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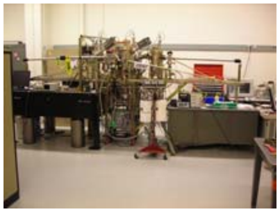
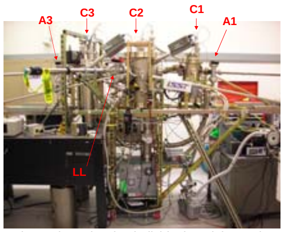
LSST Camera Materials Test Chamber

To allow deep, wide field imaging, the LSST camera has a 3 billion pixel CCD detector array maintained in a vacuum environment, with the focal plane and electronics at 180-240 K. Materials within the vacuum cryostat will remain for years and be subject to thermal cycling. They must not outgas in such a way as to degrade light transmittance to the focal plane or compromise the vacuum.

We have developed a large sequential vacuum chamber testing setup to evaluate samples of all candidate materials for suitability in the LSST camera.

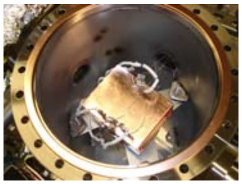


Wide view of CMTC



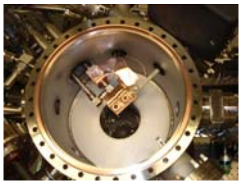
Closer view, showing individual modules and pumping, control, and readout systems

Material samples are introduced through load-lock 'A1'. Samples are then moved via a magnetic transporter arm to chamber 'C1' where they can be heated. Samples move again into 'C2' and are placed in a small box with holes where they are allowed to outgas. In C2, the outgassing products are measured with an RGA mass spectrometer, and they are allowed to deposit on a glass disk placed in a basket maintained at the focal plane temperature. The glass disk is then moved to C3, where the transmission through it in 6 optical bands is compared to that through a clean disk. Glass disks are introduced and removed through load lock 'A3', and sample boxes through 'LL'.

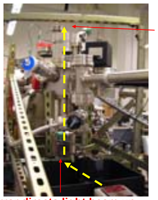


Interior of C1

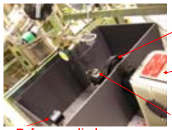
Interior of C2



Interior of C3

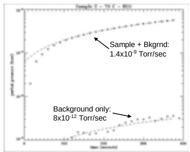


Optical setup for measuring transmission through glass disks in C3



Outgassing test results of coated circuit board sample in CMTC. The RGA shows essentially only H_2, H_2O, N_2, and CO_2.

RGA snapshot



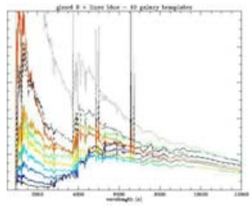
Partial pressure rise of H_2O with pump valved off and sample at 79° C

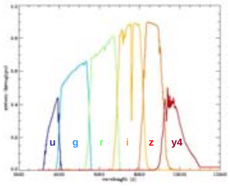
LSST Photometric Redshift Issues

LSST will rapidly survey 10 deg^2 patches of sky deep enough to capture ~40 galaxies per arcmin^2, or ~4 billion galaxies total over 10 years, enabling the precision characterization of dark energy and dark matter. With only 6 band optical photometry available, these science goals will require accurate photometric redshift reconstruction out to z~4 with well understood systematics.

Photometric redshift reconstruction relies on galactic spectral features such as the 4000Å Balmer break and 900Å Lyman peak changing the flux through different filters as the redshift increases. Photometric redshifts with LSST present a new challenge, because to date most photo-z projects have either been interested in low z or have included H, J, and K band infrared data.

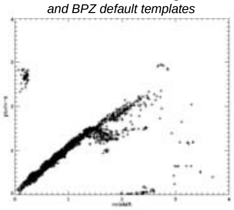
Photo-z packages that fit template spectra give varying results depending on the template spectra used. Without infrared band information, there is always potential ambiguity in the range of 1.3<z<2, as the Balmer break is somewhere in the y band and the Lyman peak hasn't entered the u band, and there are always catastrophic outliers 'confusing' the Balmer and Lyman features.
We are using these simulations to test proposed y-band filter shapes.



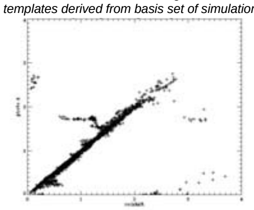


A galactic spectrum basis set that I have used for constructing simulated spectra for exploring photo-z issues (top), on top of the response of the LSST 6 band passes (bottom)

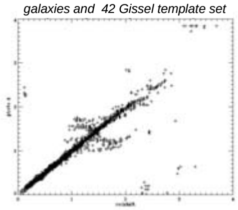
BPZ results with simulated galaxies and BPZ default templates



BPZ results with simulated galaxies and templates derived from basis set of simulations

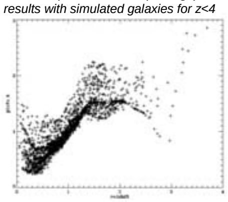


LePhare results with simulated galaxies and 42 Gissel template set

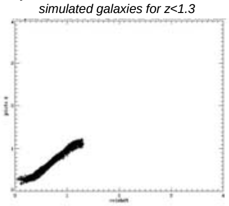


It seems that neural network photo-z approaches fail for the LSST 6 band photometry when z>2 galaxies are included. This is because as the Lyman feature enters the various bands, patterns of relative intensity mimic the patters for the Balmer feature for z<1.3. In the literature, success has been claimed for neural networks for either a low redshift sample only, or when infrared band information is included.

ANNz (neural network package) results with simulated galaxies for z<4



My custom neural network results with simulated galaxies for z<1.3



We are continuing to explore custom neural network approaches