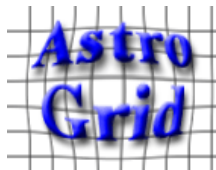


Conclusions

- brief survey of one science area requiring support from AstroGrid
- started to identify requirements for AstroGrid - many fairly generic
- need similar for other science areas - and much more quantitative
- a crucial early task for AstroGrid will be to get the community to define what it wants, via a comprehensive set of use cases with science drivers



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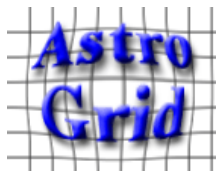


Tools needed

- image analysis tools for images from X-ray event lists
- multicomponent X-ray spectral fitter
- basic statistical package, including cosmological effects
- visualisation tool for multidimensional point dataset
- photometric redshift estimator using library of galaxy SEDs
- probabilistic association tool using population models
- interfaces from databases to Planck data processing pipeline
- ...etc etc

most of these already exist, but...

- need to be capable of operating over the network: **GRID-ENABLING**
- require well-defined interfaces: **STANDARDS**

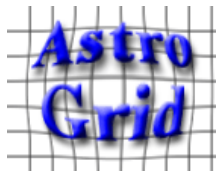


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What will be done with the data?

- **XMM-Newton:**
identify extended sources as cluster candidates - clustering of events
check for AGN contamination - spectral/spatial analysis
model selection function for sample - global statistical analysis
Problem: beyond standard analysis package - needs uploading of code?
- **SDSS/WFCAM/VISTA:**
spatial/colour selection of cluster candidates
photometric redshift estimation
Problem: vast volume of data to be analysed
- **Planck:**
identify spectral signature in multi-wavelength component separation -
using input of known cluster catalogues
Problem: requires integrating external databases with Planck pipeline



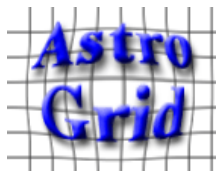
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How much data and where will it be?

- **XMM-Newton**: ~1TB (2010). VILSPA (Spain), UK mirror @ Leicester?
- **SDSS**: ~5TB (2007). Baltimore, UK mirror @ Edinburgh?
- **WFCAM**: ~10TB (2008). Edinburgh
- **VISTA**: ~300TB (2016). Edinburgh? Cambridge?
- **Planck**: <1TB (2010). MPA Garching? VILSPA? UK mirror?
- +....**optical spectra** in many telescope archives around the world

DEFINITELY A LARGE, DISTRIBUTED PROBLEM

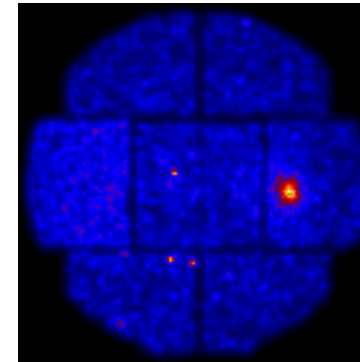


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Major new cluster samples in the coming decade

- **X-ray:** XMM-Newton through serendipitous detection (see www.xcs-home.org)



- **Sunyaev-Zel'dovich:** Planck (2007-2009) - all-sky survey

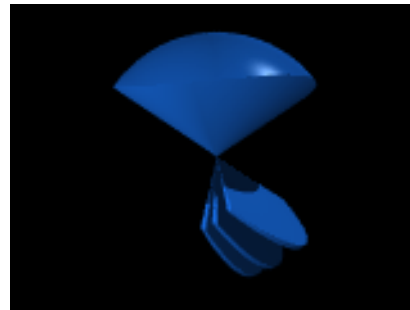


- **optical/near-IR:**

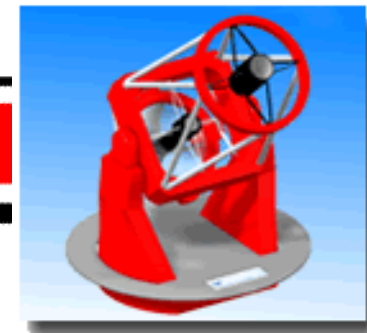
Sloan + WFCAM

VISTA

large area surveys



WFCAM
UKIRT



Physics from combining data from different bands

- **X-ray + SZ effect: redshift-independent distance to cluster**
+ **redshift: estimate of Hubble constant, H_0**
sample to high redshift: constraints on $(\Omega_M, \Omega_\Lambda)$
- **optical + near-IR: photometric redshift estimates for cluster galaxies**
- **X-ray/SZ + optical/near-IR: properties of clusters galaxies as $f(L_X)$, $f(T_X)$, $f(L_{SZ})$, etc**

How do we detect clusters?

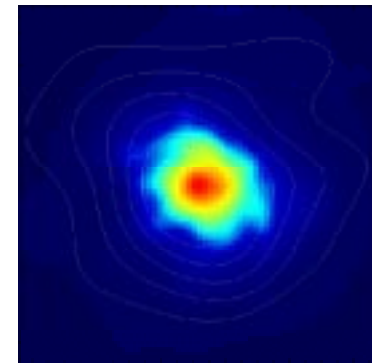
- **optical:** enhancement in number density of galaxies on the sky:



- **X-ray:** thermal emission from hot gas:

$$f \sim n_e^2$$

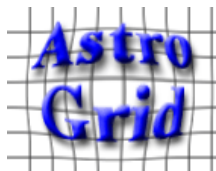
- **(sub)mm:** scattering of microwave background photons (Sunyaev-Zel'dovich effect): $f \sim n_e$



Galaxy clusters: a use case for AstroGrid

Bob Mann (IfA, Edinburgh)

- **AstroGrid needs science requirements set by researchers - “use cases” defining what they want AstroGrid to do for them**
- **example: clusters of galaxies**
 - inherently multi-wavelength objects**
 - learn different things from looking in different passbands**
 - full picture needs combination of these data**
 - ...and that will require federation of many databases**



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