■ Scientific Justification

Observations of the type Ia supernova (SN Ia) rates in high and low redshift galaxies show inconsistent results on the implied progenitor mechanisms responsible for producing these important events. We propose to investigate correlations of SN Ia events to the properties of their host galaxies in the highest redshift regimes ($1 < z < 2$) from the GOODS survey (Koekemoer et al. 2004, Dahlen et al. 2008). Our goals are:

- To determine if measured relations of SN Ia luminosities to their low-z host galaxies still hold at the highest-z by determining the best estimates of high-z SN Ia *intrinsic* and *observed* properties in relation to their host galaxy properties, normalized by the average populations at the same redshifts.

- To probe for additional SNe Ia near the confusion limit of the surveys for even higher-z SNe ($1.5 < z < 2$), testing the development time for these events.

The results of this program have important implications on the robustness SN Ia progenitors to changes in host environmental properties, such as star-formation histories and metallicity.

■ Analysis Plan

There has been some concern on the sensitivity of the GOODS survey to events in the highest magnitude and redshift ranges, but recent attempts find more SNe Ia at $z > 1.4$ via independent detection criteria (Kuznetsova et al. 2008, Rodney et al. 2008), or the deepest near-IR imaging of the NICMOS UDF (Strolger & Riess 2006) have failed to produce *any* additional candidates. Assuming all studies are efficient in recovering detectable SNe, the independent combinations of data only push the detection threshold by as much as few tenths of a magnitude over GOODS itself (Dahlen et al. 2008), or in the case of the UDF, do not probe a sufficient area to expect a significant impact.

Until plausible scenarios are developed to rectify this clear discrepancy in the SN Ia rates (see Kobayashi & Nomoto 2008), it is important to push the sensitivity of these highest-z surveys to find events at the confusion limit of the ACS data. We propose to develop the deepest comparison templates to date by comparing single-epoch data to all available remaining data in the GOODS North and South fields. We will employ *tested and complete* methods for identifying potential candidates, similar to those used originally in Strolger et al. (2004) for GOODS, and Rodney et al. (2008) for $N - [N(N-1)/2]$ comparisons, as detailed in Barris & Tonry (2004) for the IfA survey.