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A Study on the Variable Aberration of Starlight

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Abstract

We examine the implications of the Correas' revised theory of stellar aberration, taking the star Vega as a concrete example. Two distinct velocity-dependent displacement effects are delineated based on the Aetherometric theory of voltage-equivalent ambipolar electric wavespeed. While the electromagnetic detection of starlight does entail an effectively constant aberration angle, the aberration of the impelling ambipolar energy, as well as the apparent displacement due to proper motion, are found to be variable in magnitude. This leads us to predict small but not insignificant positional variations and spectral distortions that could in principle be tested using modern astrometric data.

In monograph VII.2 of the Aetherometric Theory of Synchronicity [1], A. Correa and P. Correa amend and elaborate their earlier treatment of the Bradley aberration [2, section 3.2], rendering it more consistent with the Aetherometric theory of ambipolar electricity and its variable speed of longitudinal propagation [3, 4]. In the end, however, they leave several "flaming questions" unanswered. Does the fully Aetherometric treatment of stellar aberration contradict Bradley's observations? How do we rectify his observed nearly constant 20.5″ aberration angle [5] with the Aetherometric contention that this angle is severely overestimated—and that it varies from star to star? Is Aetherometry wrong? Were Bradley's measurements incorrect?

We will address the apparent contradictions in due course, however, there are even more burning questions implicated by the Correas' proposed theory. These stem from the fact that stellar ambipolar radiation does not propagate uniformly at a modal wavespeed—as might be assumed by a cursory reading of AToS VII.2. Rather, the longitudinal transmission of radiant electricity is conveyed across the vast reaches of space at variable, voltage-dependent wavespeeds that correlate with the observed electromagnetic spectrum of each star. How do these variable transmission speeds affect the perceived image of any given star in the vicinity of the Earth? How do the relative motions of the emitter and receiver combine with these variable transmission speeds? Do stars actually appear to us as point-like emitters, or does the combination of these effects result in a distortion of the ambipolar and resultant electromagnetic profiles? Can we differentiate and quantify these various effects? Are they observable? Can we formulate any testable predictions?

I will attempt to offer preliminary answers to these questions by applying Aetherometric theory to the star Vega and its inferred electromagnetic and ambipolar spectra. This star was chosen due to its relative brightness and the fact that it has long served as a standard of reference in photometric science, being one of the most well-studied stellar spectra aside from that of our Sun. Additionally, its distinct bi-modal spectrum, plotted in Figure 1, makes it especially relevant to this line of questioning.

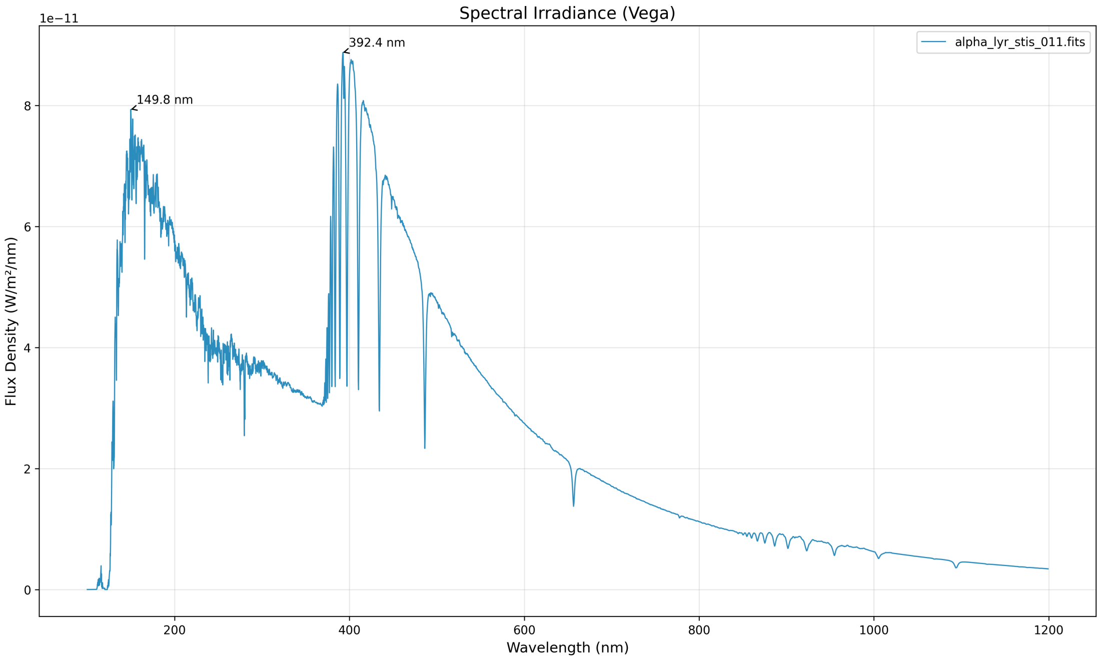

Figure 1: Spectral irradiance of Vega (CALSPEC)

Stellar spectra are typically reported in terms of electromagnetic flux density over a range of photon wavelengths. In order to convert from photon wavelength λ_φ to ambipolar wavespeed W_v, we first need to determine the corresponding photon energy (hc/λ_φ), then multiply it by α^{-2} to get the magnitude of the impelling ambipolar energy [6] and, finally, divide the result by the fundamental electric charge p_e. We can abridge this to a single operation by abstracting from electric charge (note that $h/p_e = \lambda_x$) and reducing the equation to its barest form:

$$\mathrm{W_v} = \frac{\alpha^{-2}hc}{\lambda_\varphi p_e} = \frac{\alpha^{-2}\lambda_x c}{\lambda_\varphi} = \frac{\lambda_e c}{\lambda_\varphi} = \frac{p_{Ae}}{\lambda_\varphi} \tag{1}$$

Taking the lawful Aetherometric value of the mass-equivalent wavelength of the electron, $\lambda_e = 5.485\,799 \times 10^{-6}$ m, and the corresponding inertial momentum $p_{Ae} = \lambda_e c = 1644.601\mathrm{m}^2/\mathrm{s}$ [7, sections 3 & 6], we can readily determine the ambipolar electric wavespeed that is productive of a given photon wavelength. For our present purposes, I will take six representative wavelengths, corresponding to approximately 50%, 90% and 100% of the peak power density of Vega's radiant ambipolar output. Table 1 summarizes these values, along with the corresponding transit times to Earth (with the distance estimated at 7.68 pcs $= 2.37 \times 10^{17}$ m, based on Vega's conventionally inferred parallax of 130.23 ± 0.36 mas).

λ_φ (nm)	Flux Density / Peak (%)	$\mathrm{W_v}$ (10^9 m/s)	Transit Time (y)
132.0	50	12.46	0.603
149.8	**90**	**10.98**	**0.684**
232.4	50	7.077	1.06
375.9	50	4.375	1.72
392.4	**100**	**4.191**	**1.79**
512.3	50	3.210	2.34

Table 1: Representative photon wavelengths of Vega's radiant energy spectrum with corresponding power densities, ambipolar wavespeeds, and transit times to Earth.

It is worth noting that Vega's effective temperature is usually quoted between 8910 K and 10 070K, which, according to Wien's law, corresponds to a photon wavelength of 325nm to 288 nm. However, both of these wavelengths reside in the "trough" of Vega's pronounced bi-modal spectrum; they have relative flux densities of less than 50% of the peak value and do not characterize the observed distribution of photon energies. This not only goes to show how *inexact* conventional science is with regards to the energy content of starlight (and, indeed, all things), but how any reduction of the spectrum to a single modal value is liable to obfuscate the energy distribution.

In effect, Vega presents two images to an observer in the vicinity of the Earth, and both of these are themselves spread over a range of energies. The first (UV) image reaches us in a mere 8 months (7–12 months for the top 50% peak energy band), while the other (blue-violet) image takes nearly two years (21–28 months) to travel the same distance. Thus, there are two major aberration angles at play—and really, two ranges of effective aberration angles. Moreover, at any given moment, we simultaneously see the image of where Vega was 8 months ago, and the image of where Vega was 21.5 months ago. In the meantime, the relative position of the star and Earth changed by approximately $1.79 - 0.684 = 1.106$ times Vega's yearly "proper motion" of $\sim 0.35''$. That is to say, the two images are separated by some $0.4''$, even when aberration is virtually nil (when the Earth is moving parallel to the line of sight).

Aberration angles are normally described in terms of the ratio between the velocity of the Earth's translation and of the propagation of starlight—or, Aetherometrically, of the ambipolar radiation that ultimately produces starlight—as per the equation

$$\theta - \phi = \arcsin\left(\frac{\mathrm{v_E}}{\mathrm{W_v}}\right) \tag{2}$$

with $\mathrm{v_E}$ ranging between 29 290 m/s (at aphelion) and 30 290 m/s (at perihelion), with an average linear speed of 29 780 m/s. For earth-bound observers, we must add to this between 0 and ± 465 m/s to account for the rotation of the Earth, modulated by the observer's topocentric position and its rotational phase relative to the line of sight.

We also need to account for the solar apical motion: for, this motion is not shared with the emitter, and, even though it is conventionally subsumed under the latter's "proper motion", it is—properly speaking—a motion of the receiver. Modern estimates of the Sun's translation relative to the Local Standard of Rest are in the vicinity of $13\,378 \pm 915$ m/s [8]; in AToS VII, the Correas adopt a reference value of 13 528.93 m/s [9]. Since the solar apex is inclined by some 60° relative to the ecliptic, this presents, on one hand, a skewing of $\mathrm{v_E}$ towards the solar apex and a resultant modulation of its speed by up to $\pm\cos(60°)\,13\,528.93\,\mathrm{m/s} = \pm 6764\,\mathrm{m/s}$,—and, on the other hand, a nearly constant velocity term perpendicular to the ecliptic at close to $\sin(60°)\,13\,528.93\,\mathrm{m/s} = 11\,716\,\mathrm{m/s}$. Notably, both of these figures are expected to vary periodically, due to the wake-like motion of the solar system as a whole [9].

Since the direction of the solar apex is nearly aligned longitudinally with the solstitial axis, the minimum and maximum speeds of the Earth's translation *relative to the LSR* actually occur around the equinoxes, when the direction of the solar system's movement is aligned momentarily with that of the Earth's orbit. Around the time of the Vernal Equinox, the two movements are parallel but oppositely directed, so the Earth's total LSR motion along the ecliptic plane is at its slowest, $(29\,780 - 6764)\,\mathrm{m/s} = 23\,016\,\mathrm{m/s}$, while around the Autumnal Equinox, it is at its fastest, $(29\,780 + 6764)\,\mathrm{m/s} = 36\,544\,\mathrm{m/s}$. (These values are only approximate, since the Earth is not exactly moving at its average orbital speed at the equinoxes, nor in all likelihood are the equinoxes exactly at right angles to the solar apex.)

In order to gain a more accurate view of the composite motion, we need to account for both the Earth's instantaneous orbital speed (by way of the *vis-viva* equation) and the angle between the tangent of the Earth's orbital motion and the direction of the solar apical motion. Specifically, the Earth's and Sun's combined speed on the ecliptic plane, relative to the LSR, will at any moment be given by

$$\mathrm{v_{ES}} = \sqrt{(\cos(\lambda_{\Delta \mathrm{SA}})\, \mathrm{v_E})^2 + (\sin(\lambda_{\Delta \mathrm{SA}})\, \mathrm{v_E} - \mathrm{v_{SAe}})^2} \tag{3}$$

with $\lambda_{\Delta \mathrm{SA}}$ being the Earth's ecliptic longitude relative to the Solar Apex, $\mathrm{v_{SAe}} = 6764\,\mathrm{m/s}$ the velocity of the solar apical motion on the ecliptic plane, and with $\mathrm{v_E}$ calculated exactly for the given orbital position $\lambda_{\Delta \mathrm{SA}}$.

Vega is currently situated at ecliptic longitude $\lambda = 285.3038°$ and ecliptic latitude $\beta = 61.7350°$. Conveniently, this is virtually the same ecliptic longitude as the Earth's perihelion, located some 15° East of the solstice and the solar apex. Since this and the aphelion, located 180° opposite, are the points where the Earth's motion is oriented perpendicularly to the line of sight with Vega, they are also the points where Vega's aberration is near its maximum extent. At perihelion, even though the Earth's *orbital* motion attains its maximum speed, the latter is counteracted somewhat by the solar apical motion, resulting in a lower than average combined speed on the ecliptic plane ($\mathrm{v_{ESperi}} = \sqrt{(\cos(15°) \cdot 30\,290)^2 + (\sin(15°) \cdot 30\,290 - 6764)^2}\ \mathrm{m/s} = 29\,278\ \mathrm{m/s}$) while, at aphelion, the motions are partially additive and the resultant speed is slightly higher than average ($\mathrm{v_{ESap}} = \sqrt{(\cos(195°) \cdot 29\,290)^2 + (\sin(195°) \cdot 29\,290 - 6764)^2}\ \mathrm{m/s} = 31\,721\ \mathrm{m/s}$).

Thus, and still simplifying things somewhat,—with ϕ_E being the Earth's orbital phase relative to the line of sight, $\mathrm{v_{ES}}$ being the Earth's and Sun's combined speed relative to the LSR on the ecliptic plane, and $\mathrm{v_{EP}} = 11\,716\ \mathrm{m/s}$ being the component of the same motion that is directed towards the ecliptic pole,—at any given moment, the actual *ecliptic* aberration angle for a given ambipolar electric wavespeed will be given by:

$$\mathcal{A}_\lambda = \sin(\beta) \cdot \cos(\phi_E) \cdot \arcsin\left(\frac{\mathrm{v_{ES}}}{\mathrm{W_v}}\right) \tag{4}$$

while the corresponding, nearly constant aberration towards the north ecliptic pole will be given by

$$\mathcal{A}_\beta = \cos(\beta) \cdot \arcsin\left(\frac{\mathrm{v_{EP}}}{\mathrm{W_v}}\right) \tag{5}$$

The resulting values are summarized in Table 2, using the same reference wavespeeds outlined in Table 1. For each wavespeed, we list the ecliptic aberration angles at perihelion and aphelion (where, for Vega, aberration is near its maximum) as well as the constant aberration term directed towards the ecliptic pole. Positive values indicate displacement Eastward in longitude of Northward in latitude.

W_v (10^9 m/s)	$\mathcal{A}_{\lambda \mathrm{Vega}}$ (perihelion)	$\mathcal{A}_{\lambda \mathrm{Vega}}$ (aphelion)	$\mathcal{A}_{\beta \mathrm{Vega}}$ (constant)
12.46	$+0.427''$	$-0.463''$	$+0.092''$
10.98	$\mathbf{+0.484''}$	$\mathbf{-0.525''}$	$\mathbf{+0.104''}$
7.077	$+0.752''$	$-0.814''$	$+0.162''$
4.375	$+1.216''$	$-1.317''$	$+0.262''$
4.191	$\mathbf{+1.269''}$	$\mathbf{-1.375''}$	$\mathbf{+0.273''}$
3.210	$+1.657''$	$-1.795''$	$+0.357''$

Table 2: Extreme aberration angles for Vega's representative ambipolar wavespeeds.

As might be expected, the aberration of the lower-energy blue-violet image (with modal electric wavespeed $W_v = 4.191 \times 10^9$ m/s) is some 2.6 times greater than that of the high-energy UV image (with modal electric wavespeed $W_v = 10.98 \times 10^9$ m/s)—the effect being inversely proportional to the respective wavespeeds.

However, we are not quite finished. As mentioned above, due to the relative motion of the two stellar bodies and the variable, voltage-dependent transmission times of ambipolar electricity, each component of a star's spectrum will appear to originate from a slightly different point in the sky. Thus, in order to determine the total apparent displacement of a given wavelength of starlight, we need to add the star's relative motion ("proper motion"), applied over the ambipolar transmission time, to the aberration angle itself. For the star Vega, this means that the apparent point of origin will be shifted Westward (in the opposite direction of Vega's apparent motion) along the ecliptic by around $\mu_\lambda = 0.553\,90''$ per year of transmission time, and Southward towards the ecliptic pole at around $\mu_\beta = 0.338\,42''$ per year (these values having been obtained by converting the textbook values of Vega's proper motion into ecliptic coordinates).

Writing r_σ for the radial distance of the star and $W_{vy} = W_v \times 31\,557\,600\,\mathrm{s/y}$ (ambipolar wavespeed in meters per year), we can determine the apparent displacement along the ecliptic as:

$$\mathcal{M}_\lambda = \mu_\lambda \frac{r_\sigma}{W_{vy}} \tag{6}$$

Likewise, for the displacement in ecliptic latitude,

$$\mathcal{M}_\beta = \mu_\beta \frac{r_\sigma}{W_{vy}} \tag{7}$$

Calculating these values and adding them to those of Table 2, we obtain the total apparent displacement ($\mathcal{D}$) of each of Vega's representative ambipolar wavespeeds. These are now expressed in terms of displacement from the star's true instantaneous position, taking both aberration and proper motion into account (see Table 3).

W_v (10^9 m/s)	$\mathcal{D}_{\lambda\mathbf{Vega}}$ (perihelion)	$\mathcal{D}_{\lambda\mathbf{Vega}}$ (aphelion)	$\mathcal{D}_{\beta\mathbf{Vega}}$ (constant)
12.46	$+0.093''$	$-0.796''$	$-0.112''$
10.98	$\mathbf{+0.106''}$	$\mathbf{-0.904''}$	$\mathbf{-0.127''}$
7.077	$+0.164''$	$-1.402''$	$-0.197''$
4.375	$+0.265''$	$-2.268''$	$-0.319''$
4.191	$\mathbf{+0.277''}$	$\mathbf{-2.368''}$	$\mathbf{-0.333''}$
3.210	$+0.361''$	$-3.091''$	$-0.435''$

Table 3: Total displacement angles for Vega's representative ambipolar wavespeeds.

Of course, this still represents a rather simplified view of things. For starters, "proper motion" is not a linear function, as all stars are engaged in a distinct epitrochoidal, wake-like motion [9] whose period and amplitude differs from star to star. We are also still abstracting from the rotation of the Earth, and the observer's equatorial latitude on (or above) the rotating Earth—and ignoring parallax.

All the same, once this complex ambipolar "image" enters into a materially dense medium (such as the Earth atmosphere, or even a photosensitive plate on a spacebound observatory), it undergoes a secondary—and considerably greater—aberration that conforms effectively to the conventional value of $\sin(\beta) \cdot 20.5''$. However, this is *in addition to* the combined effects outlined above. Thus, the observed aberration angle cannot really be constant because it has both ambipolar (variable) and electromagnetic (constant) components, while, at the same time, the various spectral emissions appear to originate from diverse points in the sky due to the constant relative motion of emitter and receiver. Thus, when starlight is observed electromagnetically (by the detection of local photons), it can be predicted to exhibit a *nearly* constant aberration, with small, wavespeed-dependent variations that result in a subtle "smearing" of the image of any star that emits an appreciably broad spectrum of energies. For multi-modal spectra such as Vega's, we also predict a discernable spectral splitting of the image.

The question that remains is whether these predictions can be systematically tested using modern astrometric data. This would require developing new data reduction pipelines grounded in Aetherometric theory, and conducting a detailed comparison of the results against those obtained by conventional theory (see, for example, [10]). This would almost certainly lead to a revision of the estimated parallax of each star, as well as the corresponding radial distances. For, even though the parallax effect is 90° out of phase with the phenomenon of aberration, the conventionally-held values are likely being conflated to some extent with the displacement effects outlined herein. This is all the more likely because ambipolar aberration and the variable displacement due to "proper motion" combine asymmetrically and are generally not null when parallax is at its maximum extent.

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