Could Planet 9 be a Dwarf Star?

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Abstract

A review of star distances determined by parallax measurements reveals a number of disturbing discrepancies which raises questions about their accuracy. This article discusses these discrepancies and their effect on the distance to stars. The continued presence of large negative parallaxes is discussed, and a possible explanation provided. Using spectrographic parallax for stars currently considered red giants provides astonishing results. Such stars may in fact be dwarf stars just a few light-weeks away, instead of the current estimates of hundreds of light years. The results of several independent studies is provided which show strong evidence that stars previously considered distant red giants are actually red dwarfs within just a few light years away. It is possible that the mysterious Planet 9 could be a nearby dwarf star.

Introduction

This article explores the measurement of star distances by parallax and is divided into three sections:

- ✓ **Section I – Indirect evaluation of the results of parallax measurements which raises serious questions about the accuracy of the parallax system to measure star distances.**
- ✓ **Section II – The pervasive problem of negative parallaxes which appear in all parallax studies. A possible explanation is provided.**
- ✓ **Section III –Independent studies which provide strong evidence that numerous stars previously considered distant red giants are actually much nearer than previously thought, and considerably closer than 5 light years—in some cases less than one light year away.**

Section I – Problems with Parallax Measurement Results

The Magnitude System

Each star observed from the earth has a characteristic brightness related to the amount of light it radiates and its distance. The luminosity of stars is measured in various ways and is classified according to a relative magnitude system.

The apparent magnitude (m) of a star is the observed brightness as measured from photographic plates, by electronic means, or estimated visually by comparison with other stars.

The apparent magnitude of stars is a useful tool for cataloging and referencing stars, but by itself is of limited value. Brightness as observed from earth provides only part of the information needed to understand a star. Without more information it is impossible to tell if a star is very dim and very close, or very bright and very far away. If two stars appear to be equally bright, it is impossible to tell from their observed radiance alone if they are indeed equally brilliant, or at different brightnesses but at different distances. So a more valuable classification method would eliminate the effect of distance and allow direct comparison.

A variation of the apparent magnitude system is used to classify the relative brightness of stars. This classification is absolute magnitude (M). The absolute magnitude of a star is the *apparent* magnitude it would appear to have if it were brought to a standard distance from the earth. This standard distance is 32.6 light years, or 10 parsecs (parallax second). For example, if the sun were 10 parsecs away it would appear to the naked eye to be a fairly dim star with an apparent magnitude of 4.7, and therefore the

absolute magnitude of the sun is M = 4.7. The virtue of this system is that it eliminates the distance factor and can be used for comparison of the actual luminosity of a star with any other star whose absolute magnitude is known.

The inverse square law provides the relationship between apparent magnitude (m), absolute magnitude (M) and distance (D) measured in parsecs as follows:

$$(m - M) = 5 \log D - 5$$

The expression (m – M) is called the distance modulus. If any two variables are known, the third can be determined from the equation. In practice the apparent magnitude can be determined easily from photographs and has been measured accurately for over a million stars. Distance can be determined to calculate the absolute magnitude for any star, or absolute magnitude can be determined to find the distance.

Determining Star Distances - The Surveyor's Method

Surveyors use a simple method of measuring angles to determine the distance to a point too far away for direct measurement. In this technique, a baseline whose length (d) is accurately known is established. Angular measurements to the object are made and simple equations can then be used to determine the distance (D) to the distant object.

A similar approach forms the basis for the methods used by astronomers to measure the distance to some of the closer stars. Because stars are so far away, the simple procedure used by surveyors must be modified for use in measuring their distances. Instead of measuring two angles, astronomers have found it easier to measure an angle called the parallel angle or the angle from the star to the earth. If this angle is given in seconds of arc, then the distance in light years is simply 3.26 divided by the parallax. To simplify matters even further, distances are often quoted in parsecs, where:

$$\text{Distance in parsecs} = 1/(\text{parallax in arc seconds})$$

Measurement of Parallax

The principle of parallax measurement is simple in concept. If a nearby star is observed against a background of very distant stars, and photographs are taken from two different points separated by a known distance (a baseline), the position of the nearby star will appear to shift in relation to the background stars. This shift can be used to determine the parallax angle.

The longest baseline available is the earth's orbit around the sun. To take advantage of this baseline, nearby stars are observed at six month intervals. In this time the earth has moved completely around the sun, giving a baseline of 186 million miles. In spite of this long baseline, the parallax angle of even the nearest stars is so small that repeated searches by astronomers of the 18th century were unsuccessful. It was not until 1838 that the first parallax of a star was measured—0.31 arc seconds for the star Cygni 61, giving an estimated distance of 62 trillion miles—the distance traveled by a ray of light in ten and a half years. Although parallax measurements have now been made for millions of stars, the largest parallax measured for any star is 0.77 arc seconds: thus the distance to the closest star Proxima Centuri is estimated to be 4.3 light years. Since an angle this small is below the threshold of resolution of early astronomers, it is not surprising that their efforts to observe parallax were futile.

Satellite Measurement of Parallax

ESA's Hipparcos space astrometry mission was a pioneering European project which pinpointed the positions of more than one hundred thousand stars with high precision, and more than one million stars with lesser precision. Launched in August 1989, Hipparcos successfully observed the celestial sphere for 3.5 years before operations ceased in March 1993. Calculations from observations by the main instrument generated the Hipparcos Catalogue of 118,218 stars charted with the highest precision. An auxiliary star mapper pinpointed many more stars with lesser but still unprecedented accuracy, in the Tycho Catalogue of 1,058,332 stars.

Some of Hipparcos results raise some serious concerns. The following figure illustrates one concern:

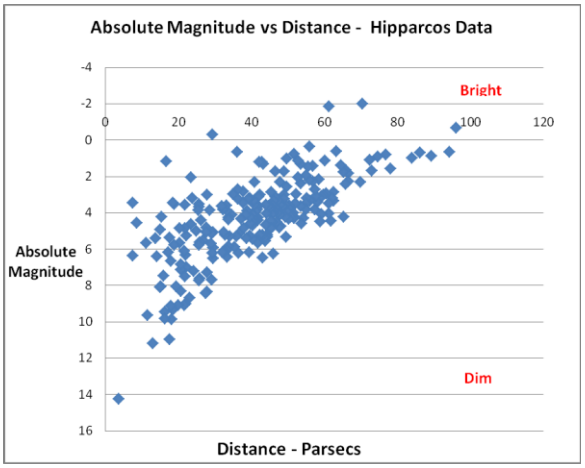


Figure 1 - Absolute Magnitude versus Distance. This chart, using data from the Hipparcos satellite, suggests that stars are intrinsically brighter the further away they are. That doesn't make sense.

The data from the Hipparcos catalog and other catalogues provide a strong correlation between star intrinsic brightness (absolute magnitude M) and distance. Since M is a normalized brightness, there should be no correlation with distance. The result can be explained if the distance to these stars is overestimated.

A second concern is in the estimated space velocity of distant stars, as illustrated below:

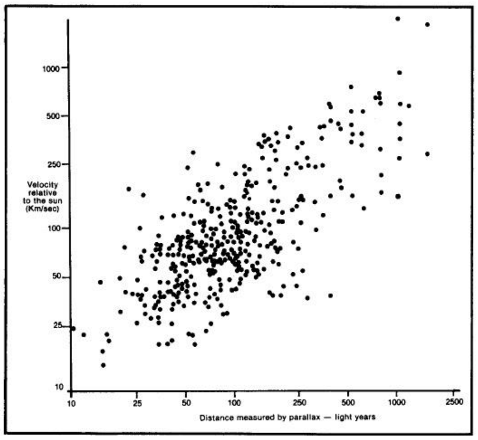
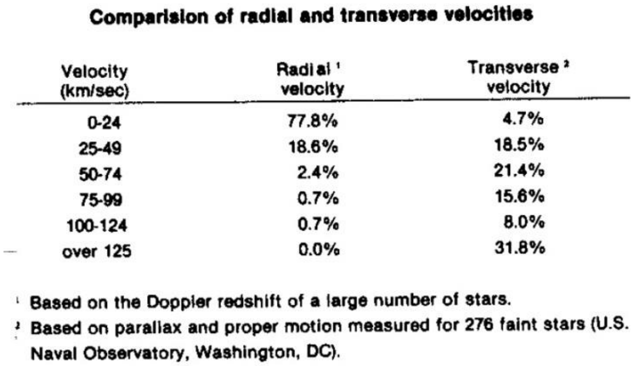


Figure 2 - Space velocity of stars versus distance from parallax measurements. From Sky Catalog 2000

Again this result raises serious questions. It seems to show that stars move faster the further away they are from the Sun. The result can also be explained if the distance measured by parallax is overestimated.

In another very detailed study by the U.S. Naval observatory of 276 stars with large proper motion, the following result was found:



Comparision of radial and transverse velocities

Velocity (km/sec)	Radial [1] velocity	Transverse [2] velocity
0-24	77.8%	4.7%
25-49	18.6%	18.5%
50-74	2.4%	21.4%
75-99	0.7%	15.6%
100-124	0.7%	8.0%
over 125	0.0%	31.8%

[1] Based on the Doppler redshift of a large number of stars.

[2] Based on parallax and proper motion measured for 276 faint stars (U.S. Naval Observatory, Washington, DC).

Figure 3 - Comparison of radial velocity and transverse velocity for a large sample of stars with large proper motion.

Radial velocity of stars (toward or away from the Sun) rarely exceed 50 km/sec, while measured transverse velocity is very much higher. Again the suggestion is that the distance to these stars measured by parallax was overestimated.

These rather startling results, largely ignored, should raise significant concerns about the validity of current distance measurements to the stars by parallax. They strongly suggest that star distance by parallax are significantly overstated, and that perhaps stars are nearer than previously believed. In the following section we will pursue these results in more detail.

Section II - Negative Parallax

All parallax work experiences something called negative parallax. The parallax angle measured to a star is negative (or zero). In terms of measuring distance to a star this is meaningless. It suggests that the star follows the earth as it revolves around the Sun. It is usually attributed to errors, although the data taken is of the greatest precision. In the Naval Observatory parallax measurement study, 7% of the measurements were negative, suggesting great distance for the stars, although the star selection was exclusively for stars with large proper motion, and the greatest care was taken in the measurements. It is difficult to attribute such a large number of negative values to error.

The Hipparcos program provides a provocative insight into negative parallax. The satellite contained two experiments—the Hipparcos measurement of 118,218 stars with high precision, and the Tycho experiment which measured over a million parallaxes. Over half of the Tycho measurements were negative or zero, while very few of the Hipparcos measurements were negative. The discrepancy can be easily explained. The Hipparcos data was extensively "deconvoluted" (Lindegren, L.), or essentially data manipulated until the negative results were converted to positive results through statistical tricks. It is difficult to attribute such a large number of negative parallaxes in the Tycho data to measurement error, given the great attention to accuracy. I suggest that negative parallax is the result of gravitational deflection of reference stars by the gravitational field of the target star. The following section will discuss this in more detail.

Gravitation Effects on Parallax Measurements

Einstein established that light could be deflected by the gravitational field of a massive object, and this has been verified many times. It is reasonable, therefore, to consider gravitational deflection effects on parallax measurements. There have been a few attempts to attribute micro-lensing as a potential cause, but the rare occurrence of such events seem to be insufficient as a cause.

Let us investigate Einstein's equation for the deflection of light by the sun. To illustrate, let's select a target dwarf star with a diameter 1/13 of the sun, with a mass of 20 times the sun. Using Einstein's equation for the deflection of light grazing the surface provides a deflection angle of 455 arc seconds, or 0.13 degrees! Even a light ray passing a thousand radii away would experience a deflection of 0.45". This is enough to distort the apparent position of distant reference stars. This demonstrates that the effect of gravitational bending of light from distant reference stars should not be ignored in many cases.

But I have long contended that light is deflected much more than predicted by Einstein's simple formula. The reason, recently discovered, is that Einstein made a mistake. His formula is based on the knowledge that light loses velocity within a gravitational field, and he assumed that it would lose velocity linearly with distance (1/R). But more recent experiments by Irwin Shapiro (the Shapiro effect) show that light loses velocity logarithmically, or (1/ln(r)). Modifying Einstein's equation to reflect this provides a much larger deflection than previously thought. For more details, see my website www.deceptiveuniverse.com/deflection-correction.htm. The following figure illustrates how light deflection by gravity can cause negative parallax:

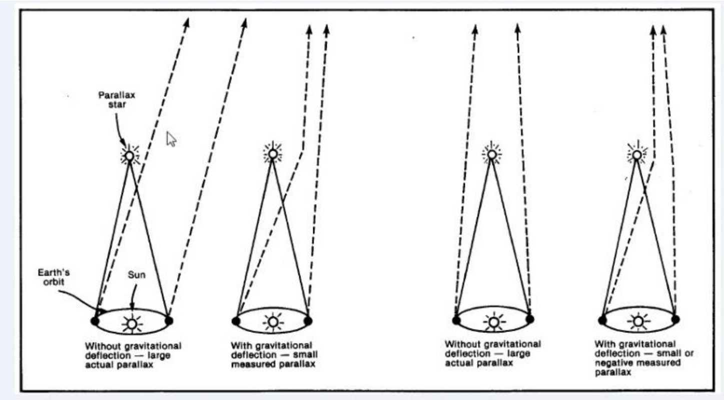


Figure 4 - Illustrating how large deflection of light from reference stars can cause inaccurate parallax measurements.

I submit that gravity deflects light more than previously thought and that is the cause of negative parallax. A negative parallax may actually indicate the target star is very nearby.

This suggestion is, of course, very controversial. However, it was not derived as a whim. In my book *The Deceptive Universe*, published in 1982 I provide numerous examples of scenes in the heavens that appear to suggest large deflection of light by gravity. On my website www.deceptiveuniverse.com/Double-Stars-and-Gravity.htm I provide significant evidence that gravity's effects are larger than previously believed.

If the gravitation deflection theory is the actual cause of negative parallax, then it may be possible to prove it. In normal parallax work, the minute movement of a target star relative to reference stars which are nearest the target star are used to measure parallax, which would exacerbate the effect of gravity. If instead reference stars at some distance from the target star were used, the effect of gravity deflection would be lessened and perhaps provide a better parallax. If the data available from Hipparcos or Tycho is available to redo the parallaxes with different reference stars, the result might be very interesting.

Section III – Experimental and Analytical Proof That Stars are Nearer than Expected

Moving Beyond Parallax – Spectrographic Analysis

Now we have dug ourselves into a hole—a very deep hole. Since parallax is the bottom rung of a large series of steps in determining distances in the universe (including the Hubble Law), if we can't depend on distances determined by parallax, what can we do? Fortunately there is an alternative—spectrographic parallax.

Astronomers study the light from stars and galaxies in different frequencies, such a blue, red, violet, yellow, and in the visible spectrum. By comparing the brightness of a star in each of these colors, a great deal of information about the star can be gleaned, including temperature, allowing each star to be categorized according to type. And surprisingly, *some of this information can be used to determine a star's distance*. The results of studying star colors is summarized in a single diagram called the Hertzsprung-Russell diagram (H/R diagram).

I am not going to go into details about the color index and H/R diagram here, as a simple internet search will provide full information the subject. However I will point out that the H/R diagram, much used by astronomers, is based on stellar distances developed from parallax measurements, and thus may be completely useless and incorrect. There is one color index, however, that is extremely useful. It is the (B – V) index, or the difference in intensity between the blue and visible spectrum. It is used for what is called *Spectrographic Parallax*.

The (B – V) Color Index

Simply put, the B – V index can be used to determine a star's absolute magnitude, and this along with its apparent magnitude, allows the distance to be determined by the formula given below. Although the

process is somewhat more complicated than we will give here, the basics are the same. The following figure shows the relationship between the B - V index and absolute magnitude for the nearest stars.

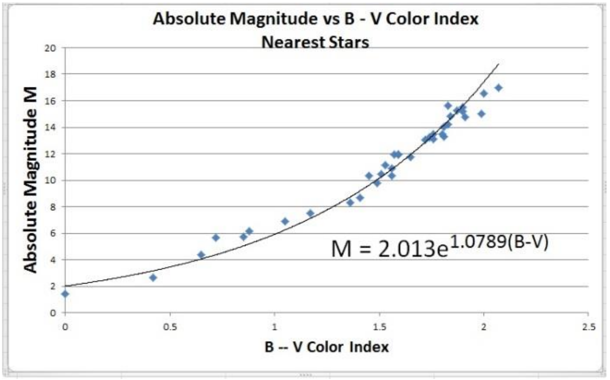
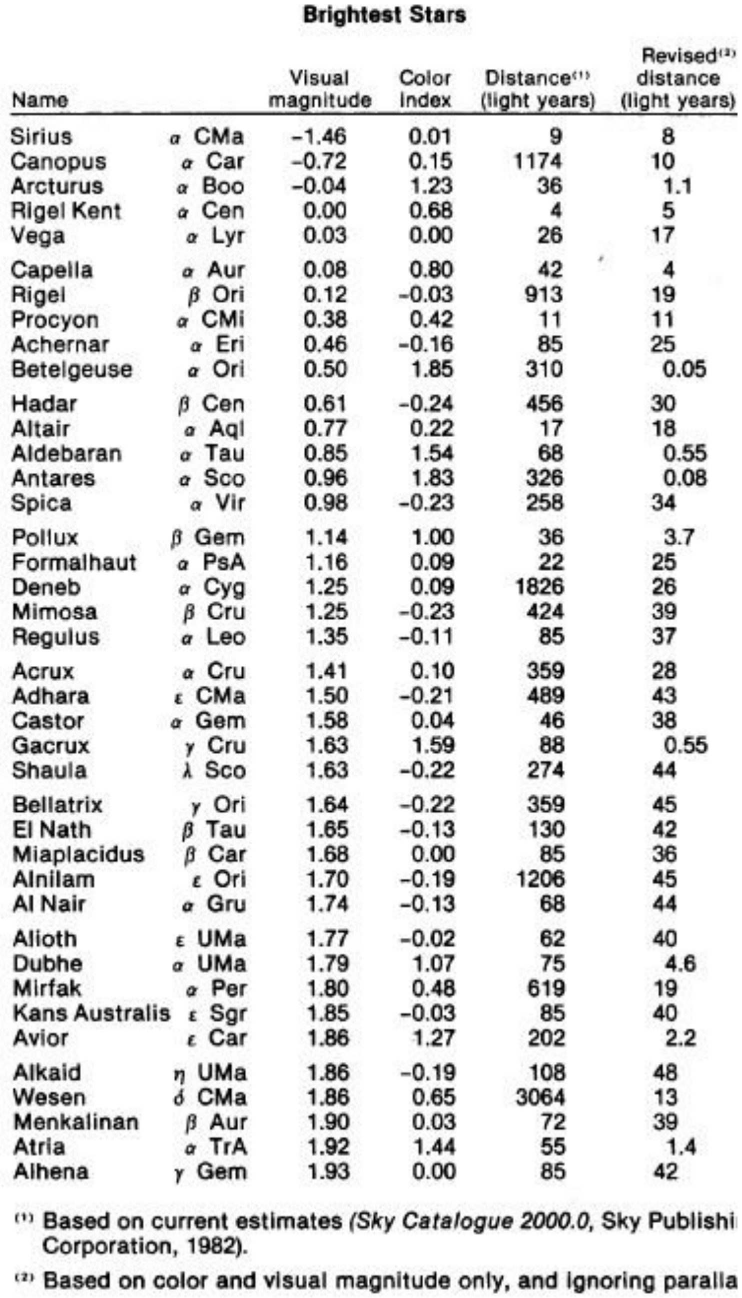


Figure 5 - Absolute Magnitude M versus B - V color index.

From this figure it is easy to determine absolute magnitude (M) for a star who's B – V index is known (nearly all stars). Then using the apparent magnitude (m) of the star and the following equation, the distance (D) can be determined. ***And no parallax is used!***

$$(m - M) = 5 \log D - 5$$

The following tables reflect the result of using the B – V color index instead of parallax to compute the distance to some well-known stars. Note that these tables were taken from my book ***The Deceptive Universe*****, published in 1982, and may be a little dated, since they used a slightly older version of this chart, but they illustrate the result**



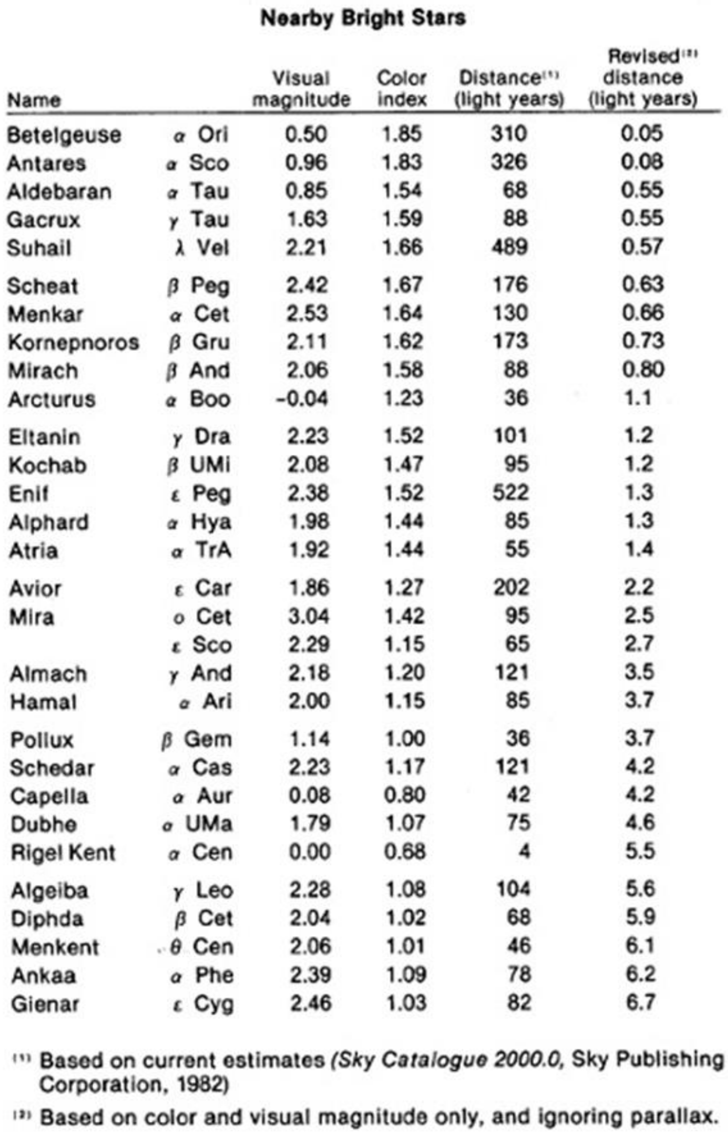
Brightest Stars

Name		Visual magnitude	Color Index	Distance(1) (light years)	Revised(2) distance (light years)
Sirius	α CMa	−1.46	0.01	9	8
Canopus	α Car	−0.72	0.15	1174	10
Arcturus	α Boo	−0.04	1.23	36	1.1
Rigel Kent	α Cen	0.00	0.68	4	5
Vega	α Lyr	0.03	0.00	26	17
Capella	α Aur	0.08	0.80	42	4
Rigel	β Ori	0.12	−0.03	913	19
Procyon	α CMi	0.38	0.42	11	11
Achernar	α Eri	0.46	−0.16	85	25
Betelgeuse	α Ori	0.50	1.85	310	0.05
Hadar	β Cen	0.61	−0.24	456	30
Altair	α Aql	0.77	0.22	17	18
Aldebaran	α Tau	0.85	1.54	68	0.55
Antares	α Sco	0.96	1.83	326	0.08
Spica	α Vir	0.98	−0.23	258	34
Pollux	β Gem	1.14	1.00	36	3.7
Formalhaut	α PsA	1.16	0.09	22	25
Deneb	α Cyg	1.25	0.09	1826	26
Mimosa	β Cru	1.25	−0.23	424	39
Regulus	α Leo	1.35	−0.11	85	37
Acrux	α Cru	1.41	0.10	359	28
Adhara	ε CMa	1.50	−0.21	489	43
Castor	α Gem	1.58	0.04	46	38
Gacrux	γ Cru	1.63	1.59	88	0.55
Shaula	λ Sco	1.63	−0.22	274	44
Bellatrix	γ Ori	1.64	−0.22	359	45
El Nath	β Tau	1.65	−0.13	130	42
Miaplacidus	β Car	1.68	0.00	85	36
Alnilam	ε Ori	1.70	−0.19	1206	45
Al Nair	α Gru	1.74	−0.13	68	44
Alioth	ε UMa	1.77	−0.02	62	40
Dubhe	α UMa	1.79	1.07	75	4.6
Mirfak	α Per	1.80	0.48	619	19
Kans Australis	ε Sgr	1.85	−0.03	85	40
Avior	ε Car	1.86	1.27	202	2.2
Alkaid	η UMa	1.86	−0.19	108	48
Wesen	δ CMa	1.86	0.65	3064	13
Menkalinan	β Aur	1.90	0.03	72	39
Atria	α TrA	1.92	1.44	55	1.4
Alhena	γ Gem	1.93	0.00	85	42

(1) Based on current estimates (*Sky Catalogue 2000.0*, Sky Publishi Corporation, 1982).

(2) Based on color and visual magnitude only, and ignoring paralla

Figure 6 - Revised distances to various stars based on the B - V spectrographic parallax.



Nearby Bright Stars

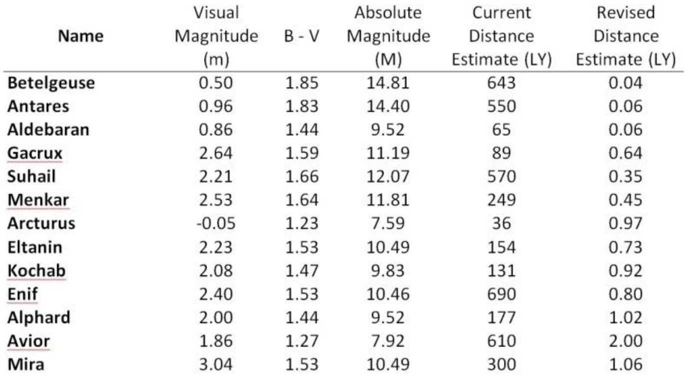
Name		Visual magnitude	Color index	Distance(1) (light years)	Revised(2) distance (light years)
Betelgeuse	α Ori	0.50	1.85	310	0.05
Antares	α Sco	0.96	1.83	326	0.08
Aldebaran	α Tau	0.85	1.54	68	0.55
Gacrux	γ Tau	1.63	1.59	88	0.55
Suhail	λ Vel	2.21	1.66	489	0.57
Scheat	β Peg	2.42	1.67	176	0.63
Menkar	α Cet	2.53	1.64	130	0.66
Kornepnoros	β Gru	2.11	1.62	173	0.73
Mirach	β And	2.06	1.58	88	0.80
Arcturus	α Boo	-0.04	1.23	36	1.1
Eltanin	γ Dra	2.23	1.52	101	1.2
Kochab	β UMi	2.08	1.47	95	1.2
Enif	ε Peg	2.38	1.52	522	1.3
Alphard	α Hya	1.98	1.44	85	1.3
Atria	α TrA	1.92	1.44	55	1.4
Avior	ε Car	1.86	1.27	202	2.2
Mira	o Cet	3.04	1.42	95	2.5
	ε Sco	2.29	1.15	65	2.7
Almach	γ And	2.18	1.20	121	3.5
Hamal	α Ari	2.00	1.15	85	3.7
Pollux	β Gem	1.14	1.00	36	3.7
Schedar	α Cas	2.23	1.17	121	4.2
Capella	α Aur	0.08	0.80	42	4.2
Dubhe	α UMa	1.79	1.07	75	4.6
Rigel Kent	α Cen	0.00	0.68	4	5.5
Algeiba	γ Leo	2.28	1.08	104	5.6
Diphda	β Cet	2.04	1.02	68	5.9
Menkent	θ Cen	2.06	1.01	46	6.1
Ankaa	α Phe	2.39	1.09	78	6.2
Gienar	ε Cyg	2.46	1.03	82	6.7

(1) Based on current estimates *(Sky Catalogue 2000.0,* Sky Publishing Corporation, 1982)

(2) Based on color and visual magnitude only, and ignoring parallax.

Figure 7 - Revised distances to nearby stars, based on spectrographic parallax and the B - V color index.

To cross-check these results with more modern Hipparcos data, I repeated the analysis using the formula in figure 5 and the most current values for visual magnitude and B - V, with the following results:



Name	Visual Magnitude (m)	B - V	Absolute Magnitude (M)	Current Distance Estimate (LY)	Revised Distance Estimate (LY)
Betelgeuse	0.50	1.85	14.81	643	0.04
Antares	0.96	1.83	14.40	550	0.06
Aldebaran	0.86	1.44	9.52	65	0.06
Gacrux	2.64	1.59	11.19	89	0.64
Suhail	2.21	1.66	12.07	570	0.35
Menkar	2.53	1.64	11.81	249	0.45
Arcturus	-0.05	1.23	7.59	36	0.97
Eltanin	2.23	1.53	10.49	154	0.73
Kochab	2.08	1.47	9.83	131	0.92
Enif	2.40	1.53	10.46	690	0.80
Alphard	2.00	1.44	9.52	177	1.02
Avior	1.86	1.27	7.92	610	2.00
Mira	3.04	1.53	10.49	300	1.06

Figure 8 - Repeating my B - V analysis with the most current values. The results substantiate my 1982 analysis.

But does this make sense? Are we to completely ignore parallax in favor of spectral parallax? Probably not. It is more complicated than that. The following chart illustrates the correlation between spectral parallax and regular parallax for a large sample of stars. It can be seen that for the majority of stars, the two techniques correlate fairly well. However there are a large number of stars for which large differences

between these two distance-measurement techniques are found. These are shown in the upper left quadrant of the chart. For the most part these are stars classified as giants. The author of the chart suggests the disparity is due to errors on determining spectral signatures. I suggest it is due to errors in parallax measurements.

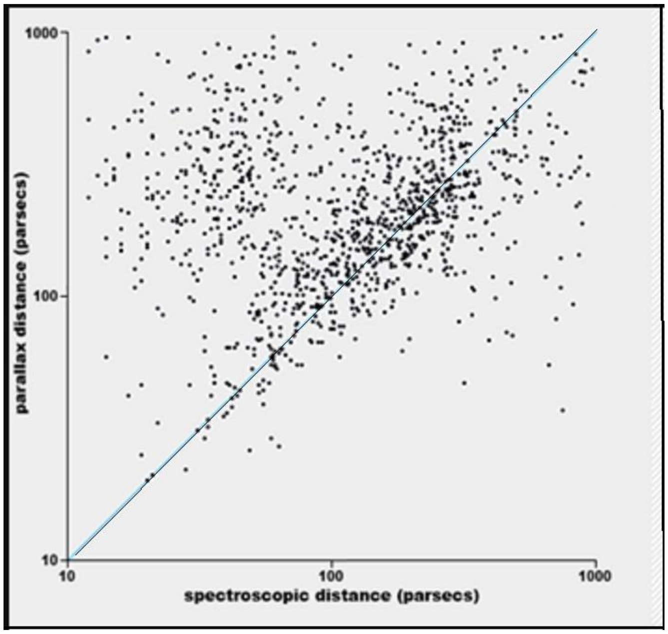


Figure 9 = Parallax distance versus Spectroscopic distance. The stars in the upper left quadrant are currently thought to be red giants. Figure by Bruce MacEvoy

From this we can see that by using some intelligent combination of ordinary and spectroscopic parallax measurements, a better understanding of stellar distances can be obtained.

A Different Look at Star Distances!

By ignoring parallax we see an entirely new view of the space surrounding us! Who would have guessed that Betelgeuse was our closest neighbor, just a fraction of a light year away? Who would have guessed how many stars are so close, when parallax measurements put them so far away? While you may have disagreed with some of my conclusions about the problems with parallax, it is hard to dispute that when you ignore parallax altogether, you get some amazing, and hard to disregard, results..

Apparently our nearest companion is the star Betelgeuse, which has been considered a giant star, but may be simply an ordinary dwarf star but very nearby.

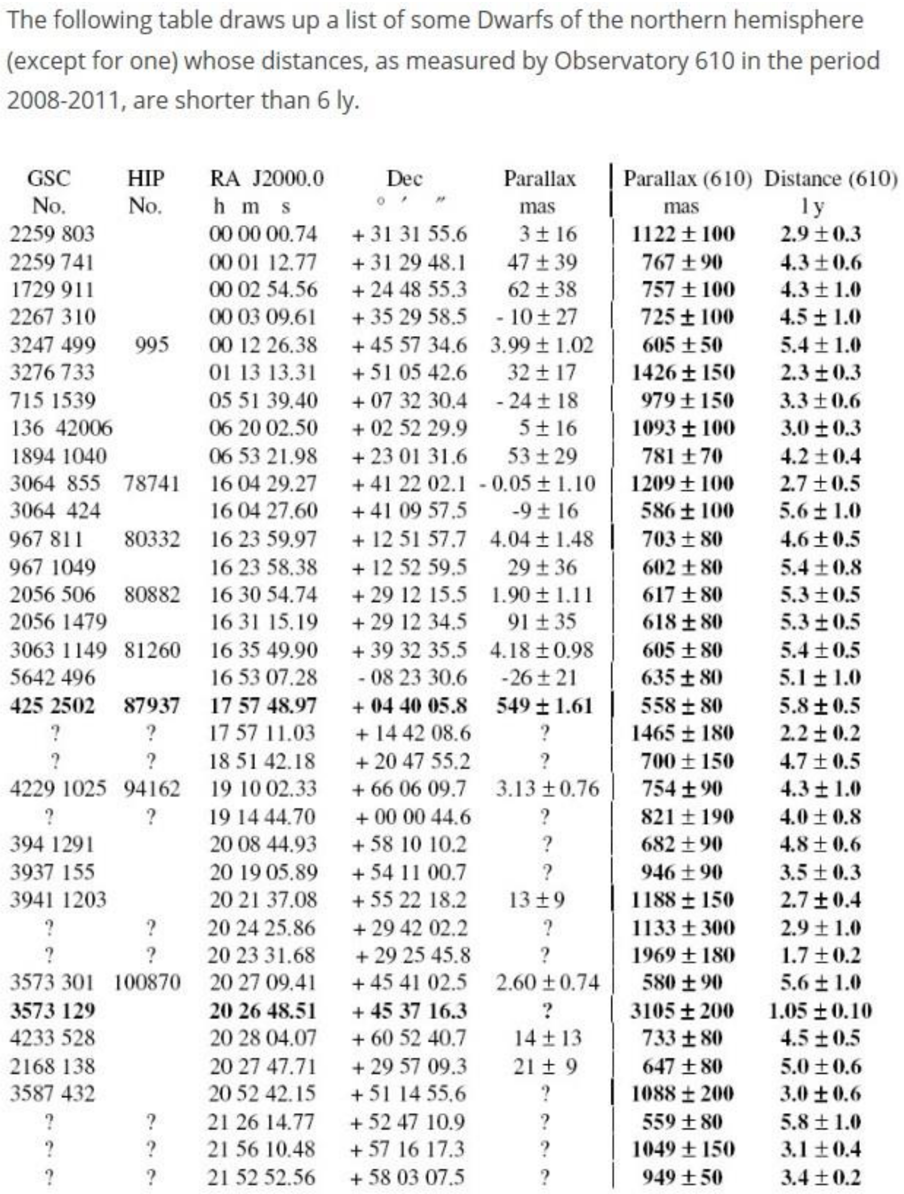
Betelgeuse

Betelgeuse is the only star whose diameter has been measured and studied by speckle interferometry to get a picture of its surface. At its currently estimated distance of 540 light years, it is clearly categorized as a giant, with a mass about twenty times that of the sun. The revised distance by color index is about 0.05 light years, *or only 250 times the distance from the sun as the planet Saturn!* Using this distance and the measured diameter of 0.45 seconds of arc, the diameter of Betelgeuse can be estimated to be about 70,000 miles, or about 1/13 that of the sun. Betelgeuse has a color index of 1.85, which would classify it as a normal red dwarf. It also has been found to emit radio energy, much as does the sun, and one of the few stars to do so.

Another interesting fact about Betelgeuse is that its diameter has been seen to decrease by 15% since 1993. Astronomers have been puzzled by this, but it is easily explained if Betelgeuse is nearby and moving away from us. In fact, it has a measured radial velocity of 21 Km/sec away from the sun. This velocity is sufficient to explain the gradual movement of Betelgeuse away from the sun, and its measured decrease in diameter since 1993.

Parallax Measurements by Vittorio Goretti

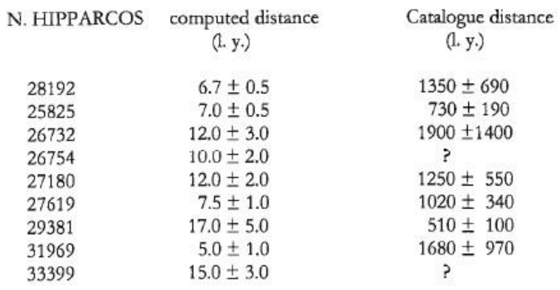
Vittorio Goretti is an Italian astronomer and astrometry expert who has used the Observatory 610 - Pianoro – Italy extensively to perform parallax studies of red giant stars (see references). Using data taken over the period 2008 to 2011 he was able to obtain parallax measurements for a large group of stars. The distances determined for these stars by his analysis differ significantly from previous distance measurements. The following two figures illustrate the results of his studies:



The following table draws up a list of some Dwarfs of the northern hemisphere (except for one) whose distances, as measured by Observatory 610 in the period 2008-2011, are shorter than 6 ly.

GSC No.	HIP No.	RA J2000.0 h m s	Dec ° ′ ″	Parallax mas	Parallax (610) mas	Distance (610) l y
2259 803		00 00 00.74	+ 31 31 55.6	3 ± 16	**1122 ± 100**	**2.9 ± 0.3**
2259 741		00 01 12.77	+ 31 29 48.1	47 ± 39	**767 ± 90**	**4.3 ± 0.6**
1729 911		00 02 54.56	+ 24 48 55.3	62 ± 38	**757 ± 100**	**4.3 ± 1.0**
2267 310		00 03 09.61	+ 35 29 58.5	- 10 ± 27	**725 ± 100**	**4.5 ± 1.0**
3247 499	995	00 12 26.38	+ 45 57 34.6	3.99 ± 1.02	**605 ± 50**	**5.4 ± 1.0**
3276 733		01 13 13.31	+ 51 05 42.6	32 ± 17	**1426 ± 150**	**2.3 ± 0.3**
715 1539		05 51 39.40	+ 07 32 30.4	- 24 ± 18	**979 ± 150**	**3.3 ± 0.6**
136 42006		06 20 02.50	+ 02 52 29.9	5 ± 16	**1093 ± 100**	**3.0 ± 0.3**
1894 1040		06 53 21.98	+ 23 01 31.6	53 ± 29	**781 ± 70**	**4.2 ± 0.4**
3064 855	78741	16 04 29.27	+ 41 22 02.1	- 0.05 ± 1.10	**1209 ± 100**	**2.7 ± 0.5**
3064 424		16 04 27.60	+ 41 09 57.5	-9 ± 16	**586 ± 100**	**5.6 ± 1.0**
967 811	80332	16 23 59.97	+ 12 51 57.7	4.04 ± 1.48	**703 ± 80**	**4.6 ± 0.5**
967 1049		16 23 58.38	+ 12 52 59.5	29 ± 36	**602 ± 80**	**5.4 ± 0.8**
2056 506	80882	16 30 54.74	+ 29 12 15.5	1.90 ± 1.11	**617 ± 80**	**5.3 ± 0.5**
2056 1479		16 31 15.19	+ 29 12 34.5	91 ± 35	**618 ± 80**	**5.3 ± 0.5**
3063 1149	81260	16 35 49.90	+ 39 32 35.5	4.18 ± 0.98	**605 ± 80**	**5.4 ± 0.5**
5642 496		16 53 07.28	- 08 23 30.6	-26 ± 21	**635 ± 80**	**5.1 ± 1.0**
425 2502	**87937**	**17 57 48.97**	**+ 04 40 05.8**	**549 ± 1.61**	**558 ± 80**	**5.8 ± 0.5**
?	?	17 57 11.03	+ 14 42 08.6	?	**1465 ± 180**	**2.2 ± 0.2**
?	?	18 51 42.18	+ 20 47 55.2	?	**700 ± 150**	**4.7 ± 0.5**
4229 1025	94162	19 10 02.33	+ 66 06 09.7	3.13 ± 0.76	**754 ± 90**	**4.3 ± 1.0**
?	?	19 14 44.70	+ 00 00 44.6	?	**821 ± 190**	**4.0 ± 0.8**
394 1291		20 08 44.93	+ 58 10 10.2	?	**682 ± 90**	**4.8 ± 0.6**
3937 155		20 19 05.89	+ 54 11 00.7	?	**946 ± 90**	**3.5 ± 0.3**
3941 1203		20 21 37.08	+ 55 22 18.2	13 ± 9	**1188 ± 150**	**2.7 ± 0.4**
?	?	20 24 25.86	+ 29 42 02.2	?	**1133 ± 300**	**2.9 ± 1.0**
?	?	20 23 31.68	+ 29 25 45.8	?	**1969 ± 180**	**1.7 ± 0.2**
3573 301	100870	20 27 09.41	+ 45 41 02.5	2.60 ± 0.74	**580 ± 90**	**5.6 ± 1.0**
3573 129		**20 26 48.51**	**+ 45 37 16.3**	**?**	**3105 ± 200**	**1.05 ± 0.10**
4233 528		20 28 04.07	+ 60 52 40.7	14 ± 13	**733 ± 80**	**4.5 ± 0.5**
2168 138		20 27 47.71	+ 29 57 09.3	21 ± 9	**647 ± 80**	**5.0 ± 0.6**
3587 432		20 52 42.15	+ 51 14 55.6	?	**1088 ± 200**	**3.0 ± 0.6**
?	?	21 26 14.77	+ 52 47 10.9	?	**559 ± 80**	**5.8 ± 1.0**
?	?	21 56 10.48	+ 57 16 17.3	?	**1049 ± 150**	**3.1 ± 0.4**
?	?	21 52 52.56	+ 58 03 07.5	?	**949 ± 50**	**3.4 ± 0.2**

Figure 10 - Revised distances to some Dwarf stars, based on parallax results by Vittorio Goretti



N. HIPPARCOS	computed distance (l. y.)	Catalogue distance (l. y.)
28192	6.7 ± 0.5	1350 ± 690
25825	7.0 ± 0.5	730 ± 190
26732	12.0 ± 3.0	1900 ±1400
26754	10.0 ± 2.0	?
27180	12.0 ± 2.0	1250 ± 550
27619	7.5 ± 1.0	1020 ± 340
29381	17.0 ± 5.0	510 ± 100
31969	5.0 ± 1.0	1680 ± 970
33399	15.0 ± 3.0	?

Figure 11 - Additional revised distances by Vittorio Goretti

Direct Measurement of Star Movement – Without Parallax

In a very important study, the actual movement of star images of 200 red giant stars was followed over three years. This study is the first direct measurement of the movement of the star images over a three year period, and does not involve parallax or color index. The following figure shows the measured shift in position of 200 Red Giant stars over the period studied. The author's comments on this figure, slightly edited, are:

> ***Plot of the first moment centroid positions in the x-axis only of ~200 red giant stars over 12 quarters. Their astrometric signatures have been normalized by their median value. The flattest of these curves have variations of ~100 mas. These curves do show some repeatability with common seasons suggesting pixel phase variations as a possible culprit. The vertical lines represent the different quarters.***

From:
http://keplerscience.arc.nasa.gov/K2/docs/WhitePapers/Tanner_Kepler_White_Paper.pdf

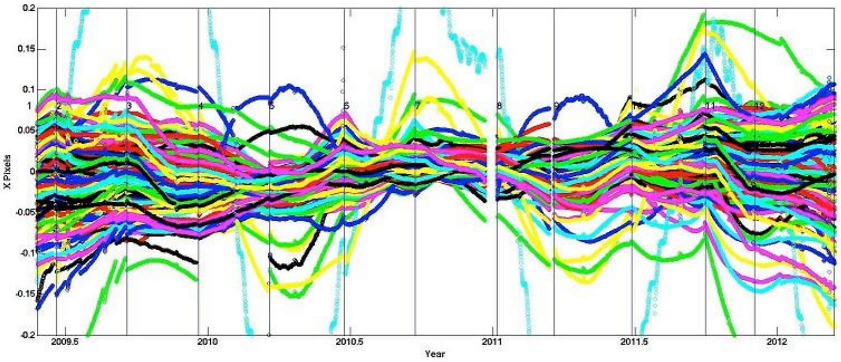


Figure 12 - Movement of the centroid of 200 red giant star images over a 3 year period. It is clear that the centroids move as the earth moves around the sun. This is parallax and it is very large, indicating that the stars are very nearby.

From http://keplerscience.arc.nasa.gov/K2/docs/WhitePapers/Tanner_Kepler_White_Paper.pdf

This figure, while it does not identify specific stars, is *very significant*. It shows that red giant stars, thought to be very distant, appear to have major annual changes. *This is parallax, and exactly what is expected for nearby stars.* With this evidence there can be no doubt that red giant stars are actually dwarf stars and quite nearby!

Summary

There is strong evidence that parallax measurements of stars systematically overestimates their distances. Some of the evidence includes:

- ✓ **There is a strong correlation between absolute magnitude and estimated distance which should not be. It suggests that stars are intrinsically brighter the further away they are which is unlikely.**
- ✓ **There is a wide discrepancy between radial velocity (toward or away from earth) and transverse velocity. Only 1.4% of stars in a US Navy study have a radial velocity greater than 74 km/sec while 55.4% have measured proper motion above this amount. This is clear evidence of a systematic overestimation of distance.**
- ✓ **The difference between parallax measurements and spectroscopic parallax measurements for red giant stars is quite large, and suggests that regular parallax measurements for this star type may be inaccurate.**
- ✓ **Determining distances for red giant stars by spectrographic analysis indicates that most of these stars are actually dwarf stars just a few light years away, with the nearest being the star Betelgeuse, only .04-.05 light years away.**
- ✓ **Parallax measurements of red giants by Goretti find that many of these stars are nearer than 5 light years.**
- ✓ **There is a very large annual variation in the measured centroid of red dwarf stars which is not present in parallax measurement. This is parallax measured without reference stars. It suggests very strongly that these objects are very nearby**

- ✓ **The star Betelgeuse, when considered as a nearby dwarf star, has all of the attributes which would be expected of a dwarf star**

The results of this analysis is that it is virtually certain that there are large numbers of dwarf stars within 5 light years of the sun and that parallax measurements are flawed.

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