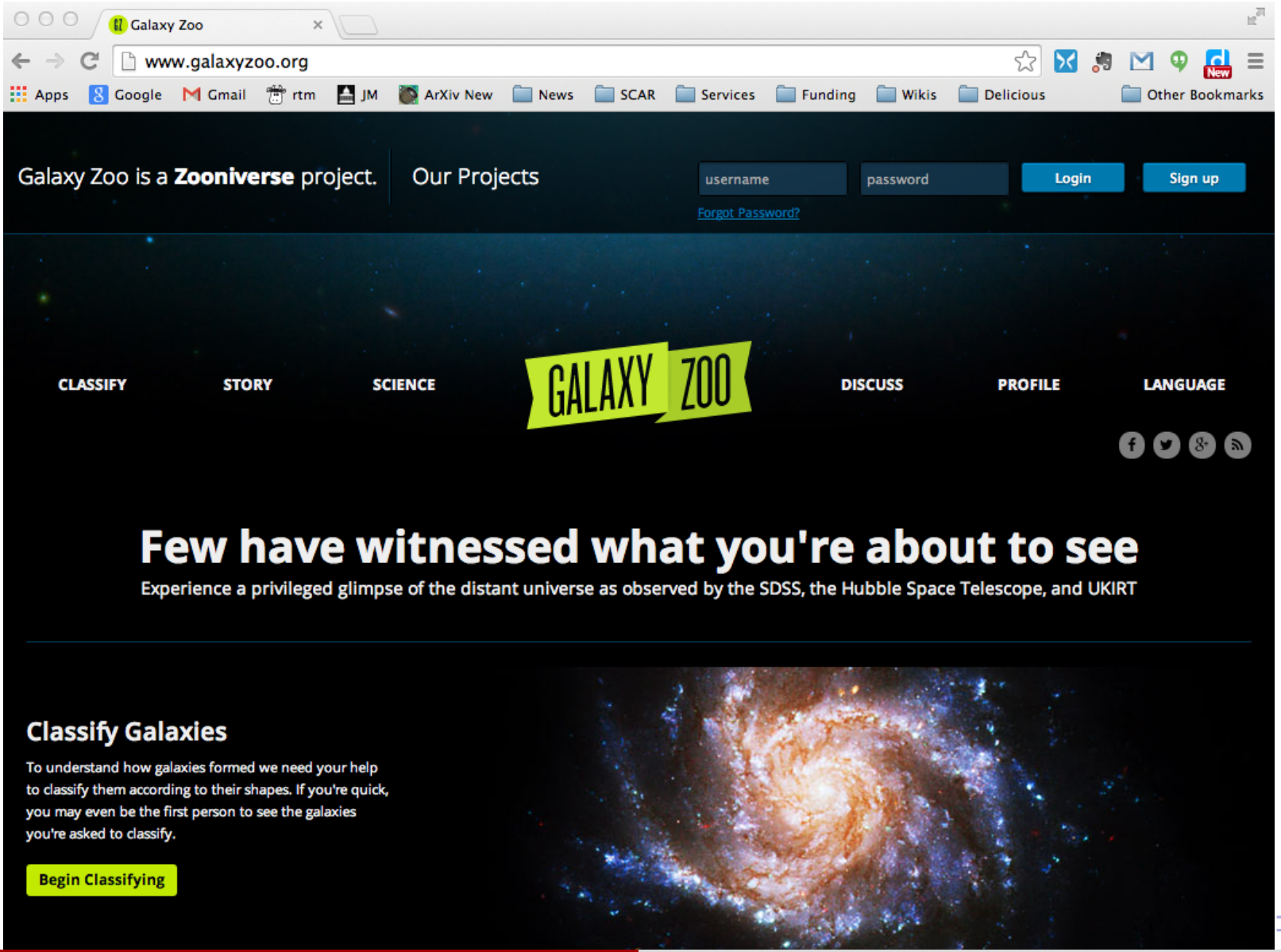
Such a vast amount of aggregated matter does not go unnoticed. In fact we observe that this stuff aggregates and forms massive structures called ***Dark Matter Halos***.

Although dark, it warps and bends spacetime such that any light from a background galaxy which passes close to the *Dark Matter* will have its path altered and



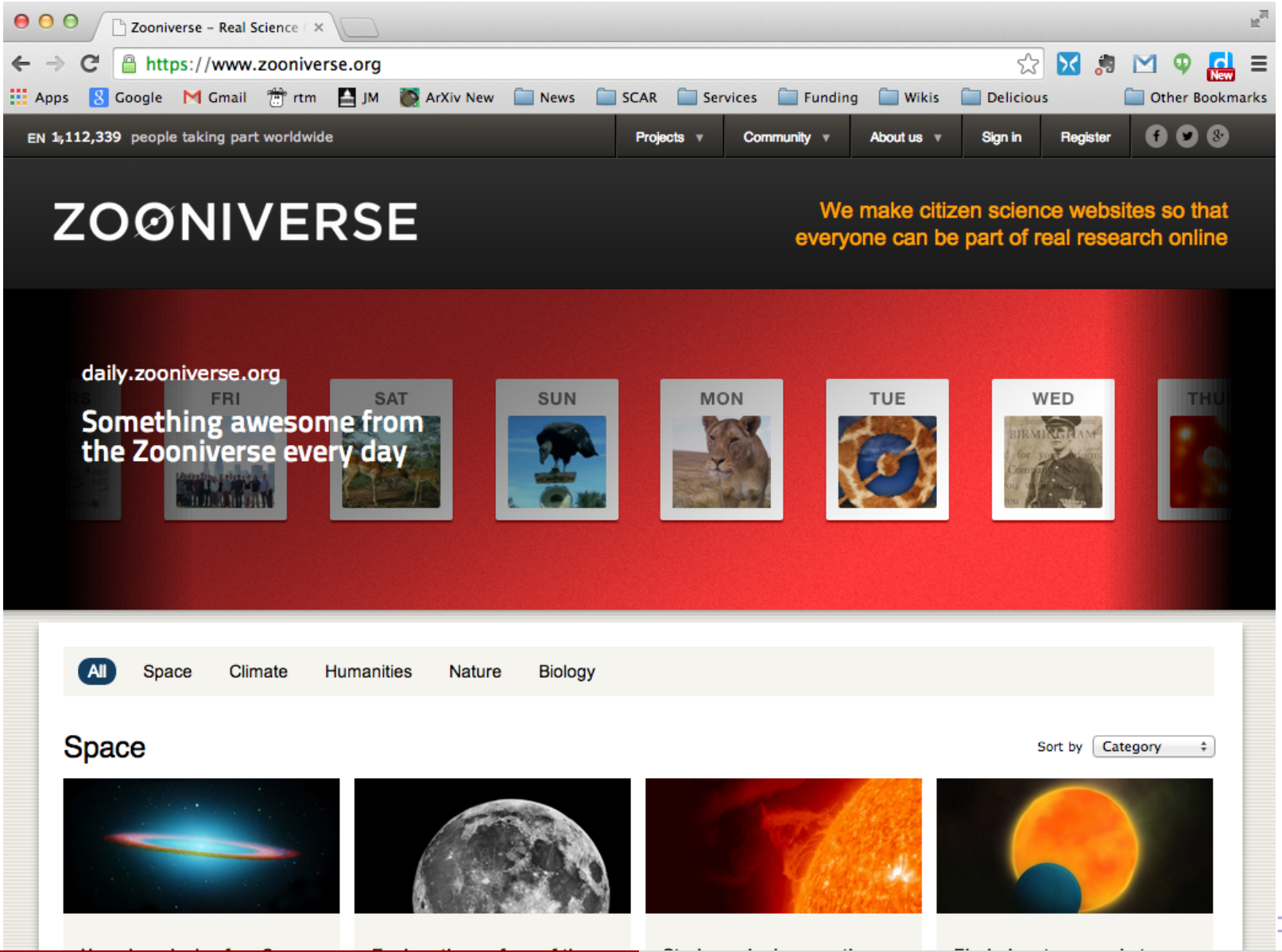
Citizen Science

www.galaxyzoo.org



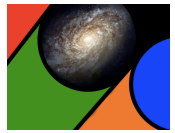
Citizen Science

www.zooniverse.org



Conferences & Meetings

- Crick Institute meeting on *Biomedical Imaging and Astronomy: Shared Algorithms and Analyses*, 6 June
- *Royal Society Science on the Sphere Workshop*, 14–15 July
  http://lateuniverse.wordpress.com/2014/05/13/science-on-the-sphere
- *Inverse Problems: From Theory to Application*, 26–28 August
  http://ipta2014.iopconfs.org/home
- *Royal Statistics Society International Conference*, 1–4 September
  http://www.statslife.org.uk/events/annual-conference
- *International Workshop on Cosmology and Sparsity*, 7–12 September
  http://iwcs2.cosmostat.org/Homepage.html
- *International Conference on Computational and Methodological Statistics*, 6–8 December
  http://www.cmstatistics.org/ERCIM2014



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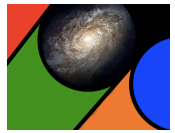
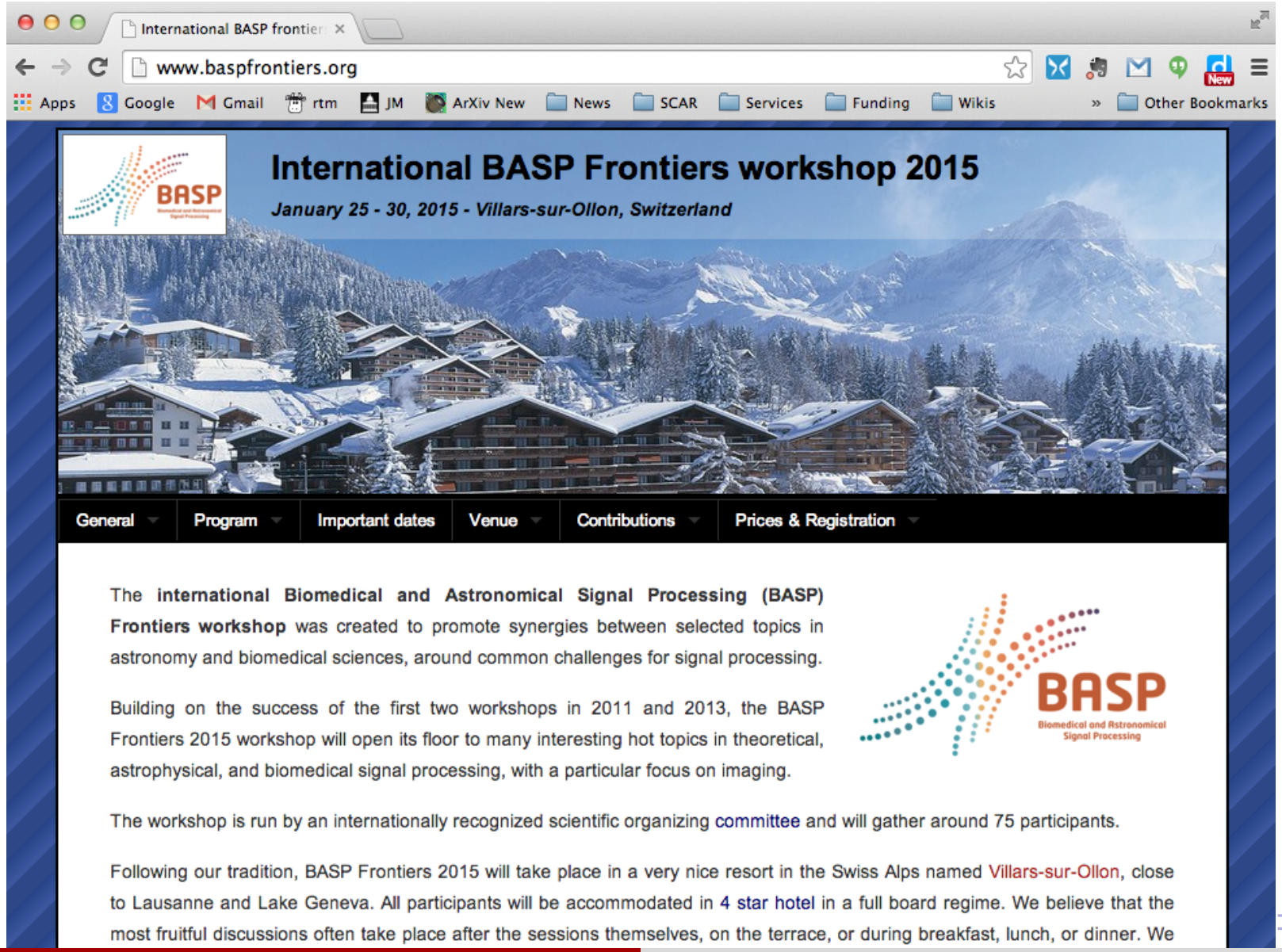
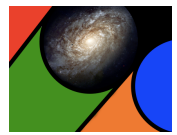


Conferences & Meetings

www.baspfrontiers.org





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www.jasonmcewen.org
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Mullard Space Science Laboratory (MSSL)
University College London (UCL)