THE DISTANCES OF THE GALACTIC NOVAE

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DATA

Interstellar Reddening Estimates:
- Collected interstellar reddening estimates for 152 Galactic novae from the literature
- Concluded all reddening estimates for each novae
- Preferred especially spectroscopic measurements; e.g
  - Na I, K I lines
  - 2200 Å feature
  - Hydrogen column density
  - Line ratios.
- Other measurements; e.g.
  - Intrinsic colour
  - Colour-colour evolution
  - Reddening est. of nearby stars
  - ...
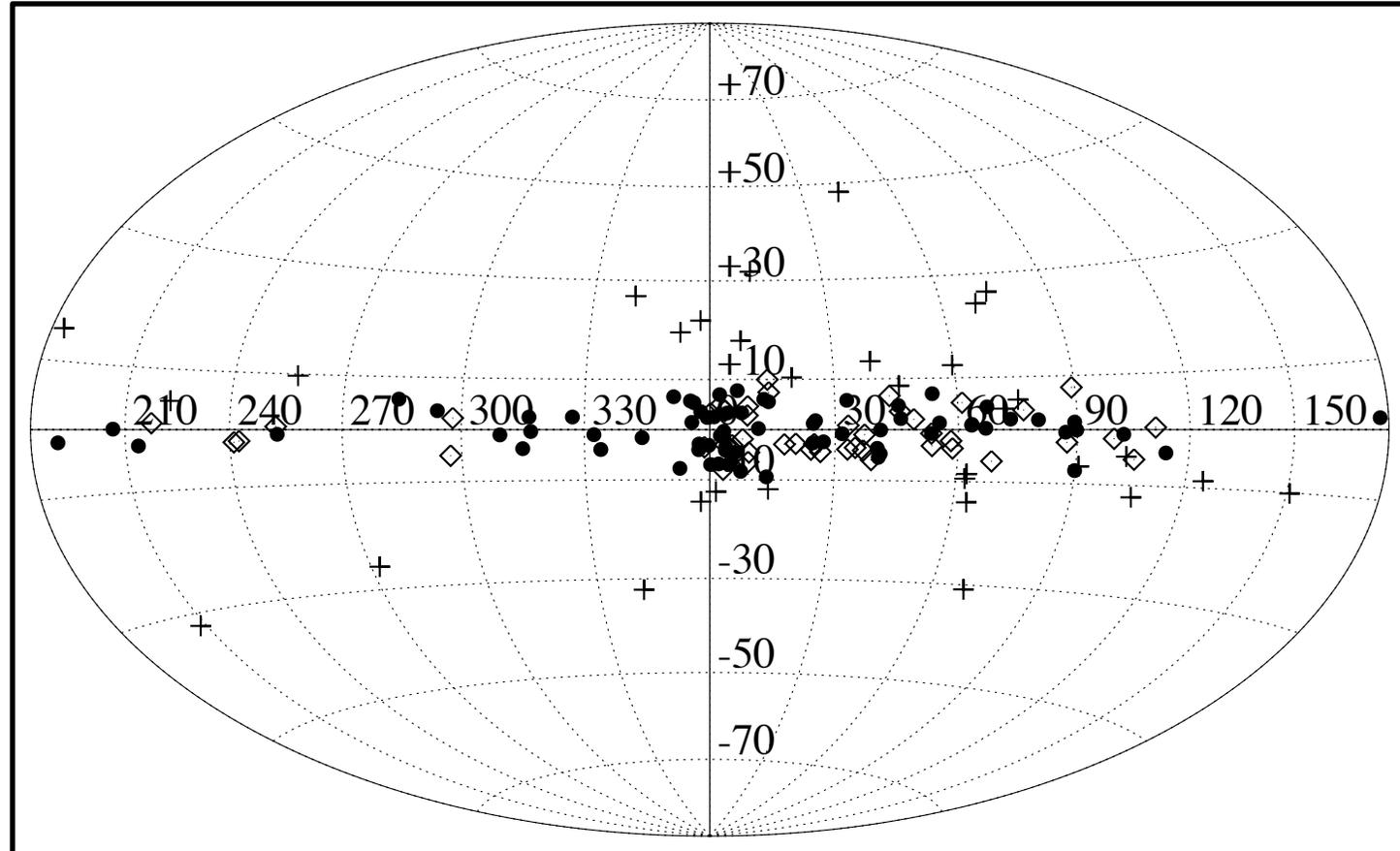
Fig 1. Galactic coordinates of novae which have reddening estimates. (•), (△), and (+) indicate the ones for which the distances could be obtained, only lower limits could be calculated, and the ones for which the distance could not be calculated, respectively.

DATA

- **Parameters of the RC Stars:**
  $M_{Ks} = -1.595 \pm 0.025$ (Yaz Gökçe et. al. 2013)
  $(J-K_s)_0 = 0.625 \pm 0.03$ (Yaz Gökçe et. al. 2013)

- **Photometric Data:**

2MASS	VISTA-VVV	UKIDSS-GPS
• All sky	• Galactic bulge: $\|l\| \leq 10°$, $-10° \leq b < 5°$ • Galactic disk: $-295° \leq l \leq 350°$, $\|b\| < 2°$	• Galactic plane: $-0.5° \leq l \leq 110°$, $\|b\| < 5°$
~8 ≲ K ≲ 14 mag	~11 ≲ K ≲ 18 mag	

sky coverage
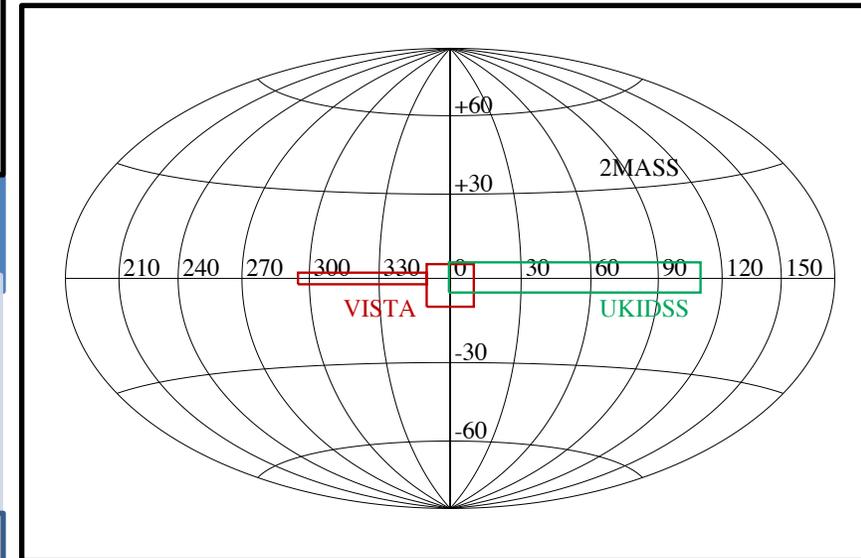
magnitude limits

Fig 2. Sky coverage of the surveys

- Boundary lines: Galaxia dust density model (Sharma et. al. 2013).
- Used gaussian models to determine colour of RC stars in magnitue intervals.
- Reddening: $E(J-Ks) = (J-Ks)_{RC} - (J-Ks)_{0, RC}$
- With using $AKs = 0.657 \times E(J-Ks)$ (Rieke & Lebofsky (1985) in distance module, the distances for reddening curve were calculated.
- Set an upper limit on magnitude where dwarf contamination is lesser then ~ 30%.
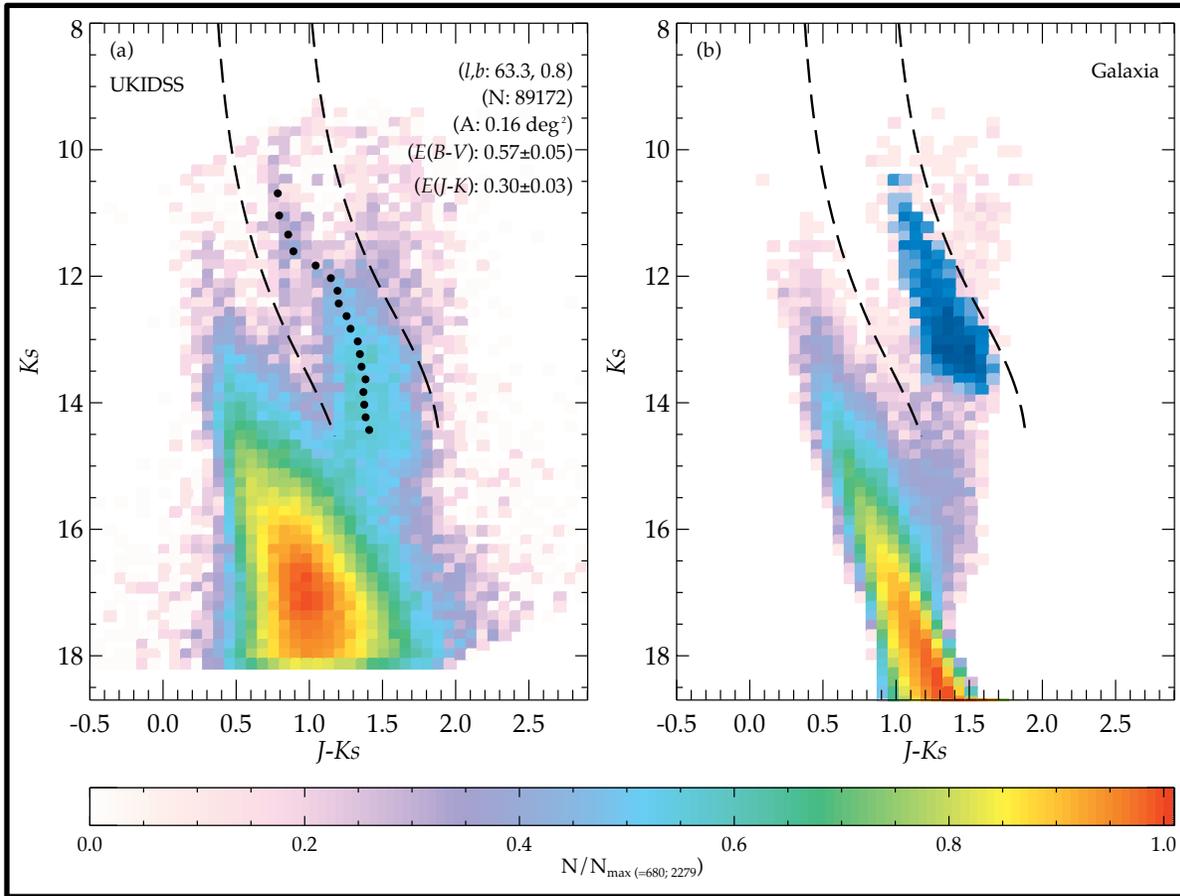
Fig 3. (a) Observational (b) Galaxia CMDs towards LV Vul. Black dashed lines are boundary lines; black dots show J-Ks colours of RC stars; Colour scale is shown below the figure. Note that: maximum number of stars for each bin is shown by red colour.
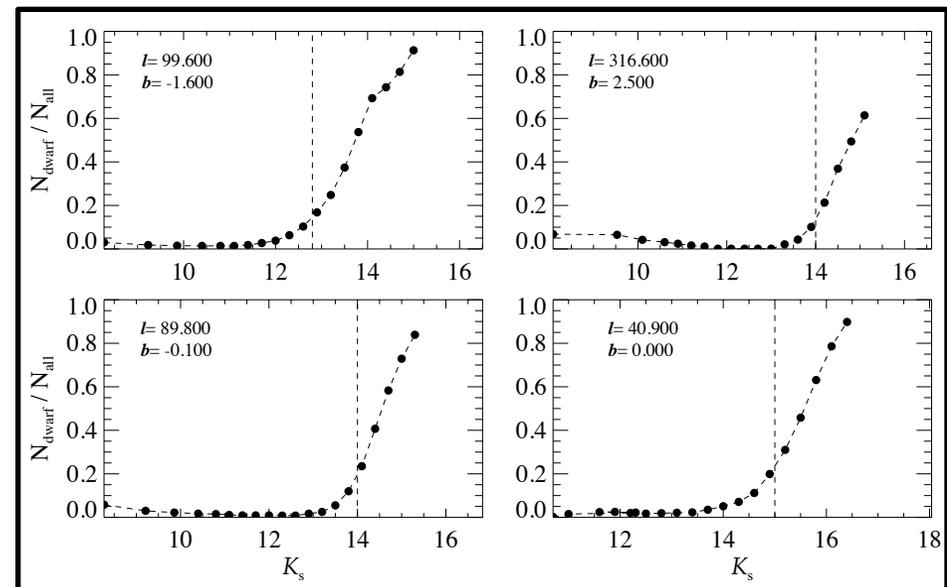
Fig 4. Rate of dwarf contamination toward four different directions. Dashed line represents the upper limit of the magnitude interval.

- In order to ensure that there are no significant variations in the reddening curve through the line of sight, we obtained reddening - distance relations using fields with varying sizes towards each nova.

- Interstellar reddening of nova compared with reddening distance relation
  - $(E(J−Ks)=0.524×E(B−V)$ (Rieke&Lebofsky 1985)).
- In the comparison, the probability density distribution was used.
- obtained most likely distance from this distribution.
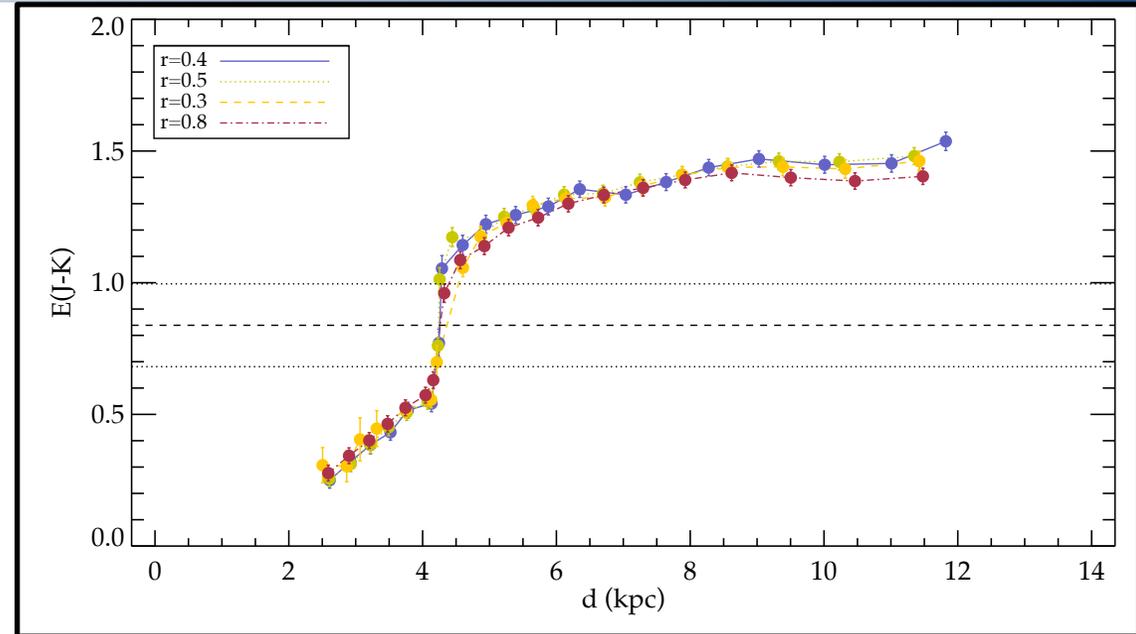
Fig 5. The reddening-distance relations through WY Sge obtained using four different radii.
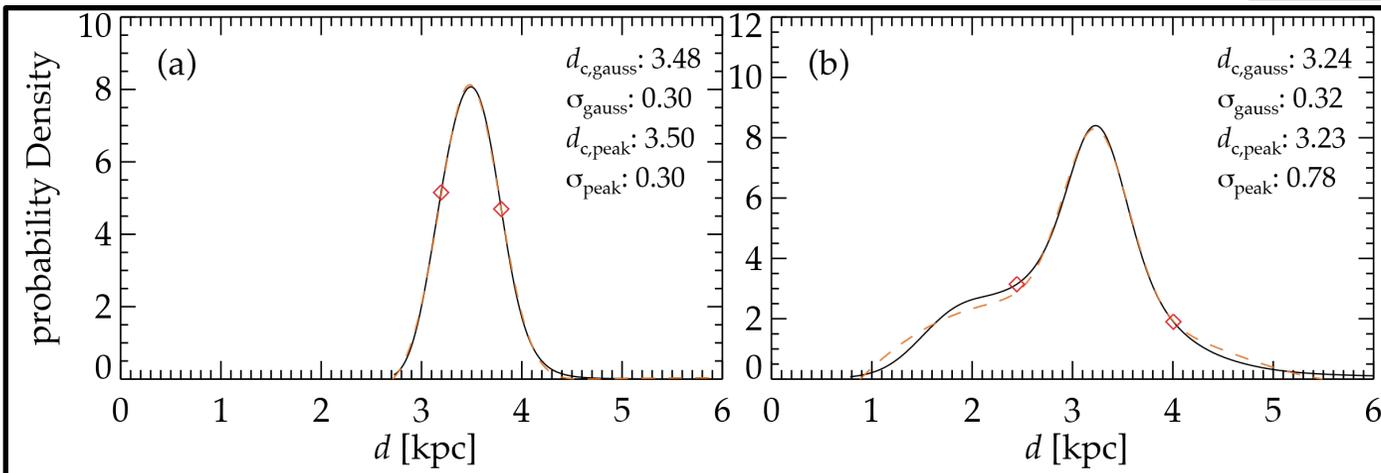
Fig 6. Probability distribution over distance to the source (a) V407 Cyg and (b) V496 Sct. Red dashed line represents the best-fitted Gaussian function and diamond symbols are the distances with uncertainties calculated from the integration method.
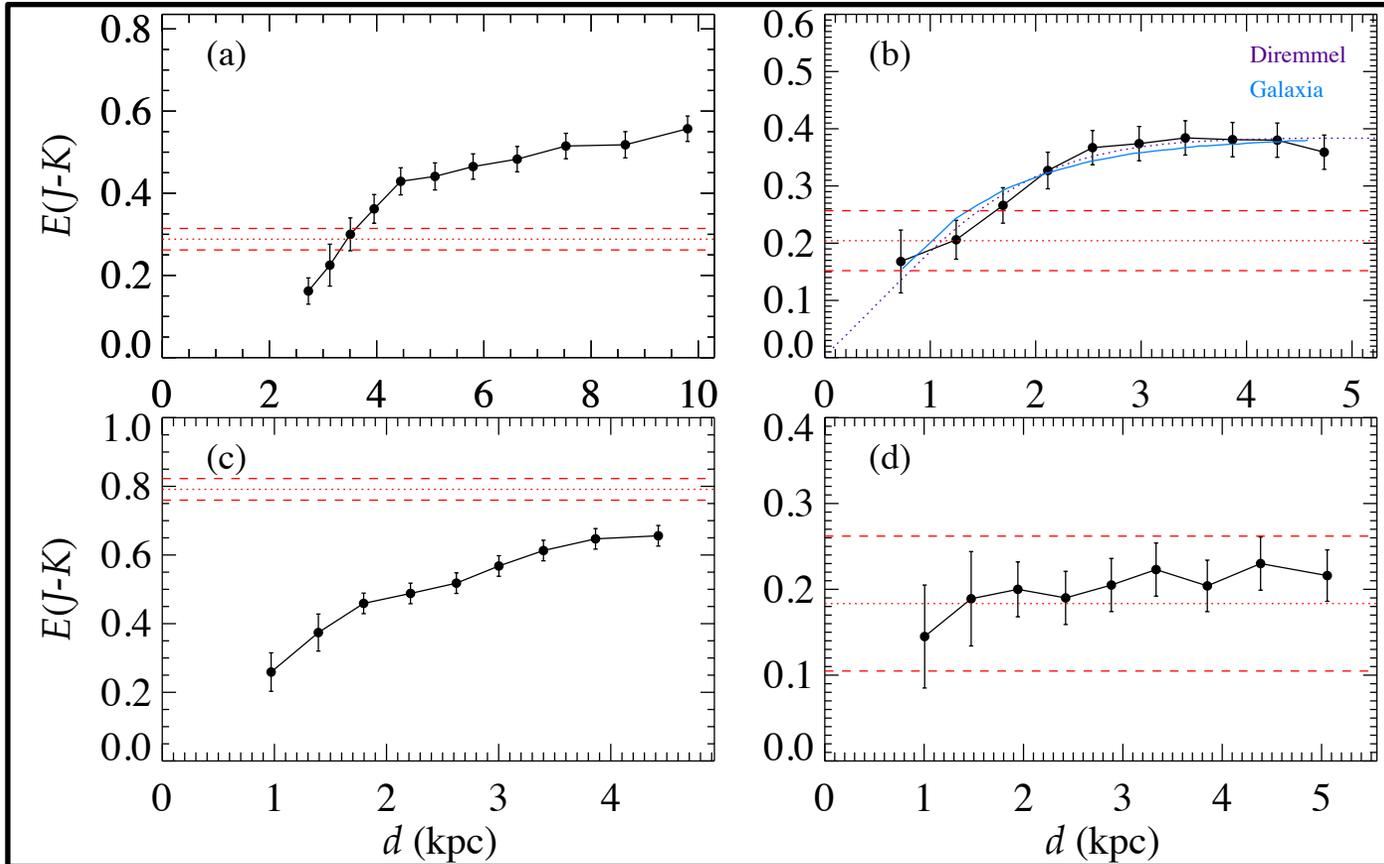
Fig 7. Reddening-distance relations for four scenarios; (a) the distance can be clearly determined, (b) the distance can be determined with getting help from models, (c) Only a lower limit for the distance can be obtained, and (d) the distance can not be measured.

The distances for 73 novae

The lower/upper limits of the distances for 46 novae

119 novae
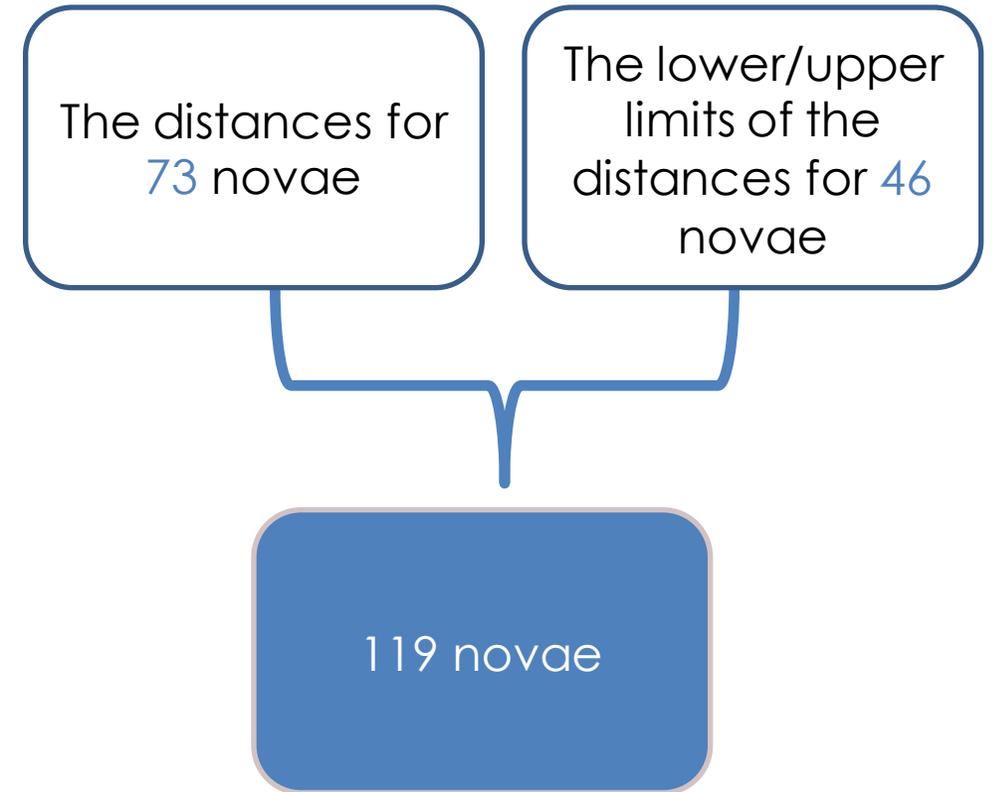
Compared calculated distances of 18 novae with parallaxes

- Median:
  $\Delta|d| = 0.11$ kpc
- Standard deviation:
  $\sigma_{\Delta|d|} = 0.7$ kpc
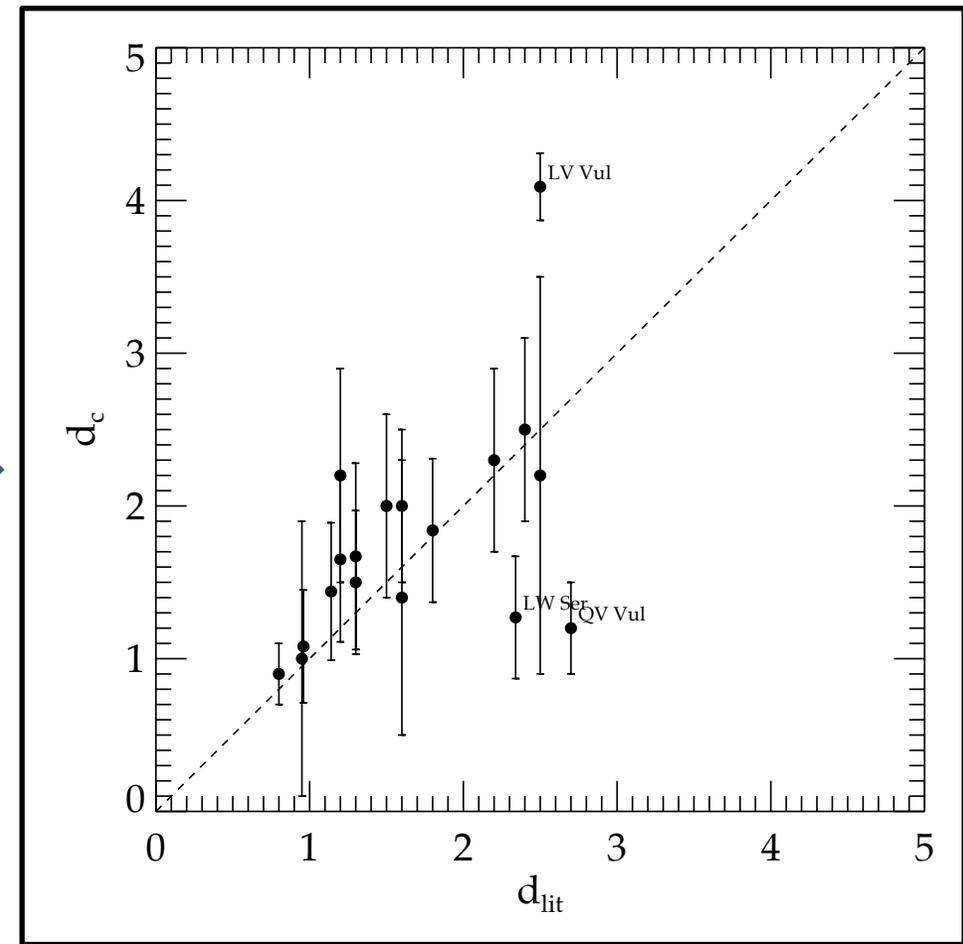
Fig 8. Comparison of our distances with those estimated from the expansion parallaxes.

RESULTS
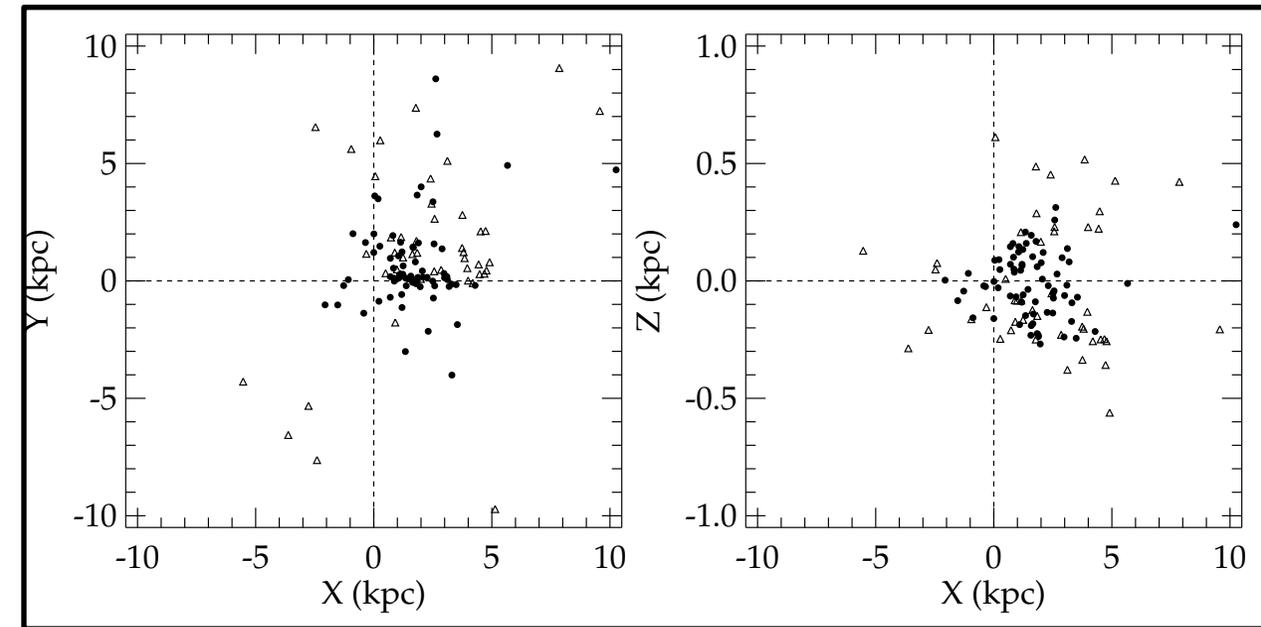
Fig 9. The heliocentric rectangular Galactic distances. (•) for which the distances are obtained, (Δ) only lower limits calculated.

- The distances of 119 novae were investigated.

- In the distance calculations presented here, the largest uncertainty arises from the uncertainties in the reddening estimates.

- Determination of distances of Galactic novae in such a systematic way

  - May help nova systems that have had mysterious distances.

  - May help to understand their luminosity function, spatial distributions…

- For current/future study:

  - A new galactic novae catalogue with an sql query

  - The MMRD relation

  - Spatial distribution and Galactic model parameters of Galactic novae

Thanks for listening

The distances of the Galactic novae

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ABSTRACT
Utilizing the unique location of red clump giants on colour–magnitude diagrams obtained from various near-infrared surveys, we derived specific reddening–distance relations towards 119 Galactic novae for which independent reddening measurements are available. Using the derived distance–extinction relation and the independent measurements of reddening we calculated the most likely distances for each system. We present the details of our distance measurement technique and the results of this analysis, which yielded the distances of 73 Galactic novae and allowed us to set lower limits on the distances of 46 systems. We also present the reddening–distance relations derived for each nova, which may be useful to analyse the different Galactic components present in the line of sight.

Key words: stars: distances – novae, cataclysmic variables.