The Effect of Local Environment on Type Ia Supernovae in the Dark Energy Survey

Lisa Kelsey
Mat Smith, Mark Sullivan, Phil Wiseman
On behalf of the Dark Energy Survey
Why Local Environment?

- Could local properties give a more accurate picture of the environmental dependence of SNIIa?
Why Local Environment?

• Could local properties give a more accurate picture of the environmental dependence of SNIa?

• Correlations found, e.g.:
  • Local rest-frame U-V colour (Roman et al. 2018)
  • Local sSFR (Rigault et al. 2018)
Why DES?

- DES-SN observed 27 square degrees with 6-day cadence
- Spectroscopically confirmed Ia sample
  - ~ 200 objects (3yr)
  - z ~ 0.05-0.85
- Stacked images in griz filters
Method

Redshift cut at $z=0.6$ for seeing-optimised stacks
Method

Global vs. local aperture 4-band griz photometry
SED fitting using PÉGASE templates
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Allows properties to be determined:
- Age
- SFR
- Stellar Mass
- UBVR Magnitudes

We focus on stellar mass and rest frame U-R colour.
Results

Global

[Graphs showing step significance, median of sample, and % supernova above step as functions of log(M/M_☉)_{global} at step and U-R at step.]
Results

Local - 4kpc radius aperture
Host Mass = $-0.047\pm0.018$ (2.6σ)

Host U-R = $-0.075\pm0.017$ (4.3σ)

Local Mass = $-0.068\pm0.018$ (3.8σ)

Local U-R = $-0.081\pm0.017$ (4.7σ)
Results

As a function of aperture size

![Graph 1](image1.png)

![Graph 2](image2.png)
$x_1 < 0: -0.044 \pm 0.026$

$1.0 \sigma$

$x_1 > 0: -0.078 \pm 0.023$
\( c < 0 : -0.031 \pm 0.019 \)

\( c > 0 : -0.140 \pm 0.032 \)

2.9\( \sigma \)
What does this mean?

- What is the underlying physical quantity or mechanism causing these steps?
- Local or global?
- Which parameter should we correct for?

Expanding this analysis to the ~3000 objects in the full 5-year DES sample will help provide more answers to these questions.