PaulAllen_S284_TMA_01.pdf

by Paul Allen

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Question 1:

a)

i.

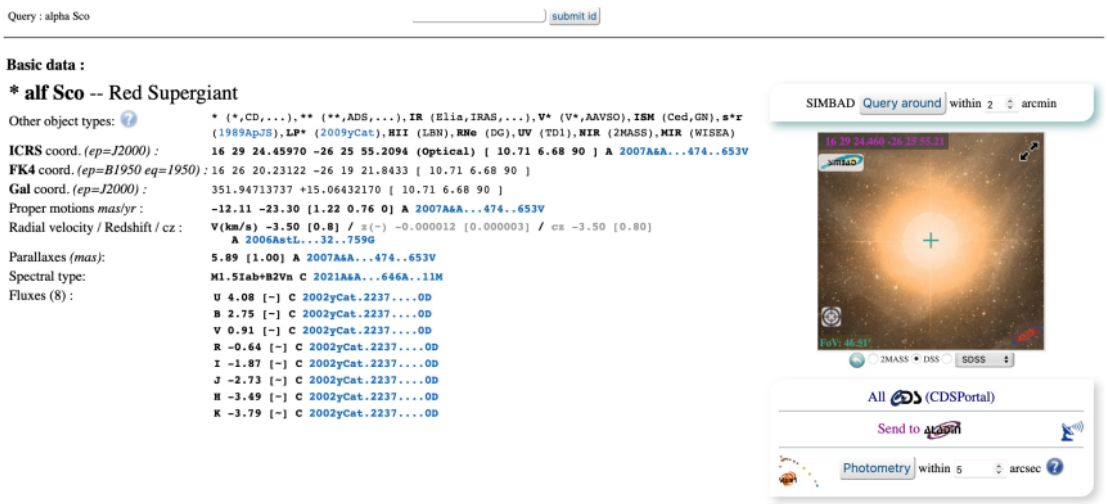


Figure 1: Screenshot of the basic data of alpha Sco. *Accessed 01/11/2024.*

ii.

From the SIMBAD database for alf Sco, we have RA;

$$(\mu_{\alpha^*} = \mu_\alpha \cos\delta) : -12.11\,\text{mas yr}^{-1}$$

and proper motion in Dec;

$$\mu_\delta : -23.30\,\text{mas yr}^{-1}$$

Using equation 1.10:

$$\mu^2 = (\mu_{\alpha^*})^2 + (\mu_\delta)^2 \qquad \text{(eqn 1.10)}$$

Substituting in our values:

$$\mu^2 = (-12.11)^2 + (-23.30)^2$$

$$\mu = \sqrt{(-12.11)^2 + (-23.30)^2}$$

$$\mu = \sqrt{146.6521 + 542.89}$$

$$\mu = \sqrt{689.54212}$$

$$\mu = 26.259...$$

$$\mu = 26.26$$

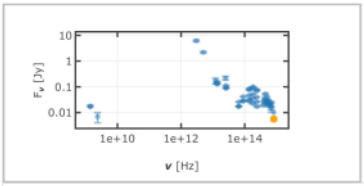
to 2 d.p

b)

i.

Results for object NGC 0001

Overview | Cross-IDs (23) | Coordinates (25) | Redshifts (29) | Distances (15) | Classifications (32) | Galactic Extinctions | Notes (3)
Diameters (8) | Photometry & SED (63) | Spectra (4) | Images (3) | References (130) | External Links | Survey Coverage



POSS-II F (North), AAO-SES/SERC-ER (South), Red image
View in IRSA Finderchart
Image Credit: Caltech or AAO/ROE

Selected data and derived quantities for NGC 0001. More information in the tabs above.

Cross-identifications				**Essential note**	
NGC 0001; UGC 00057; CGCG 477-054; CGCG 478-026; CGCG 0004.6+2726				The UZC has V = 2216 +- 65 km/sec.	
Coordinates for Fiducial Position					
Equatorial (J2000)					Galactic
RA, Dec	RA, Dec [Deg]	Unc Semi-major,minor ["]	Unc PA [deg]	Reference	Lon, Lat [deg]
00h07m15.8672s, +27d42m28.911s	1.816114, 27.708031	0.07425, 0.07250	0	2013wise.rept....1C	111.107447, -34.147298
Fiducial Redshift & Derived Quantities [H_0 = 67.8 km/sec/Mpc, Ωmatter = 0.308, Ωvacuum = 0.692]					**Redshift-independent Distances**
z (Helio)	cz (Helio) [km/s]	Reference	cz (CMB) [km/s]	Hubble Distance (CMB) [Mpc]	Mean Distance [Mpc]
0.015177 ± 2.00e-6	4550 ± 1	2008AJ....135..588S	4212 ± 24	62.13 ± 4.36	56.627 ± 2.710
Classifications					
Object Type	Morphology	Reference	Activity Type	Reference	Other
G	SA(s)b?	1991RC3.9.C...0000d			SA(s)b:
Quick-look Angular & Physical Diameters				**Foreground Galactic Extinction (2011ApJ...737..103S)**	
Passband	Diameter ["]	Reference	Diameter† [kpc]	A_λ [mag] Landolt V	A_λ [mag] UKIRT K
POSS1 103a-O	108.00	1973UGC...C...0000N	29.65	0.174	0.019

†Derived physical diameter is based on the mean redshift-independent distance = 56.63 Mpc

Figure 2: Screenshot of the basic data of NGC 0001. *Accessed 01/11/2024.*

ii.

From the NED database for NGC 0001, we have pysical distance (D): 29.65 kpc and angular diameter (θ): $108.00''$.

Using equation 1.5:

$$\sin\theta = \frac{D}{d} \qquad \text{(eqn 1.5)}$$

$$\sin\theta = \frac{D}{d}$$

using approximation theorey

$$\sin\theta \approx \theta \qquad \textit{when } \theta \textit{ is in radians}$$

$$108.00'' \approx \left(\frac{108}{3600}\right)^{\circ} \times \left(\frac{2\pi}{360^{\circ}}\right)$$

$$\approx 5.235 \times 10^{-4}\,\text{rad}$$

So:

$$\theta \approx \frac{D}{d}$$

$$D \approx d \div \theta$$

Substituting our values:

$$\approx 29.65 \div 5.235 \times 10^{-4}$$

$$\approx 56\,627.328\,75\,\text{pc}$$

$$\approx 56.63\,\text{Mpc} \qquad \textit{to 2 d.p}$$

Question 2:

a)

i.

Plane plot of the distribution of the proper motions in the Alpha Persei cluster, proper motion in right assension (pmra/(mas yr)) versus the proper motion in declination (pmdec/(mas yr)) . With the co-moving group marked in blue.

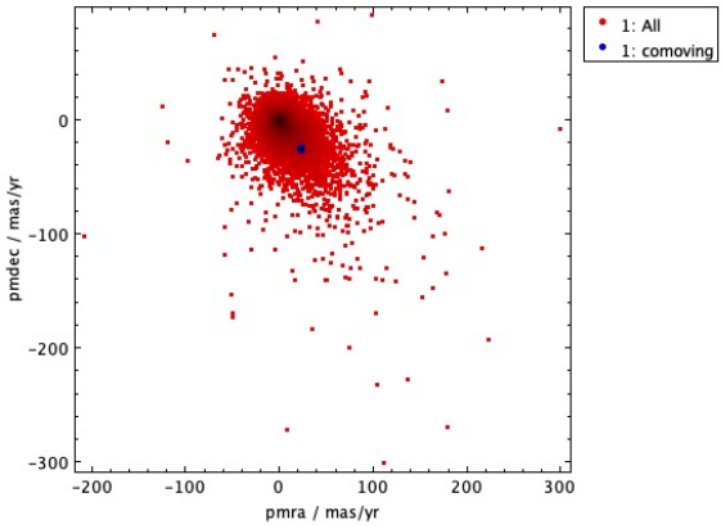


Figure 3: A plane plot to show proper motion in right ascension versus proper motion in declination. *Created 01/11/2024.*

An image of the same data but zoomed in so you can properly identify the area of stars that are co-moving.

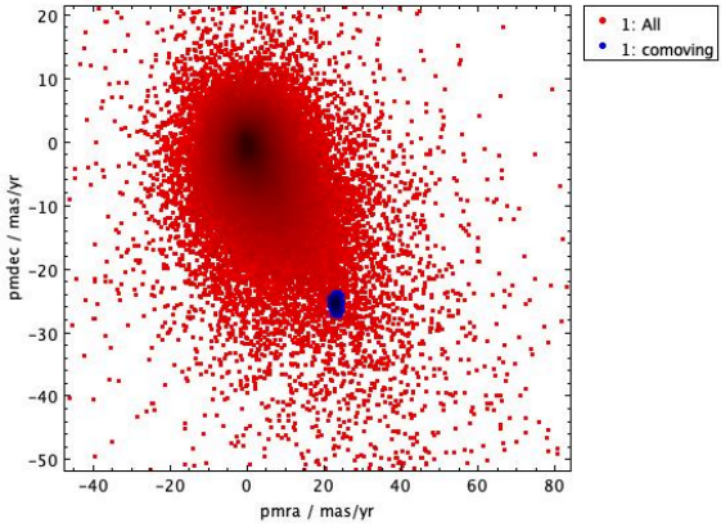


Figure 4: A plane plot to show proper motion in right ascension versus proper motion in declination, focused on the co-moving section of the cluster.. *Created 01/11/2024.*

ii.

A histogram of the parallax (parallax/mas) of the Alpha Perei cluster:

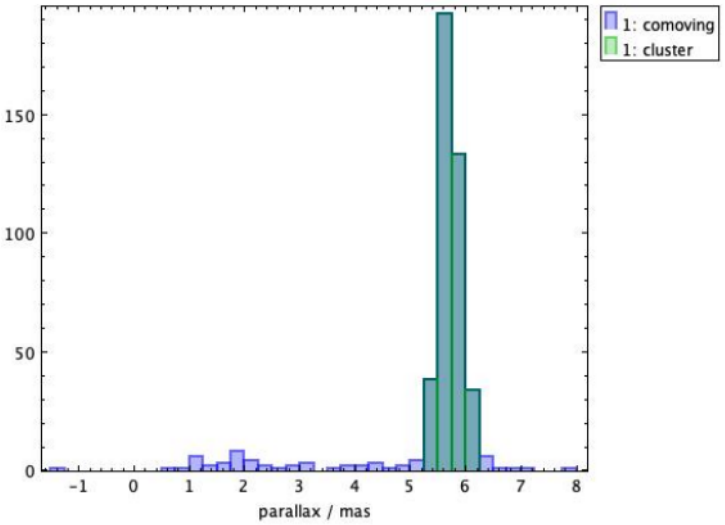


Figure 5: A histogram of the parallax of the cluster. *Created 01/11/2024.*

A histogram of the parallax (parallax/mas) of the co-moving section, ie within the range $5.25 <$ parallax/mas < 6.25 of the Alpha Perei cluster:

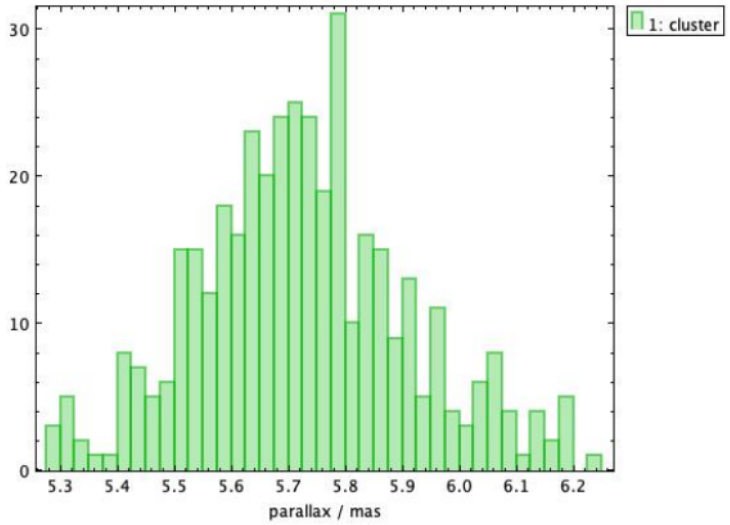


Figure 6: A histogram of the parallax of just the co-moving cluster. *Created 01/11/2024.*

iii.

A plane plot of the CMD, this is the 'blue-minus-red' (phot_g_mean_mag/mag) colour of each star versus the 'green' magnitude (bp_rp/mag), With the Y-axis flipped so that the magnitudes values increase downwards.

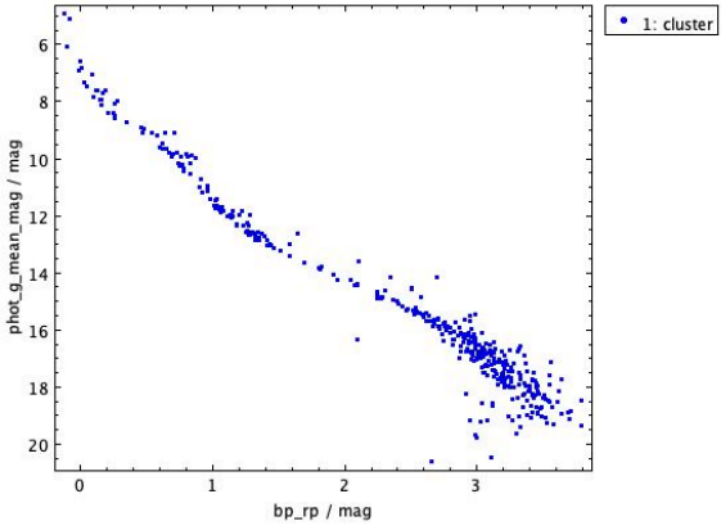


Figure 7:
A plane plot of the bp_rp versus phot_g_mean_ma
Created 01/11/2024.

b)

The mean parallax for this cluster in Alpha Persie is

$$5.724\,59\,\text{mas} = 5.724\,79 \times 10^{-3}\text{arcsec}$$

with a standard deviation of

$$\pm 0.085\,625\,\text{mas} = 8.5625 \times 10^{-5}\text{arcsec}$$

Using equation 3.1

$$d1/\text{pc} = \frac{1}{\varpi\text{arcsec}} \qquad \text{(eqn 3.1)}$$

$$d1/\text{pc} = \frac{1}{\varpi\ 1/''}$$

Substituting our values

$$= \frac{1}{5.724\,79 \times 10^{-3\,''}}$$

$$= 174.678\ldots\,\text{pc}$$

$$= 174.7\text{pc}$$

to 1 d.p

Using equation 3.2:

$$\Delta d = \frac{\Delta\varpi}{\varpi^2} \qquad \text{(eqn 3.2)}$$

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