



STARS

Radial Velocity





Radial Velocity

Overview

This lesson outlines the portions of stellar motions that are towards us or away from us in a direct line: Radial Velocities. This topic was previously introduced in the video lesson: Stellar Motions.



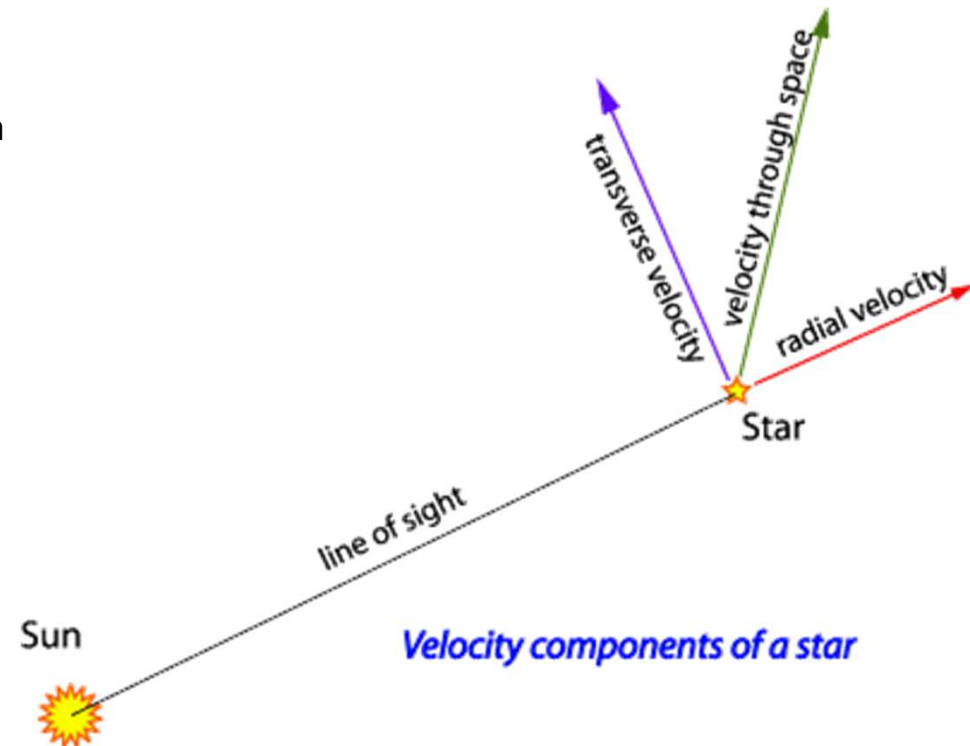
Radial Velocity

Review of Stellar Motion

Three velocity components need to be measured to specify a star's motion completely:

Radial velocity - Motion along the line-of-sight yielding fore and aft motion.

Transverse velocities (Proper Motion) in RA and DEC yielding right/left motion.





Radial Velocity

Doppler Shift: The Key to Radial Motion

Radial Velocities of stars, motions toward and away along our line of sight, are easier to measure than motions from side to side.

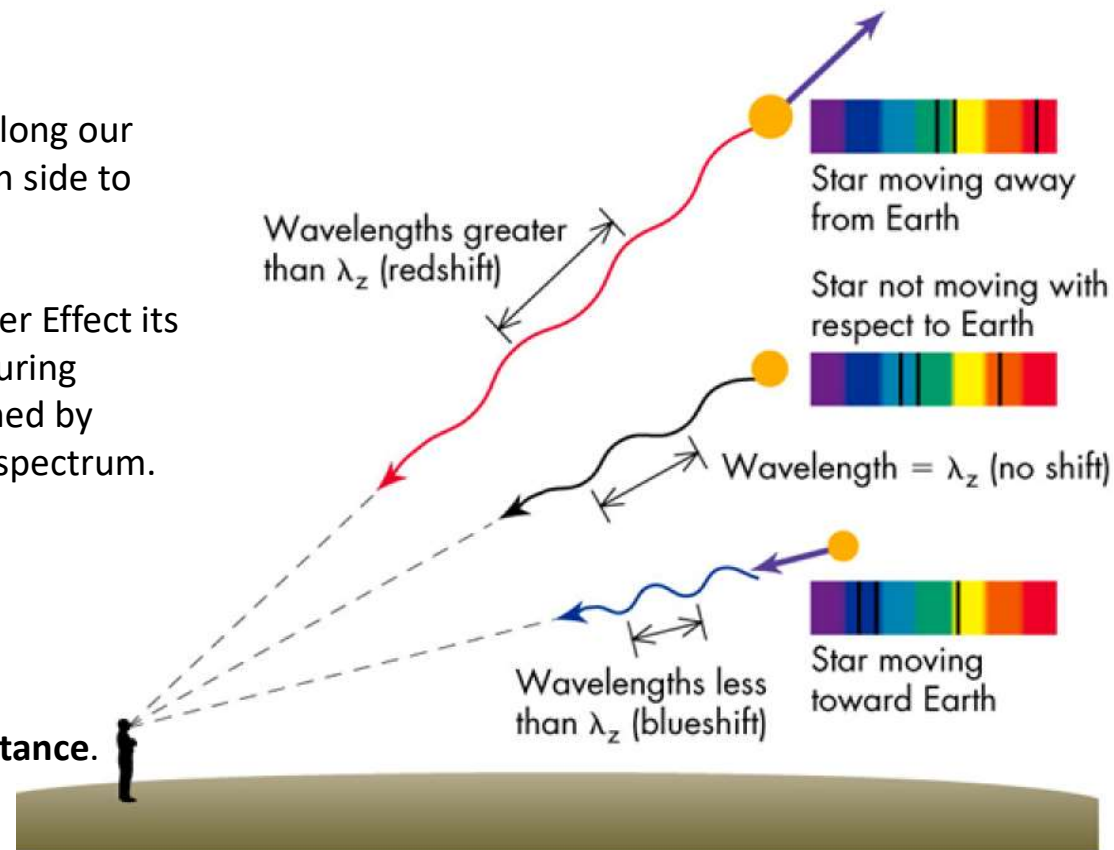
The radial velocity of a star is measured by the Doppler Effect its motion produces in its spectrum. Compared to measuring proper motion, this is more or less instantly determined by measuring the wavelengths of absorption lines in its spectrum.

Star moving towards Earth: **Blueshift**

Star moving away from Earth: **Redshift**

Star moving across our line of sight: **No Shift**

In all cases, the **Radial Velocity is Independent of Distance.**





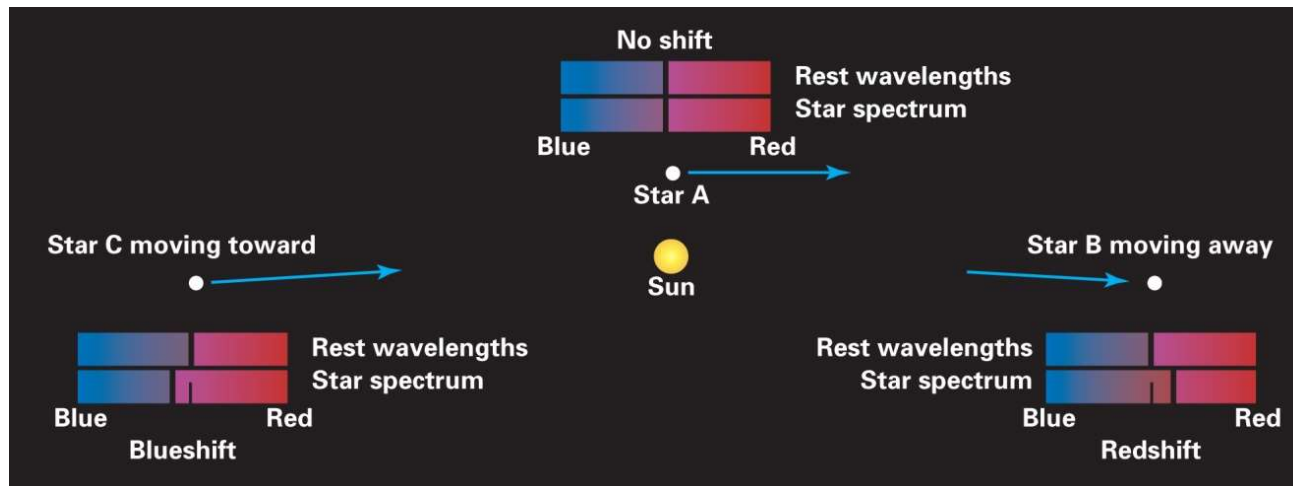
Radial Velocity

Doppler Shift: The Key to Radial Motion

Radial velocity is measured in terms of the change in the distance from the sun to the star.

- If this is increasing (the star is moving away), the radial velocity is positive
- If it is decreasing (the star is moving toward us), the radial velocity is negative.

IMPORTANT: Radial Velocity indicates a relative change. The Sun's motion can contribute to this doppler shift. The concept is still applicable.





Radial Velocity

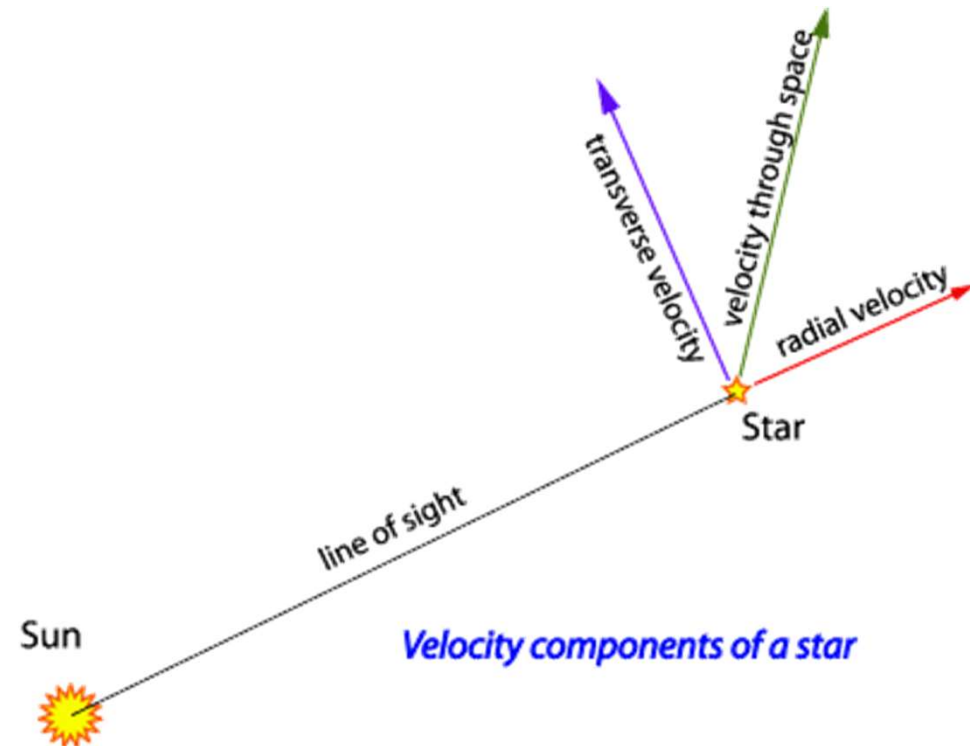
Doppler Shift: The Key to Radial Motion

To measure the speed:

Given that we measure $\Delta\lambda$, the shift in wavelength of an absorption line of wavelength λ , the radial speed v is given by:

$$v = \left(\frac{\Delta\lambda}{\lambda} \right) c$$

c is the speed of light





Stars: Radial Velocity

Summary

To measure radial velocity, we would need a spectrograph, or a known spectra, derived from another source, to measure the change.

Radial velocity is one component of stellar motion. To better understand the collective True Space Motion, consult the video lessons on: Space Motion and Proper Motion.



Questions?