Brightening and Doppler shift of binary stars predicted by emission theories

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Brightening and Doppler shift of a moving star

We will assume that the speed of light is source dependent $c+v$ and that Galilean relativity applies.

An event on a star which is approaching at the radial speed $v(t)$ and which is happening at the time t will be observed at the time t_o:

$$t_o = t + \frac{D\left(t\right)}{c + v\left(t\right)} \tag{1}$$

where:

$\boldsymbol{t}$	is the time the event is happening on the star
$\boldsymbol{t_o}$	is the time when the event on the star is observed
$\boldsymbol{D\left(t\right)}$	is the distance to the star at the time t
$\boldsymbol{v\left(t\right)}$	is the radial speed of the star at the time t
$\boldsymbol{c}$	is the speed of light in vacuum

Differentiating yields: (note that $\frac{\mathrm{d}}{\mathrm{d}t}D\left(t\right) = -v\left(t\right)$)

$$\frac{\mathrm{d}t_o}{\mathrm{d}t} = 1 - \frac{v\left(t\right)}{c + v\left(t\right)} - \frac{D\left(t\right)}{\left(c + v\left(t\right)\right)^2}\frac{\mathrm{d}v\left(t\right)}{\mathrm{d}t} \tag{2}$$

$$\frac{\mathrm{d}t}{\mathrm{d}t_o} = \frac{1}{1 - \frac{v(t)}{c+v(t)} - \frac{D(t)}{(c+v(t))^2}\frac{\mathrm{d}v(t)}{\mathrm{d}t}} \tag{3}$$

Assuming $v\left(t\right) \ll c$ and setting $\frac{\mathrm{d}v(t)}{\mathrm{d}t} = a\left(t\right)$, the radial acceleration:

$$\frac{\mathrm{d}t}{\mathrm{d}t_o} \approx \frac{1}{1 - \frac{v(t)}{c} - \frac{D(t)\cdot a(t)}{c^2}} \tag{4}$$

If an amount of energy is transmitted towards the observer during the time $\mathrm{d}t$, and this energy is received by the observer during the time $\mathrm{d}t_o$, then the relative brightening of the star due to the motion will be $\frac{\mathrm{d}t}{\mathrm{d}t_o}$. But $\frac{\mathrm{d}t}{\mathrm{d}t_o}$ is also the Doppler shift of the of a signal transmitted from the star at the time t.

That the relative brightening and the Doppler shift are equal is a general rule not dependent on theory because they are the same phenomenon.

The Doppler shift of the frequency is then:

$$\frac{f_0}{f} = \frac{1}{1 - \frac{v(t)}{c} - \frac{D(t) \cdot a(t)}{c^2}} \tag{5}$$

where:

- $\boldsymbol{f}$ is the frequency emitted from the star
- $\boldsymbol{f_0}$ is the measured frequency on the Earth

According to Galilean relativity will there be no Doppler shift of the frequency due to the relative speed between the emitter and the detector. However, in this case the acceleration term will change that.

Generally we have:

$$f = \frac{c'}{\lambda} \tag{6}$$

where c' is the speed of light in the frame of reference where the frequency is f and the wavelength is λ. In our case, we have:

$$f = \frac{c}{\lambda} \quad \text{and} \quad f_0 = \frac{c+v}{\lambda_0} \tag{7}$$

where λ is the wavelength of light emitted from the star and λ_0 is the wavelength observed on the Earth.

Inserting (7) in (5) yields:

$$\frac{\lambda_0}{\lambda} = \left(1 - \frac{v(t)}{c} - \frac{D(t) \cdot a(t)}{c^2}\right) \cdot \left(1 + \frac{v(t)}{c}\right) \tag{8}$$

Since we can assume that $\left(\frac{v(t)^2}{c^2} \ll 1\right)$ and $\left(\frac{D(t) \cdot a(t) \cdot v(t)}{c^3} \ll 1\right)$ we can write:

$$\frac{\lambda_0}{\lambda} \approx \left(1 - \frac{D(t) \cdot a(t)}{c^2}\right) \tag{9}$$

However, whenever the predicted brightening is more than negligible, the $\frac{D(t) \cdot a(t)}{c^2}$ term will dominate so the Doppler shift of the wavelength will be very close to the inverse of the Doppler shift of the frequency.

This means that if the emission theory predicts that an orbiting star (in a binary or multiple) has an brightness variation of two $(1 \pm \frac{1}{3})$, the spectrum of the star should also have a variation in the Doppler shift by two. Such a Doppler shift is never observed from any variable star.

Conclusion

Since no variable star has a variation in the Doppler shift of the spectrum equal to the the brightness variation, it is clear that the brightness variation of no star is caused by its motion as predicted by the emission theory. This is yet another falsification of the emission theory.