# How do the remnants of SLSNe look like ?

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#### A decade of Superluminous Supernovae



SN 2005ap, M = - 22.7

Quimby+ 2007

Smith+ 2007, Ofek+2007



### Superluminous Supernovae



### SLSNe II



Chatzopoulos+ 2011

#### Moriya+ 2012

SN 2006gy: collision of ejecta With 15  $M_{\odot}$  of CSM

### SLSNe I



Quimby+ 2011

### SLSNe R (or slow I)



Gal-Yam+ 2009



Nicholl+ 2016

### How do the remnants look like?





CC SN

SN Ia

### Likely not in the MW



(See also: Lunnan+ 2014, Angus+ 2016, Perley+ 2016; Chen+ 2016)

# But theoretically possible at SMC-LMC metallicities



### Polarimetry can be used to probe asymmetries of unresolved sources

P = Q = U = 0: intensity the same in orthogonal directions, photosphere is circularly symmetric, supernova is spherically symmetric (or special viewing angle)



P, Q, U  $\neq$  0: intensity different in orthogonal directions, photosphere is not circularly symmetric, *supernova is asymmetric* 





Credit: Craig Wheeler

### Example: SNe IIP



Leonard+2006

See review by Wang & Wheeler 2008

## The first polarimetric observations of a SLSN I

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Leloudas+ 2015b

### The Stokes parameters

- \* Consistent with no evolution
- Consistent with ISP at the host
- Implies axis ratio > 0.9 (for oblate ellipsoid, Hoeflich 1991)



### A SLSN II (but not IIn)





\* Ambiguous but *maybe* compatible with small polarization

### A nearby SLSN R !



- \* Nordic Optical Telescope
- \* 10 epochs between -20 and 42d
- \* Preliminary results again indicate < 1%</p>
- Proper removal of ISP and evolution study is pending

### Conclusions

- \* A new class of stellar explosions
- \* Unlikely to directly observe a nearby SL-SNR
- \* Polarimetry the only way to probe their geometry
- \* Presented observations for all types of SLSNe
- \* At least the first results do not point to a large asphericity
- \* The sample is growing
- \* Spectral polarimetry also possible for z ~ 0.1 events