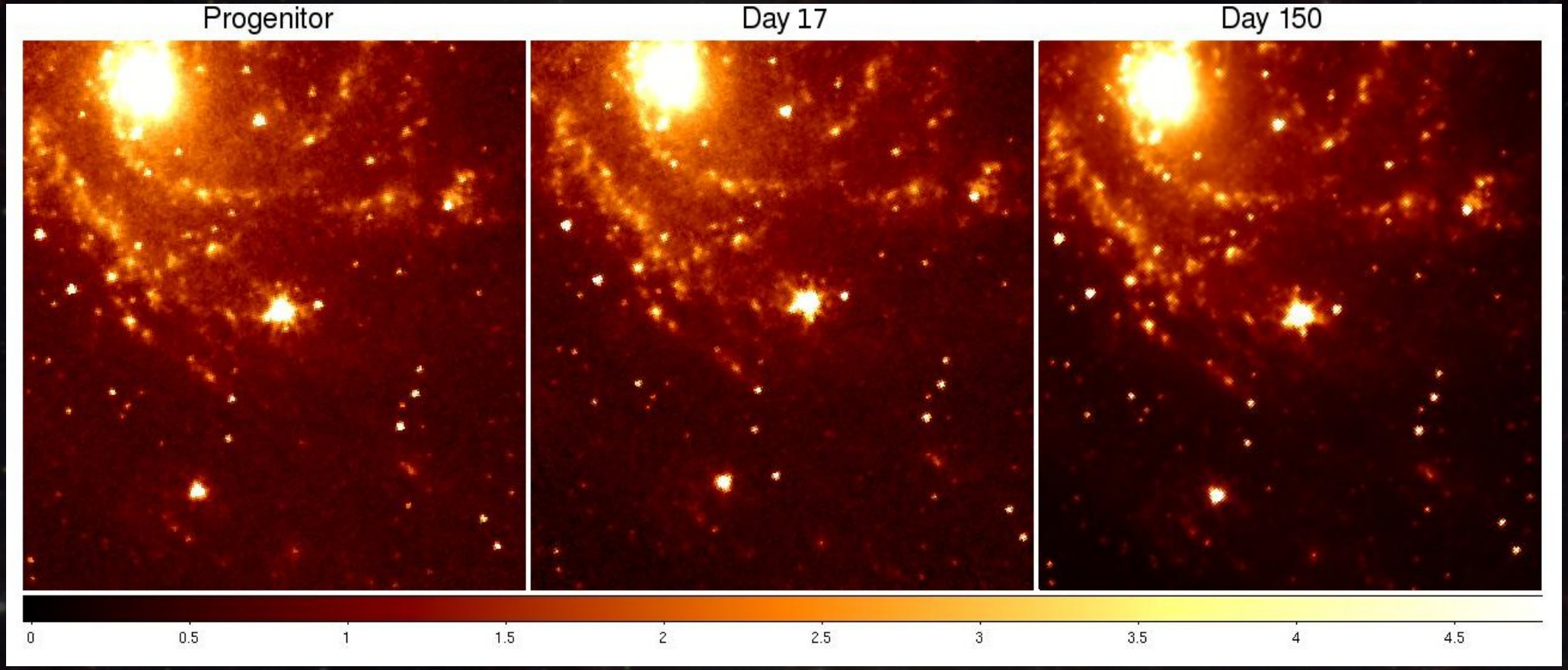
The dust shell around SN 2008S



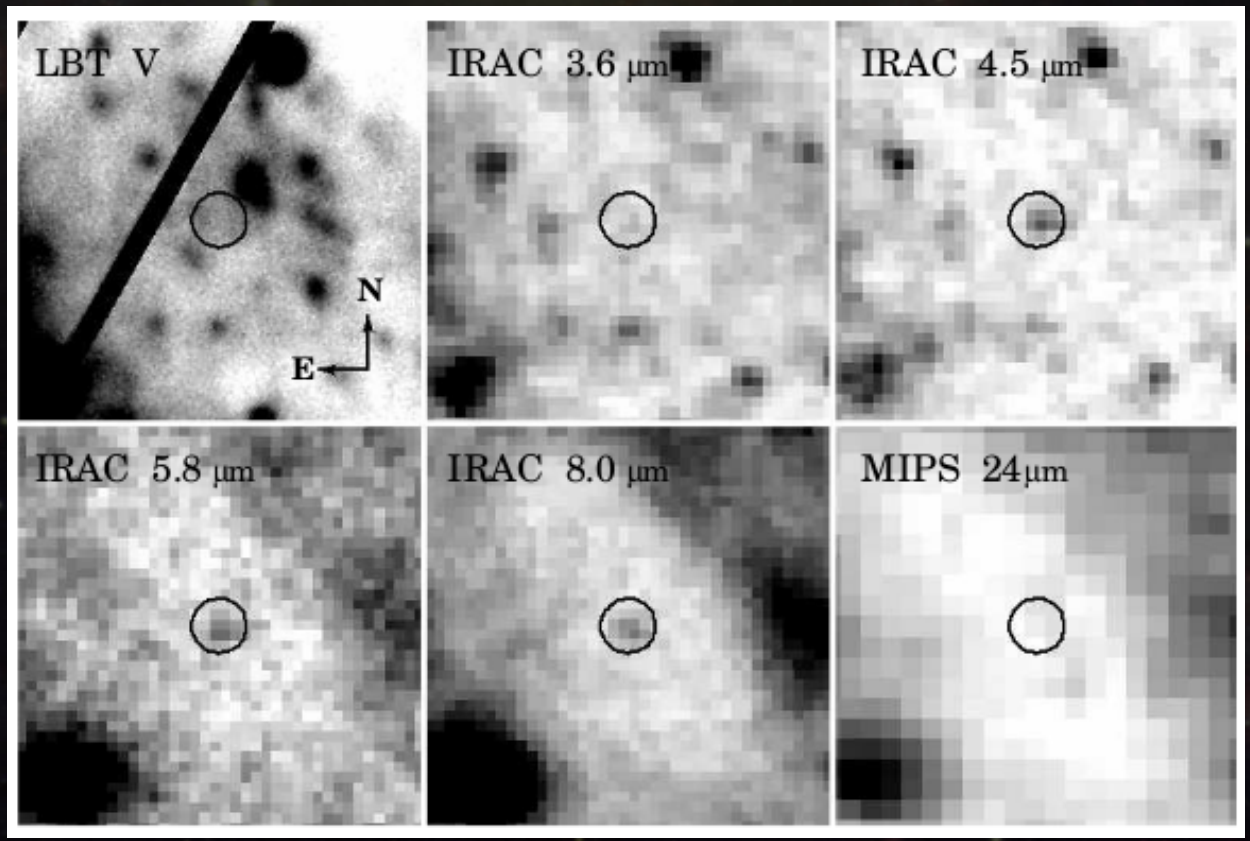
R. Wesson, M.J. Barlow (UCL), B. Ercolano (IoA, Cambridge), G. Clayton, J. Andrews, J. Gallagher (Louisiana State University), B. Sugerman (Goucher College), M. Meixner, M. Otsuka (STSci)

The dust shell around SN 2008S

SN 2008S erupted in late January 2008, in 'supernova factory' NGC 6946

The dust shell around SN 2008S

Prieto et al. (2008): deep pre-explosion optical images show no source at progenitor position, but Spitzer images show mid-IR source:



The dust shell around SN 2008S

Bright mid-IR emission after explosion implies:

- large quantity of dust around progenitor

- outburst did not destroy it all

The dust shell around SN 2008S

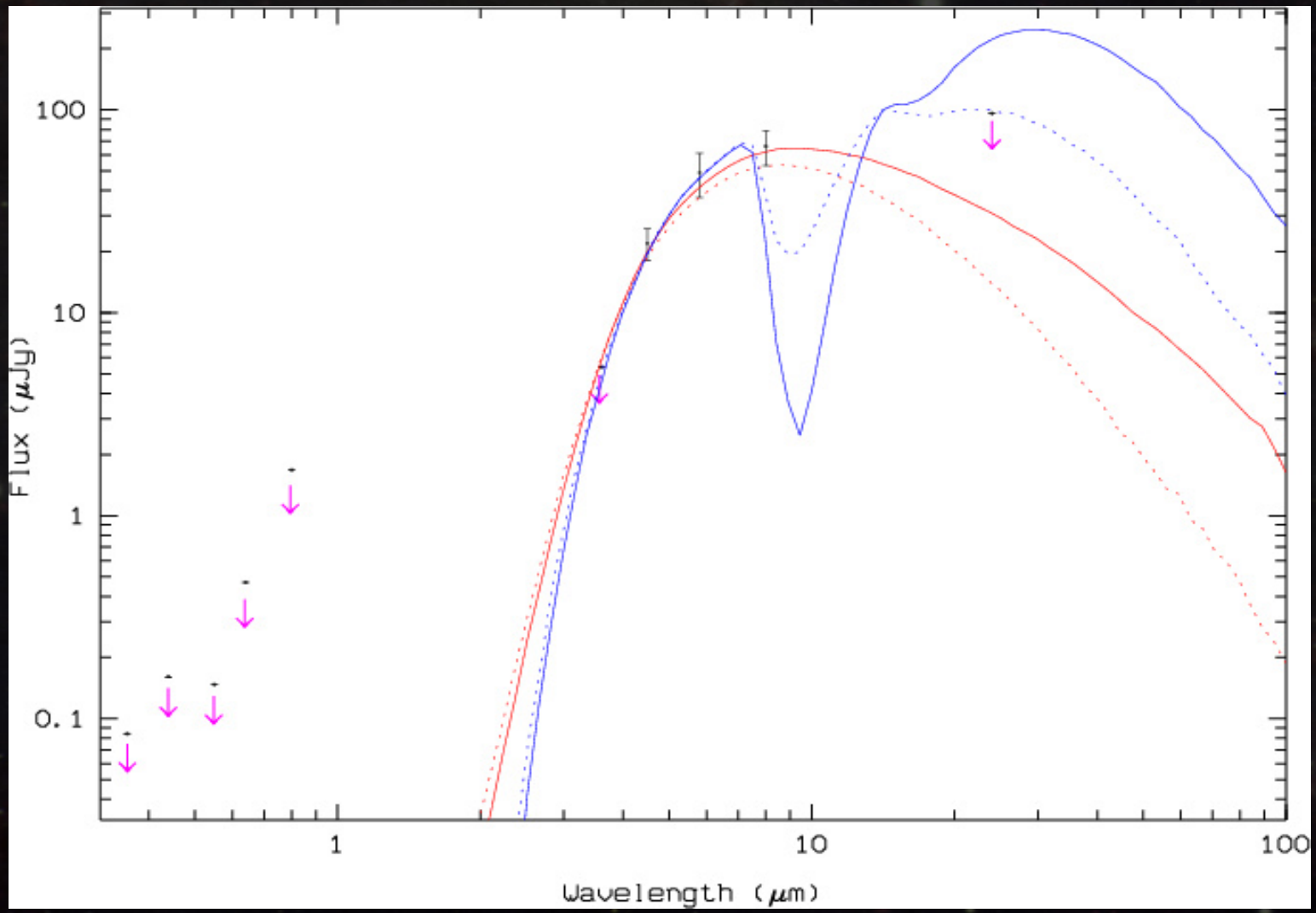
Models of dust shell created using Mocassin.

Progenitor: dust shell has to be carbonaceous. Silicate shells dense enough to match 3.6-4.5 slope have strong absorption at 10um.

24um upper limit constrains outer radius of silicate shell to 425AU – would have been completely vaporised by outburst.

The dust shell around SN 2008S

Fits to progenitor SED:



The dust shell around SN 2008S

Best match to progenitor SED is from a carbonaceous shell with:

- $\rho \propto r^{-2}$
- Total mass $7 \times 10^{-4} M_{\odot}$
- R_{in} = 85 AU
- R_{out} = 20,000 AU

R_{out} corresponds to age of about 10,000 years.

The dust shell around SN 2008S

Late-time IR observations of nearby SN 2002hh on 6 Feb 2008 serendipitously caught SN 2008S, ~17 days after its outburst.

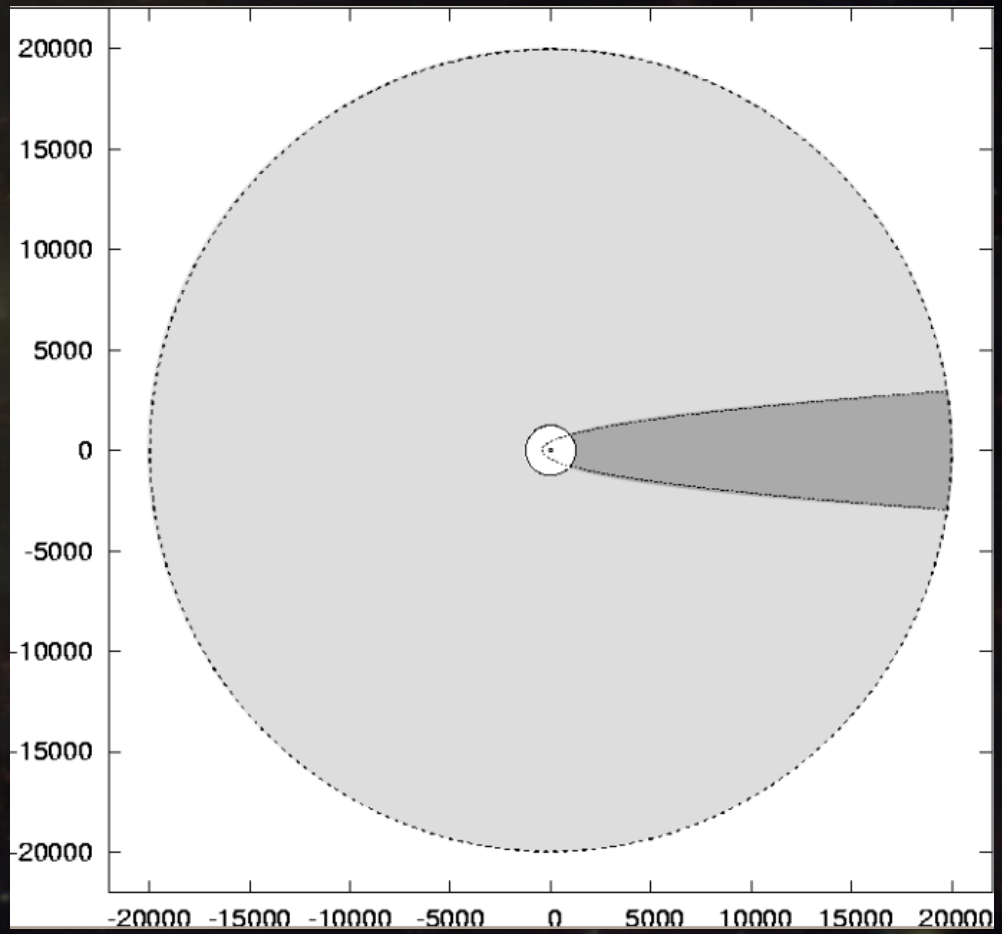
Constructed SED from our Spitzer data + optical and near-IR data from Thompson et al. (2008) and Botticella et al. (2009)

The dust shell around SN 2008S

Day 17 modelled considering

- vaporisation of inner dust by outburst

- light travel time: easy to model using 3D codes



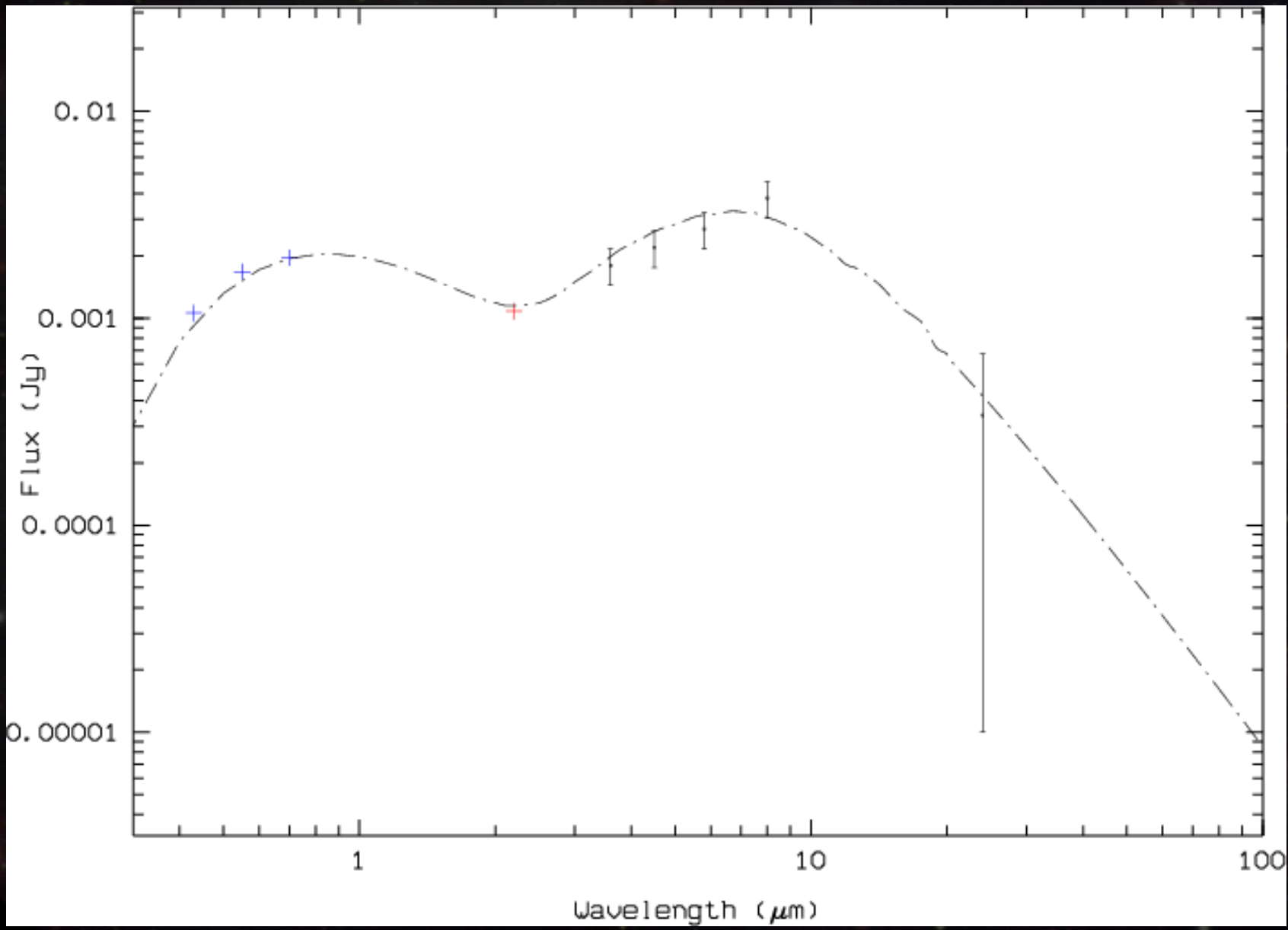
The dust shell around SN 2008S

Matching both optical and IR emission sets new inner radius to 1250AU. If peak luminosity of $3 \times 10^{7} L_{\odot}$ (Thompson et al. 2008) is correct, then dust sublimation temperature is 1050K.

Hollowing shell to 1250AU:

- reduces τ from 13.4 to 0.7
- reduces mass from 7×10^{-4} to $6.59 \times 10^{-4} M_{\odot}$

The dust shell around SN 2008S



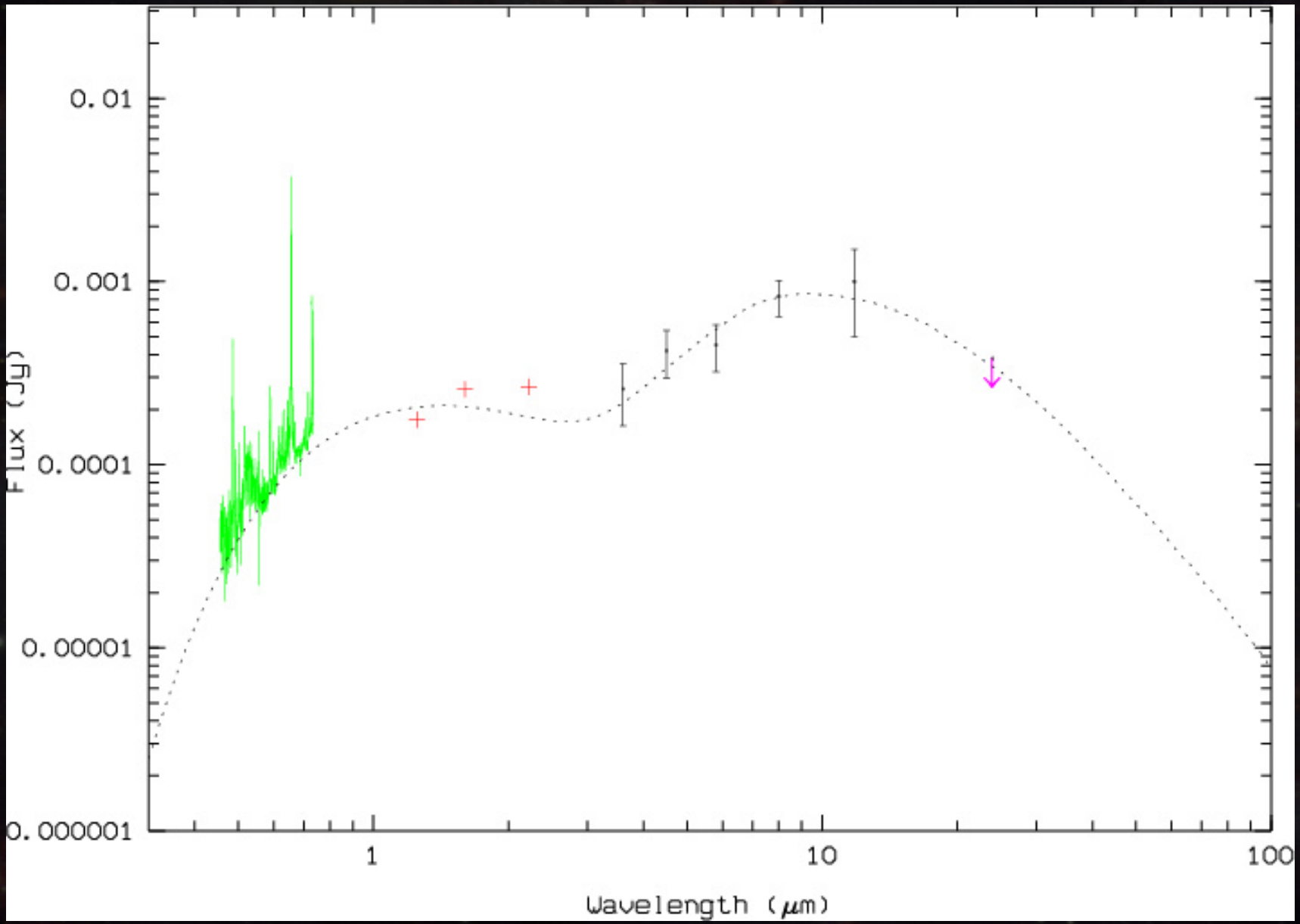
The dust shell around SN 2008S

SN observed in July 2008: GMOS optical spectra and photometry, Michelle and Spitzer mid-IR photometry.

Near-IR photometry at this epoch from Botticella et al. (2009)

Optical-IR SED well matched using previous hollowed-out dust density distribution and only adjusting source parameters

The dust shell around SN 2008S



The dust shell around SN 2008S

Nature of the outburst:

- peak luminosity very low (Mv ~ -14)
- spectral lines very narrow (eg Hα in our GMOS spectra has FWHM 600km/s)
- luminosity decline Feb-July 2008 slower than expected from radioactive decay

The dust shell around SN 2008S

Conclusions:

- progenitor of SN 2008S was surrounded by an extensive carbonaceous dust shell with a mass of $7 \times 10^{-4} M_{\odot}$

- the outburst destroyed only a small fraction of the dust

- the nature of SN 2008S is not yet certain – could it yet explode as a bona fide supernova?