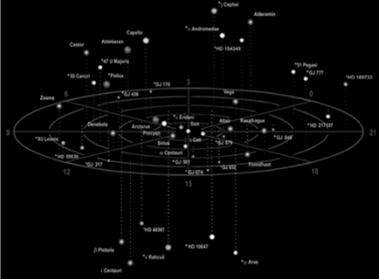


Lecture 32: The Solar Neighborhood

Lecture 32
Meet the Neighbors



Astronomy 141 – Winter 2012

This lecture describes the nearest stars to the Sun and beyond.

The closest star is Proxima Centauri, a red dwarf 4.24 light years away.

The nearest Sun-like star is α Centauri, 4.36 light years away, that is in a triple star system with Proxima Cen.

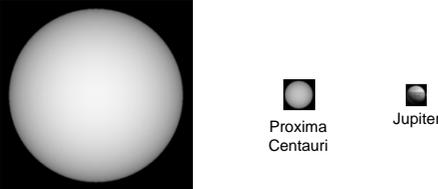
The Solar Neighborhood is the stars within about 15 light years of the Sun.

Most nearby stars are red dwarfs: cool M-type main sequence stars.

The Sun is part of the Milky Way Galaxy, a system of more than 200 Billion stars, made up of a disk and central bulge.

The closest star to the Sun is Proxima Centauri, a faint red dwarf located 4.24 light years away.

M5.5 main-sequence (“dwarf”) star
0.12 M_{sun}
0.15 R_{sun}
0.0017 L_{sun}
More than 100x fainter than the naked eye can see.



Proxima Centauri Jupiter

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If the Sun were a golf ball in Columbus, Proxima Centauri would be a 5mm pea in Salt Lake City

Distance is 4.24 ly
or 268,000 AU

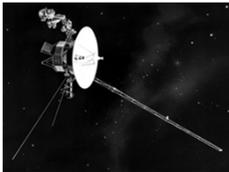
If the Sun were 4.27cm
in diameter...



Proxima Cen would be
~2500 km away



Even the fastest spacecraft to date, Voyager 1, would take millennia to reach Proxima Centauri.



Voyager 1 is now travelling at
61,400 km/h (38,200 mph).

As of Feb 2012 it is 120 AU away
(~18 Billion km)

Proxima is 4.024×10^{13} km away.

Would take 74,000 years to reach
Proxima Centauri.

*Space is very empty, and the stars are
very far apart.*

There are only 3 stars within 5 light years of the Sun: Proxima Centauri and α Centauri A & B.

α Centauri A
G2V Star
 $1.1 M_{\text{sun}}$
 $1.23 R_{\text{sun}}$
 $1.52 L_{\text{sun}}$



Sun
Proxima



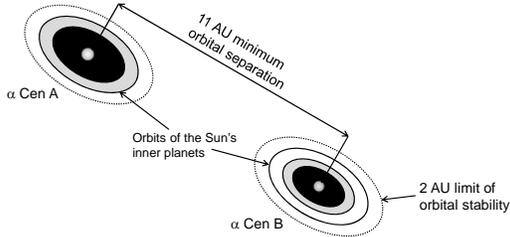
α Centauri B
K1V Star
 $0.91 M_{\text{sun}}$
 $0.86 R_{\text{sun}}$
 $0.5 L_{\text{sun}}$



A binary star system
located 4.37 light years away
Forms a triple star system with
Proxima Centauri

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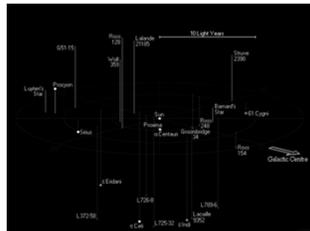
So far we do not know of any planets around either α Centauri A or B, but we're still looking.



The Habitable Zones for α Cen A and B are in regions of orbital stability.

The Solar Neighborhood is the collection of stars within ~15 light years of the Sun.

- 56 stars in 38 systems
- 24 single stars
- 10 binary systems
- 4 triple systems

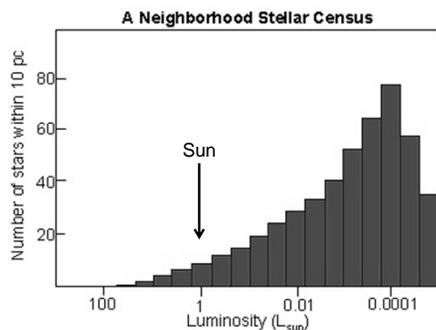


~1/2 of all stars come in multiples (doubles and triples)

Only about 4 stars per 1000 cubic light years.

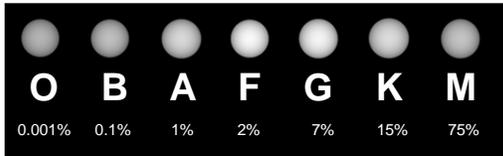
The average distance between stars is about 6 light years in the local solar neighborhood.

The distribution of stellar luminosities in the Solar Neighborhood is dominated by low-mass stars.



Lecture 32: The Solar Neighborhood

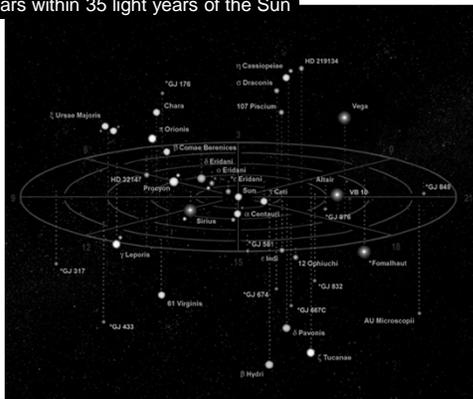
Most main-sequence stars are faint, cool M-type dwarfs (red dwarfs).



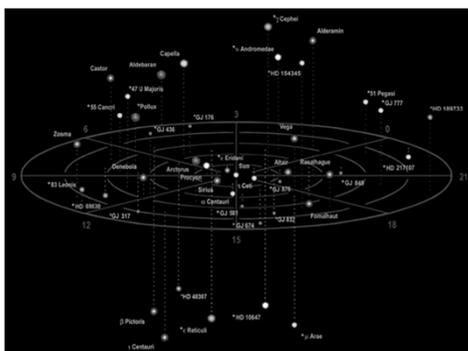
Stars like the Sun are relatively rare.

This means we must search out to greater distances to find planetary systems like our own.

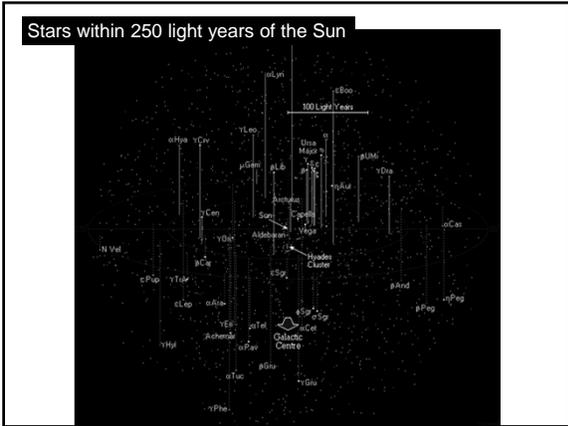
Stars within 35 light years of the Sun



Stars within 65 light years of the Sun



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The Milky Way is the diffuse band of light crossing the sky.

The name is derived from Greek and Latin:

Greek:
Galaxias kuklos = "Milky Band"

Latin:
Via Lactea = "Road of Milk"

The Milky Way is a rotating, flattened disk of stars with a central bulge.

~100,000 light years in diameter and ~1000 light years thick

The center and much of the disk is obscured by dust and gas in the plane of the Galaxy

The Sun is ~26,000 ly away from the center.

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The Galactic Bulge is a roughly spherical population of older stars around the center of the Milky Way.

Most bulge stars are older than those near the sun

~10 Gyr old (almost as old as the Universe!)

Much denser than the Solar Neighborhood:

~3 stars per cubic light year compared to 4 per 1000 cubic light year nearby.

The bulge is very populous – Tens of billions of stars



There are nearly 200 Billion Stars in the Milky Way, most of the M-type dwarfs.