The Large Zenith Telescope (LZT) Survey

Calibrated Spectral Energy distributions (and redshifts)
for 10^6 galaxies, 10^4 QSOs, and 10^5 stars

Object: Suggestion of a common LZT/CFHLS survey field
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1 The LZT project

The Large Zenith Telescope (Hickson *et al.* 1998) is a 6-m liquid-mirror telescope under construction near Vancouver, Canada. With first-light expected in spring 2002, it will conduct drift-scan surveys of a strip of sky centered at $49°17'17''$ declination, and in the right ascension interval $7^{\rm h}$ to $19^{\rm h}$. It is a zenith-pointing telescope equipped with a $2k \times 2k$ thinned CCD ($0.5''$/pix) at the prime focus, which scans a $17' \times 110°$ strip of sky at sidereal rate. During the first part of the observations, the survey region will be observed in a preliminary phase through UBVRIZ broad-band filters. The second and major observations for the LZT survey will be obtained through 40 medium-band filters with logarithmically-separated central wavelengths from 4000 Å to 1 μ (see Fig. 1). These will yield calibrated spectral energy distributions (SEDs) to $R \lesssim 23$ with a resolution $R \simeq 40$ for $\sim 10^6$ galaxies ($z \lesssim 1$), $\sim 10^4$ QSOs ($z \lesssim 3.5$) and $\sim 10^5$ stars. Application of a 10-component principal component analysis onto these 40-filter SEDs complemented by the U broad-band filter, provides a robust spectral classification scheme for the identification of stars, galaxies and QSOs, and reliable measurement of redshifts for the galaxies and QSOs (Cabanac, de Lapparent, and Hickson 2001):

- for a S/N$\geq$ 3, 98% of stars, 99.9% of galaxies and 87% of QSOs are correctly classified. These values increase to 100% of stars, 100% of galaxies and 97% of QSOs at a S/N= 10
- for a S/N= 3, redshifts are measured with an accuracy of $\sigma_z \lesssim 0.05$ for galaxies with $z \lesssim 1$, and to $\sigma_z \lesssim 0.1 - 0.2$ for QSOs with $z \gtrsim 2$. At a S/N= 10, $\sigma_z \lesssim 0.02$ for galaxies with $z \lesssim 1$, and $\sigma_z \lesssim 0.03$ for QSOs with $z \gtrsim 2$.

2 Scientific Objectives of the LZT galaxy survey

Among the major issues which the LZT galaxy survey will address are: (1) characterization of the evolution of the different galaxy populations via their luminosity functions (the results of the CADIS sample, Fried *et al.* 2001, with a similar redshift resolution as the LZT, demonstrate the feasibility of the project); (2) study of the evolution of galaxy clustering using the angular two-point correlation calculated per redshift interval; (3) discrimination between the predictions of the different theories of large-scale structure formation using the high-order moments of the galaxy distribution (counts-in-cells, N-galaxy probabilities, and Minskowski functionals; see Mitsouras, Brandenberger, and Hickson 1999, and references therein).

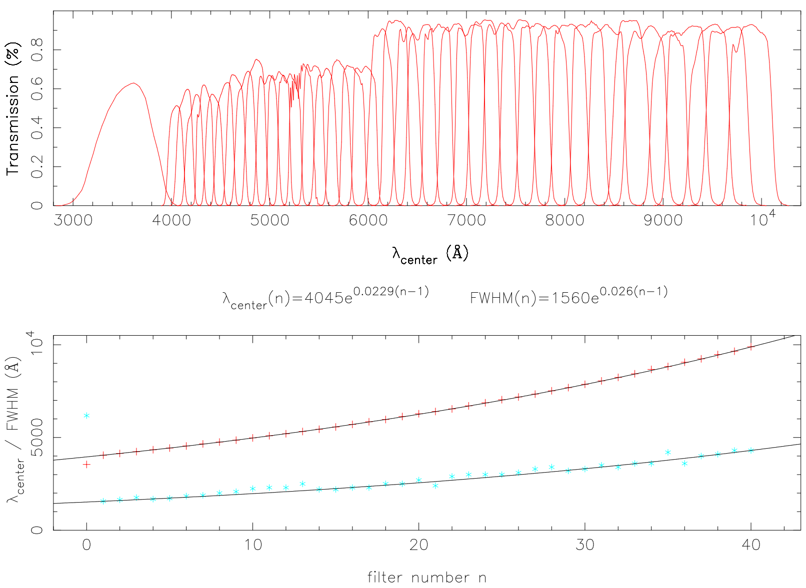

Figure 1: The transmission curves of the 40 medium-band filters + U band (top graph) used for classifying objects and measuring redshifts for the LZT survey. The central wavelengths λ_{center} (crosses) and $FWHM$ of the filters multiplied by 10 are also shown (bottom graph).

3 For a common LZT/CFHLS-wide-synoptic target

We propose that the $6° \times 6°$ patch of the CFHLS "Wide Synoptic Survey" presently located at 10^{h} 0° be considered for displacement to 10^{h} and $49°17'17''$. By centering one of "Wide Synoptic Survey" target field at the declination of the LZT, both surveys will make substantial benefits. The LZT survey will obtain spectro-photometrically calibrated SEDs and spectral classification for the $\sim$ 50000 galaxies, 500 QSOs and 5000 stars in common with the CFHLS patch, along with redshifts for the galaxies and QSOs. At comparable S/N, and for $z \lesssim 1$, the galaxy redshifts measured from the 40-medium-band-filter + U system have a typically 5 times smaller uncertainty than provided by u*g'r'i'z'-based photometric redshifts (Pelló *et al.* 2001); the spurious identifications are $\sim 0.1\%$ for the LZT galaxies with a S/N= 3, compared to 5 to 10%

with the broad-band photometric redshifts. In turn, thanks to the excellent image quality obtained with the CFHT, it will become possible, for the first time at $z \simeq 1$ with a large statistical sample of galaxies, to examine the relationships between the morphological types provided by the CFHLS and the spectral types obtained from the LZT SEDs. A common survey region will also allow to convert the LZT UBVRIZ galaxy luminosity functions into the u*g'r'i'z' system provided by the CFHLS photometry. There is no doubt that this wide set of multi-color luminosity functions will become a widely used reference for future studies of galaxy evolution.

References

[] The Large Zenith Telescope Web Site: **http://www.astro.ubc.ca/lmt/lzt/**

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