PROGENITORS OF SNe II ASSOCIATED WITH YELLOW SUPERGIANT STARS

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and some others
CC-SNe TYPES AND PROGENITORS

**Ib** **Ic** **IIb**

several SNe with deep pre-explosion images available but samples but none progenitor detected

↓

**Wolf-Rayet** stars or interacting massive binaries?

**IIn** **IIL**

infrequent subtype

↓

**LBV?**

**yellow supergiant?**

?  

**SNe 2009hd and 2009kr could be the first two cases**

?  

**IIP**

most common explosion

+ better observational campaigns

+ High resolution SNe sites before explosion

↓

The greatest number of progenitors detected and better constrains

N. Elias-Rosa (ICE-IEEC/CSIC)
ON THE PROGENITOR OF THE TYPE II-L SN 2009kr

- **SN 2009kr** is a **Type II-L SN** in NGC 1832
- Identified a candidate progenitor star coincident with the SN position (Li et al. 2009)

<table>
<thead>
<tr>
<th>Angular Quantity (mas)</th>
<th>V (RA/Dec)</th>
<th>I (RA/Dec)</th>
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</thead>
<tbody>
<tr>
<td>Total astrometric error</td>
<td>9/20</td>
<td>9/30</td>
</tr>
<tr>
<td>Diff. position</td>
<td>13/4</td>
<td>7/22</td>
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</table>

5” × 5” detail of the HST image. The 3σ positional uncertainty ellipse is 0.03” × 0.09” in radius.

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ON THE PROGENITOR OF THE TYPE II-L SN 2009kr

Considering:

• $E(B - V)_{\text{tot}} = 0.08 \pm 0.01$ mag
• $\mu = 32.09 \pm 0.30$
• $12 + \log(O/H) = 8.67$ (solar)

$(V-I)_0 = 0.95 \pm 0.21$ (yellow)
• $\text{Teff} = 5300 \pm 500$ K
• $L_{\text{bol}} = 10^{(5.12 \pm 0.15)} L_\odot$

$M_{\text{ini}} \approx 18-24 M_\odot$

consistent with the limits found:
SN 1980K prog. $< 20 M_\odot$ (Smartt et al. 2009)
SN 1979C prog. $> 17-18 M_\odot$ (Van Dyk et al. 1999)
ON THE PROGENITOR OF THE TYPE II-L SN 2009hd

- **SN 2009hd** is a **Type II-L SN** in NGC 3627 (M66)
- High extinguished SN

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<tbody>
<tr>
<td>Total astrometric error</td>
<td>8/6</td>
<td>15/8</td>
</tr>
<tr>
<td>Diff. position</td>
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<td>20/1</td>
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SN location is **contaminated** by another source, or sources

High contribution of the progenitor emission but the SN location may be contaminated by another source or sources.

Detail of the HST image
5 x 1σ positional uncertainty in radius
ON THE PROGENITOR OF THE TYPE II-L SN 2009hd

Considering:

• $E(B-V)_{\text{tot}} = 1.23 \pm 0.05$ mag
• $\mu = 29.86 \pm 0.08$
• solar metallicity

• $(V-I)_0 \geq 0.99$ mag
• $\text{Teff} \leq 5200$ K
• $L_{\text{bol}} \leq 10^{(5.04)} L_\odot$

$M_{\text{ini}} \leq 20 M_\odot$

consistent with the SN 2009kr progenitor mass (18-24 $M_\odot$)

(See also the Hanin Kuncarayakti’s poster - #18)
Two Type II-L SNe 2009kr and 2009hd seem to have a possible yellow supergiant with initial masses between 18-32 as $M_\odot$ progenitor.

- whether the yellow color of these supergiant progenitors is due to dust, strong mass loss, binary interaction, rotation, or perhaps non-standard stellar evolution?

- do they produce only subtypes of CC-SNe other than II-Plateau?