Measuring Distances to the Galactic Supernova Remnants Using Red Clump Stars

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SN 1987A, 30 years later
Réunion Island, 22February 2017

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Outline

- BACKGROUND
- Method
- Results

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BACKGROUND

- Reliable distance determination to Galactic Supernova Remnants (SNRs) is important to constrain its physical parameters like the age, the size and the explosion energy.

- Only about half of Galactic SNRs have distance measurements

- Measure the distances of Galactic SNRs by taking advantage of the extinction (Av)-distance (d) relation.

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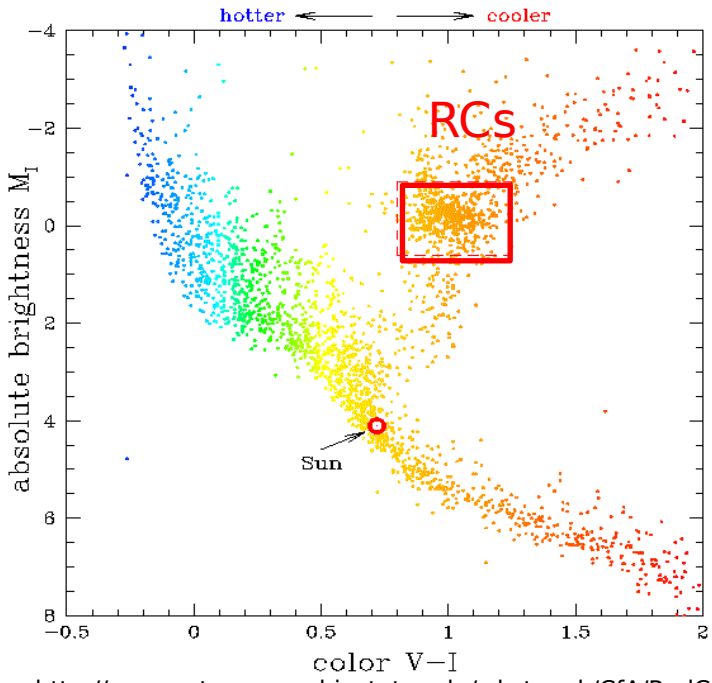
Red clump stars(RCs) as a standard candle



http://www.astronomy.ohiostate.edu/~kstanek/CfA/RedClump/

- An obvious concentration region in the color-magnitude diagrams.
- The absolute magnitude of RCs varies fairly little.

$$D(pc)=10^{[(m-M-A(D)+5)/5]}$$

A(D) ⟷ D

Build the extinction (Av)-distance(d) relation in each direction of Av-known SNRs

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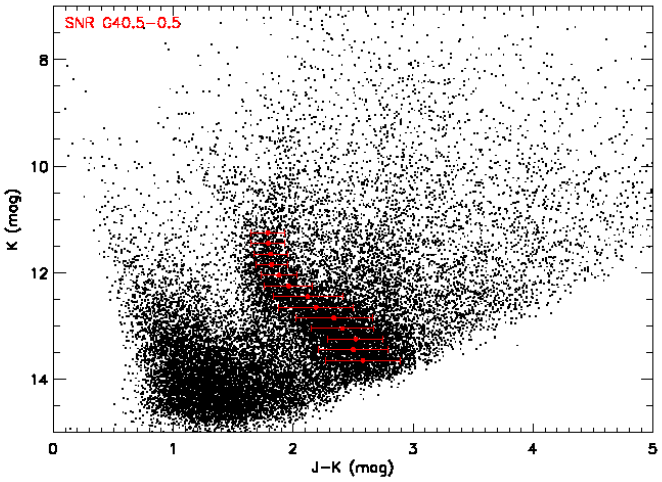
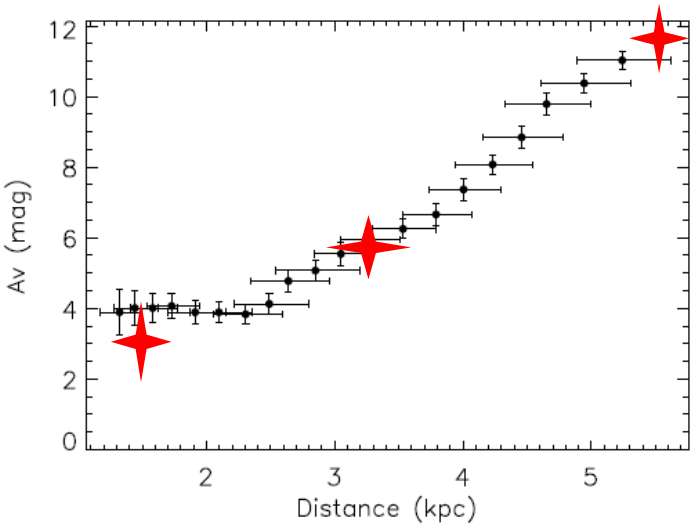
Method

We take SNR G40.5-0.5 as an example

- Data: 2MASS All-Sky Point Sources Catalog
- Centering SNR G40.5-0.5, extract stars in the 0.5 deg^2 area around the SNR



Color–magnitude diagram for the stars within 0.5 deg^2 of G40.5-0.5, the red dot and lines show the fitted location of the RC peak and its extent with 1σ.



Overlap the extinction of the SNR on the extinction-distance relation we build by RCs.

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Result

- Obtain distances of 22 SNRs and upper/lower limits for 34 SNRs in the first quarter of Galaxy.
- Among them, 3 SNRs' distances are given first time.
- Compared with previous distance-known SNRs, we find that most of our distances are consistent with previous results.
- In the future, we will extend our work to the whole Galaxy. We can use the distances to re-calibrate the Sigma-diameter relation and estimates SNRs' other distance-dependent parameters.

Part of the result

Sourse Name	A_V (mag)	D_{known} kpc	$D_{(ourwork)}$ kpc
G54.1+0.3	7.7±0.5	6.2	6.4
G63.7+1.1	16±5	3.8-6	> 4
G65.8-0.5	2.4±0.4	-	2.5
G66.0+0.0	2.0±0.2	-	2-3
G67.7+0.9	1.9±0.2	-	2
G82.2+5.3	1.9±1.1	2.0	1.8

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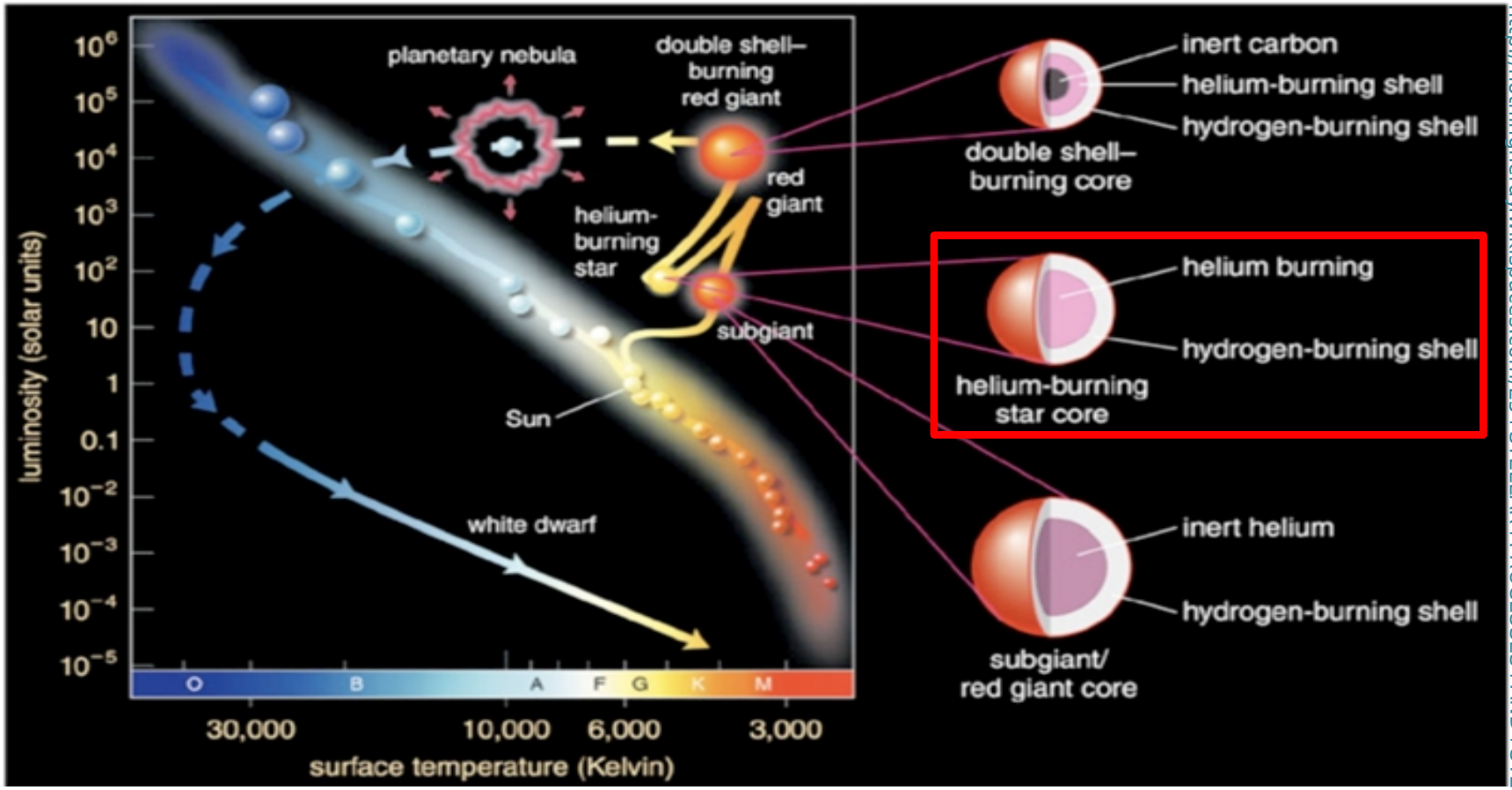
Thanks for
your attention!

红团簇星简介



红团簇星是小质量恒星演化到早期氦核燃烧阶段。