MegaCam Observations of High Redshift Supernovae

My principal interest in wide field imaging with Megacam is in the study of very distant supernovae, several magnitudes deeper ($I_{lim} = 25.5$ or deeper) than existing supernova surveys. We propose a search for distant Type Ia and Type II supernovae using Megacam, to $z > 0.8$ for SNeI, and to $z > 1.4$ for SNeIa. The observed SNeII will be used to obtain a completely independent estimate of the redshift dependence of star formation that is less affected by dust. In addition we will also learn much more about the low redshift properties of SNeIa, and possibly detect rare (but extremely informative) lensed SNe at $z > 2$.

In this survey, SN types will be obtained to sufficient statistical accuracy from decay rates, and redshifts will be obtained from photometric $z$'s of the host galaxy. It is not necessary to observe the SNe at maximum light. The entire observing and reduction procedure has been successfully simulated (see figures), and we (Ray Carlberg, David Hartwick, John Ouellette and myself) are scheduled to obtain some first results with CFH12K this fall (99II).

Our survey differs in several key ways from other ongoing high $z$ SN surveys: (i) the scientific goal is to measure the cosmic star formation rate and constrain the progenitors of SNeIa, not measure cosmological parameters; (ii) our limiting magnitude is $1-2$ mag deeper; and (iii) imaging at maximum light and followup spectroscopy are not necessary. This survey is matched to a nearly unique capability at CFHT.

The basic database required for studies such as this one is a sequence of 4 hour $I$ band exposures of one or more fields ($I_{lim} = 25.5$ or deeper), with epochs separated by of order 15-60 days (30 days is roughly optimal; the exact sequence of epochs is not critical). Single epoch exposures in $UBVR$ will also be needed for the photometric redshifts. The aims of the survey could be realized with $\sim 20$ nights of data over 2 years; queue scheduling would be desirable (though not absolutely essential) for this project.

It should be noted that this data will be useful for many other projects, including studies of Kuiper belt objects, and weak lensing studies of large scale structure.

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