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RESEARCH ARTICLE

Investigation of Limb darkening for short period AB Andromeda eclipsing binary star

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ABSTRACT

This work deal with characterizing the limb darkening coefficients for the short period binary stars AB Andromeda to determine the size, luminosities and masses of the Individual stars as well as orbital size and orientation of the binary system. Calculating limb darkening for monochromatic pass bounds, the visual rang i.e. intermediate (uvby) have been calculated and broad bands to the near infrared. Also bolometric limb darkening coefficients for a linear as well as nonlinear logarithmic and square root limb darkening law as function of surface effective temperatures covering a wide range and surface have been computed. The calculations and computing have been carried out by using the interpolation program of Van Hamme.

Key words: Eclipsing binary, AB Andromeda and Limb darkening.

1. INTRODUCTION

Eclipse binaries are a rich source of information about the physical properties of stars (mass, size, luminosity, internal structure, etc.) and their evolution over time. Impressive accuracy with fundamental physical properties can be determined. The mass and size of stars are well known for better than 1%. The investigation of eclipsing variables usually goes through a series of steps. Frist is in the discovery stage. Most eclipsing variables were found in surveys covering most of the sky. When someone looks at the sky, find variable stars that are repeatedly retrieved over a month or even years (John William, 2006).
The study of near binary stars is interesting for several reasons. For example, understanding the structure and evolution of a star is a basic ultimate of a star. It is needed in astronomy, and most other areas of astronomy. Binaries play an important role in understanding the universe and its components. The importance of binary stars are the primary source of information on the fundamental attributes of stars. The advantages of EB research have been well known for a long time, which is the reason for the continuous observation of binaries. A lot of information could about the structure and evolution of stars. Of particular importance are their role in providing basic star data: (mass, radius, velocity, separation distance, period) (Helen, 2020).
Also, depending on its chemical and mass components (Bonanos, 2006). Hence, needs as accurate data as possible to test stellar evolution and structure. This knowledge is usually well analyzed in

binary stars, as basic properties such as mass, radius, velocity, separation distance, and period know that proximity effects gives information about the stars which are under consideration. These stars will benefit from binary stars. "Born" from the same population. A group is a group of stars that are burned or created at about the same time. The eclipsing variable system provides one of the only direct ways to measure the mass and radius of stars outside the Sun. It is necessary to better understand the Physics of the stellar stars.
Many evolutionary models of low-mass contact have been developed that able representing the differences temperature and luminosity changes between individual components, as well as their orbital periods and mass ratio distributions (Menon and *et al*., 2020). The University of Tabriz's Khadjeh Nassir Addin observatory did a photoelectric observation for AB Andromeda. The observations were carried out for three nights in September and October 2001, and 5 nights in August and September 2003. (Hasanzadeh, Jassur, and Kermani, 2008).

2. METHODOLOGY

The major objective of this study is to shed light on so-called edge darkening coefficients of the phenomenon and its relationship to a binary star system, calculating limb darkening coefficients for the short period for the Individual stars AB Andromeda. The approach being atmospheric studies (B, V) and for each star, a certain temperature was used, given by the Van Hamm program, darkening towards the edge, as well as the reflection effect were taken into account. Van Hammer's program computing the coefficients were utilized.

3. THE BINARY STAR (AB) ANDROMEDA

The AB Andromeda variability (Hip 113052, RA. = 23h 11m 32.09s), DE. = 36 dgree53 minute 35.11 second), Guthnick and Prager found it to be an eclipsing binary **(**Guthnick, and prager, 1927). This system was first discovered by Oster Hoff. (Oster Hoff, 1950). Photographically 0 and then by (Binnendijk, 1959, Al- Naimiy et. al., 1989). The following characteristics of this binary are given: V = 9.50, B-V 0.87, the geometric elements of the binary type of this binary star are depicted as follows: period = 0.331905 days, spectral type G7/G2, k = 0.6, rp = 0.461, rs = 0.286, and its inclination 76 degree. While following its physical elements: Rp = 1.29, Rs = 0.80, $T_{eff.}1$ = 5550 k (Maupome *et. al.*, 1991). While the latest component of space velocities in the galaxy was calculated by Biller (Biller *et. al.*, 2005).

4. LIMB DRAKENING

The term "limbs" used by astronomers to describe the apparent edge of the sun and moon, or other celestial bodies with detectable disks.
LD is the dimming of the star's surface when viewed from the star's center towards the edges of the disc (or limbs). This effect is seen on the light curve as a rounding at the bottom of the minimum where the "shoulder" goes in and out of the main minimum. It's not a sharp boundary, it's a little rounded. The overall shape of the primary minimum also changes.

Figure 1: The Limb darkened of the Sun.

LD appear when the result of the effects star (1) the star's density decreases with increasing distance from the center (2) as strength of the edge dimming effect decreases towards the edge or edge, the star's temperature reduces the solar disk's surface temperature "limb".

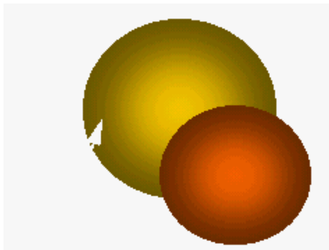

Figure 2: The Limb darkened of the star.

Table 1: Contains equatorial coordinates and the equinox 2000, HD and BD NO. For the short period binary star from (SQR) as used in the present work.

Star	Period day	HIP	RM H M S	Dec. Deg m s	Spectral type
AB	0.331 905	11305	23 11 45	+36 53 35.11	G5V G7/G2

5. THE GEOMETRY OF THE LIMB DRAKENING.

When the stars are displayed from the practical figure of the trend (3). It does not appear on standard discs. Although stars are usually nearly spherical symmetrically, they appear faint at the edge of their disk. The LD happens because we perceive overall cooler gas when this obliquely towards the star's surface, and when looks at the surface from the normal. Because cooler gas is less bright, the star's limbs appear dimmer. When analyzing EB light curves, LD is an important factor to consider.

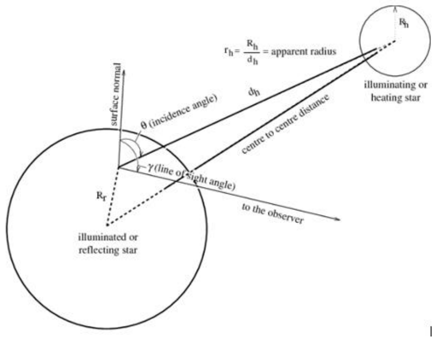

Figure 3: The geometry of an eclipsing.

This edge dimming occurs because when looking diagonally at the star's surface, the gas can be seen as a whole cooler than when looking at the surface from normal. Because the cooler gas is less bright, the star's limbs appear dimmer.

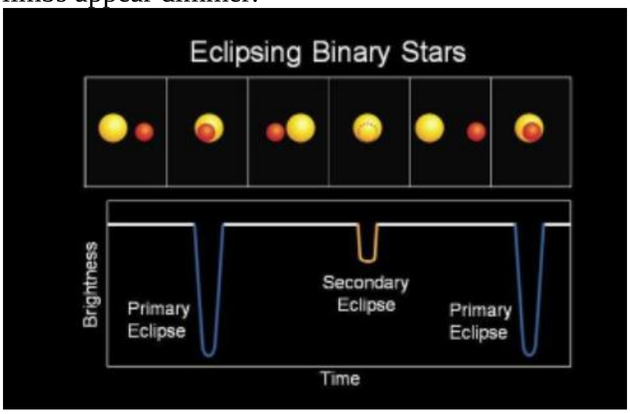

Figure 4: The geometry of an eclipsing.

Historically, the first law of LD developed was an analytical solution of the atmosphere whose light source function is linear in optical thickness (Ian, 2011).

6. THE RULES OF LIMB DRAKENING.

A fairly good empirical representation of the edge-dimming is given by a formula in the an approximate expression for a specific intensity the light intensity at the surface of a star is (Mline, 1921).

$$I(\theta) = \mathrm{Io}(1 - \mathrm{w}\cos(\theta)) \quad (1)$$

θ = angle formed by the stellar surface's normal and the observer's line of sight.
Io = the brightness of light in the star disc's center($\theta = 0$).
w = is the wavelength dependent LD coefficients (<1, ~0.3). The theory of the LD was placed on it is present basis though the work of lindblad and Milne in paper published from 1920-1923. The linear and simple traditional monochromatic LD law (Mline 1921) is

$$I_\alpha(m) = \mathrm{I}(1)(1 - x_\alpha(1 - m) \quad (2)$$

Milne published equation (2) in 1921. In this equation I_α is the intensity at wavelength α, m is the cosine of the angle between the normal to the atmosphere and the direction of the beam, and x_α are the Limb obscuration coefficients. Alternative to this, Sobieski and Klinglesmith wrote the logarithmic rule (Sobieski and Kliglesmith, 1970).

$$I_\alpha(m) = \mathrm{I}(1)(1 - x_\alpha(1 - m) - y_\alpha m(\ln(m))$$

Such that y_α is nonlinear LD coefficient. Diaz and Cordova's introduced the square root rule (Diaz – cordoves and Gimennez, 1992).

$$I_\alpha(m) = \mathrm{I}(1)(1 - x_\alpha(1 - m) - y_\alpha\left(1 - \sqrt{m}\right) \quad (3)$$

The most important factor affecting the shape and amplitude of oval changes is the darkening of the limbs. Analysis of the light curve of BEs to characterize them is a key influence that must be allowed when looking at symmetric uncertainties in stellar radius based on light curve analysis. When it comes for modeling LC, differences in brightness on a stellar disk are explanted by different parameters known as coefficients of LD laws for determining observation through light curve analysis of EB.

The linear law is the most basic LD law $I(m) = \mathrm{I}(1)(1 - u(1 - m)$.

Such that $m = \cos(m)$, m is the angle at which the line of sight intersects the stellar surface, $I(m)$ is the flux received per unit area at an angle, $I(1)$ is the flux per unit area from the star disc's center. The value's m depending on observation wavelength, the T_{eff}, the star's chemical composition and its surface gravity. The quadratic law is

$$I(m)I(1) = (1 - a(1 - m) - \mathrm{b}(1 - m)^2 \quad (4)$$

Such that a and b are constants. The logarithmic rule for LD defined by Klinglesmith and Sobieski (Sobieski and Kliglesmith, 1970).

$$I(m)I(1) = (1 - c(1 - m) - \mathrm{d}m(\ln(m) \quad (5)$$

Such that c and d are constants.
The square root rule defined by Diaz and Gimennez (Diaz and Gimennez, 1992).

$$I(m)I(1) = (1 - e(1 - m) - \mathrm{f}(1 - \mathrm{p}m) \quad (6)$$

Such that e and f are scalars. Barban generalized the cubic law to (Barban *et. al.*, 2003).

$$I(m)I(1) = (1 - p(1-m) - \mathrm{q}(1-m)^2 \\ -\mathrm{r}(1-m)^3 \quad (7)$$

such that $p, q$and r are fitted scalars, investigated coefficients rule for coefficient ak, expressed by (Claret 2000).

$$I(m)I(1) = (1 - \mathrm{k}X^2 = \mathrm{lak}(1 - \frac{km}{2}) \quad (8)$$

This law is more successful than the two-coefficient law in fitting all types of stars. Claret introduces a new two-parameter approximation given by (Claret 2003).

$$I(m)I(1) = (1 - g(1-m) - h(1 - em) \quad (9)$$

To better fit the theoretical LD predicted by contemporary spherical models atmosphere. At short and long wavelengths, the final two rules are more effective. The degree of agreement between the expected and actual LD and the rule of LD was used to adapt the prediction.

7. LIMB DARKENING AND ECLIPSING BINARY.

In this section we explain how the darkening of the limbs is related to the binary star as follows:

7.1 LIGHT CURVE.

A plot of the brightness of an eclipsed binary over a complete orbital period is called its light curve. By studying this curve, a large number of fundamental astrophysical quantities can be determined when analyzing the light curve (LC). Figure 5 shows a schematic diagram of the LC. The LD laws available are limited to those included in the light curve code. It is critical to generate outcomes for many scalars of variance to see how they affect the solution. The atmospheres of closed binaries can be altered by fluxes, LD properties from other stars in the system are changed.

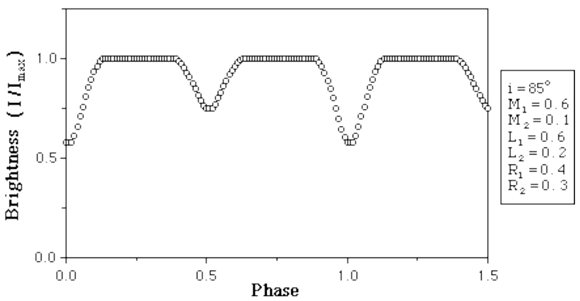

Figure 5: Schematic diagram for the binary star light curve. (Claret, and Gimenez, 1990).

Theoretical scalars are mainly used to describe single stars. but the LD of the illuminated atmosphere is defined (Claret, and Gimenez, 1990, Alebcar and Vaz, 1999). These researchers also compared theoretical conclusions to linear LD scalars derived from photometric measurements, finding reasonable agreement within (very huge) error margins. Other comparisons between theory and observation have been made (Al-Naimiy 1978), with generally good results. Also, the linear LD rules doesn't adequately describe the flux characteristics of the model atmosphere, it should also be remembered that the theoretical LD factor is given to be dependent on atmospheric metal abundance (Claret 1998) and the treatment of convection (Michael 2003). It is important. The observed and theoretical LD coefficients do not match at UV wavelengths. This is Stromgren u and Johnson V (Etazl, and Milone, 2003).

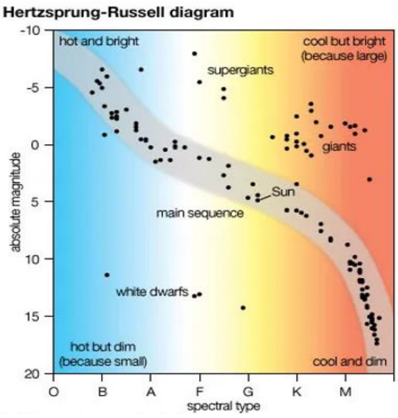

Figure 6: Hertzsprung – Russell diagram for stars in the solar neighborhood.

Table 2: Tabulation of LDC and laws in the literature for different investigators.

N	Authors and References	linear	log	Squ.	Quad.	cubic	Exp	Remark
1	Sobieski S. and Kilnglemith D. in 1970.	*	*					$T_{eff} > 10000K$
2	Al-Nuimiy H. in 1978.	*						
3	Muthsam in 1979.	*			*			
4	Wade R. & Rucinski S. in 1985.	*			*			

5	Claret A. & Gimenez A in 1990.	*			*			$T_{eff} < 66730K$
6	Diaz-Cordovies J. and Gimenez A. in 1992.	*		*	*			Not tabulated
7	Van – Hamme W. in 1993.	*	*	*				
8	Diaz – cordoves J. Claret A. and Gimene z. in 1995.	*		*	*		*	Uvby & UBV pass bands
9	Diaz – cordoves J. Claret A. and Gimene z. in 1995.	*		*	*		*	RIJHK pass bands
10	Claret A. in 2000a.	*						
11	Barban and et. al. in 2003.	*		*	*	*	*	uvby pass bands A and F stars
12	Claret A. in 2000b.	*						Uv by UBVRIJ HK pass bands
13	Claret A. in 2003.	*	*					Geneva & Walraven pass bands
14	Hasanzadeh A. in 2008.	*		*	*			The u and V pass bands.
15	Erdem A., Özkarde B. in 2009	*	*		*	*		$T_{eff}5780K$
16	Chun-Hwey K. and et al. in 2014.	*	*	*	*		*	
17	Awadalla N. S. in 2016.	*	*		*	*	*	Uv & UB pass bands
18	Edward G. in (2017.	*		*	*		*	
19	Donald R. S. Jerome A. O. Gur W. and william F. W. in 2018.	*	*	*	*	*		$T_{eff}6034K$
20	Helen R. L. in 2020.	*	*		*	*	*	The u and V pass bands.
21	Menon A. et al. in 2020.	*	*	*	*		*	

7.2 THE EFFECTS OF GRAVITY, LIMB DARKENING AND REFLECTION

The falling in temperature of the photosphere with height causes an effect called as edge darkening. If we move closer to the Sun's limb to investigate a certain depth in the photosphere, more material will be shown, on the limb, shows less of the photosphere than we would if the Sun were in the middle. Because the light we see has a constant optical depth, the radiation from the limb is often colder than that from the Sun's center, therefore, it is going to be less intense than the radiation from the center of the sun.

7.3 GRAVITY DARKENING

The most important parameter affecting the shape and magnitude of the ellipsoid changes is limb darkening. The second most important static parameters affecting the magnitude of the ellipsoid change are gravitational bolding (GD) and gravitational brightening, which deal with the local temperature on the star's surface. The function of GD, T_eff~gβ, is independent of wavelength and is not strongly affected by mixing length or changes in stellar composition. The GD's size is determined by how energy is transferred through the star, therefore related to the mass star. B~0.32 for low-mass convective meteors and radiative-envelope stars β=1 (Lucy, 1967). We selected a value of 0.32 for the cool secondary stars in our model. He calculated the GD index for stars with masses ranging from 0.08 to 40 M⨀, and found that a more accurate way to calculate the GD index should include the shape of the star.

7.4 REFLECTION COEFFICIENTS

In the binary system, the presence of a single star increases radiation glitter on the side facing the companion, the cause being the heat of the partner and radiant energy. This in turn increases the temperature calculated from the equation (2.13). Because heat caused by natural radiation in physics. The use of the expression effect is somewhat misleading. When one star's radiation hits the surface of another, its energy heats the receiving surface and, if the star mainly emits, re-produces the energy as mirror. Bolometric albedo is the percentage of the drop-in radiation that re-produces the Companion star. The reflection coefficient ($E_{ff\ h}$ and $E_{ff\ c}$) and the gravitational shadow coefficient ($\tau_{h\ c}$) are given by the following simple approximation formula in (Budding, and Najim, 1980).

$$E_{ff\ h} = \tau_h (\frac{T_c}{T_h})^4 (\frac{e^{(\frac{c_2}{\varepsilon T_c}-1)}}{e^{(\frac{c_2}{\varepsilon T_h}-1)}}) \quad (10)$$

$$E_{ff\ c} = \tau_c (\frac{T_c}{T_h})^4 (\frac{e^{(\frac{c_2}{\varepsilon T_h}-1)}}{e^{(\frac{c_2}{\varepsilon T_c}-1)}}) \quad (11)$$

7.5 GRAVITY BRIGHTENING (DARKENING) EXPONENT

Zeipel in 1924 (Zeipel, 1924) proved that the surface flux of a radiating the value of gravity (g) is exactly proportional to the size of the star on surface of the star. The equation for temperature T used localized on a star's surface is:

$$\tau_{h\ c} = (\frac{c_2}{4\varepsilon T_{h,c}[1-e^{(\frac{-c_2}{\varepsilon T_c})}]}) \quad (12)$$

Where c_2 is equal to 1.433883 and $\varepsilon T_{h,c}$ is effective wave length for used filter.

Where $T_{ff\ h}$the average effective temperature of the stars' surfaces, λ is the wavelength effective $\tau_{h\ c}$ temperature of hot, cold star. According to (Lucy, 1967), the gravity brightening exponent for radiative stars is 1.00, and for convective stars it is 0.32. The wavelength independent. Radiative and convective stars are approximately 7200 K in temperature. Radiative envelopes are thought to exist in stars that are hotter than 7200 K. And Convective envelope will be present in stars cooler than 7200 K.

8. THE IMPORTANT OF LD

When looking at the stars from a certain angle, they do not look like uniform discs. Although stars are usually nearly spherically symmetric. Speaking of star edge looks faint. This LD appears because when takes an oblique view of a star's surface, generally when looking from normal to surface, a significantly cooler will be perceived. Learning difficulty is important in many areas of stellar astrophysics.

1) Determining the angular diameter of a star from interferometry requires correction from the observed uniform disk side to the actual LD disk size, especially when trying to drive the more complex LD law coefficients. This fix is small, but usually derived theoretically (Perrtman, 1997).

2) Rotating star line profile (Dominik, 2005). The passage of extra solar planets across the parent star (Brown, *et. al.*, 2001), light changes able analyzed to determine the relative radii of stars and planets, It is include the effect of LD in the gravitational micro lensing method (Heyrovsky, 2003).

3) Solar LD observations are used to determine the temperature atmosphere of the sun. Information from these observations are applied in the study of other stars.

4) Analyzing the EB light curve for finding it is characteristics is a necessary effect. When analyzing the EB light curve. Ignoring or improper representation of LD can create symmetric uncertainty in the radius of the star found from LC analysis. For the purpose of modeling the light curve, the change in brightness on the stellar disk is showed by many parameterizations known the LD law. The LD coefficient can be able found by analyzing the EB light curve.

5) When fitting the EBs light curve, the LD and the third light need to be considered. The value of the LD factor can make a big difference in the findings utilizing the Monte Carlo simulation results.

The star of AB Andromeda was chosen for the purpose of explanation and discussion. The Van Hamme program containing linear and non-linear laws (logarithmic and square root laws) and temperature range (5000 K 50 6000 K) along with the logarithm (g = 4) for sixteen passband and polymeric passband, was used to evaluate the LD coefficients Linearity in which all scroll ranges are taken into account. It can be seen that as the temperature increases, the LD decreases for any pass bands. However, in any central filter that was used, the LD value will vary according to the traffic bands used. Its value ranges from (0 to 1 or 2).

It can be noted that LD is not very significant in the logarithmic case, as its value decreases with increasing temperature. This is the opposite of exponential, which means that the value of LD decreases very slowly with increasing temperature. However, in the case of the square law, the temperature decreases inversely squared. The LD at the edge of the star is clear and pronounced, while the center is weakened because the temperature at the edge of the star decreases and increases toward the center. Figures (7 to 9) illustrate this effect of LD at the edges and centers of stars and are presented in Tables (1 to 3).

Table 3: Linear LCD for AB and for all passbands.

T	U	v	b	y	U	B	V
5000	1.039	0.949	0.837	0.724	1	0.866	0.723
5100	1.041	0.947	0.838	0.725	0.998	0.865	0.724
5200	1.043	0.944	0.839	0.726	0.996	0.864	0.725
5300	0.974	0.899	0.791	0.682	0.946	0.824	0.682

5400	0.978	0.898	0.791	0.683	0.947	0.823	0.683
5500	0.899	0.849	0.746	0.641	0.886	0.782	0.641
5600	0.906	0.848	0.746	0.642	0.889	0.782	0.642
5700	0.913	0.847	0.747	0.643	0.892	0.781	0.643
5800	0.833	0.8	0.705	0.606	0.827	0.744	0.605
5900	0.842	0.799	0.705	0.607	0.832	0.743	0.606
6000	0.736	0.759	0.67	0.537	0.7764	0.709	0.573

T	V	R	I	J	Rc	Ic	Bolo metric
5000	0.723	0.596	0.478	0.384	0.623	0.523	0.535
5100	0.724	0.597	0.488	0.385	0.624	0.524	0.536
5200	0.725	0.598	0.489	0.386	0.625	0.525	0.537
5300	0.682	0.564	0.462	0.362	0.588	0.496	0.528
5400	0.683	0.565	0.463	0.363	0.589	0.497	0.529
5500	0.641	0.53	0.434	0.339	0.552	0.466	0.517
5600	0.642	0.531	0.436	0.34	0.554	0.468	0.518
5700	0.643	0.532	0.437	0.341	0.555	0.469	0.519
5800	0.605	0.499	0.409	0.32	0.521	0.438	0.506
5900	0.606	0.501	0.411	0.3210	0.522	0.44	0.08
6000	0.573	0.471	0.384	0.300	0.491	0.411	0.495

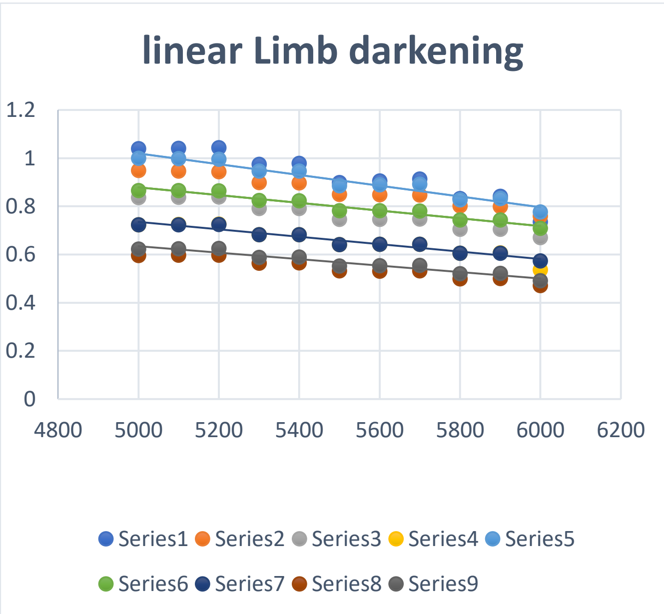

Figure 7: linear LCD for AB and for all passbands.

Table 4: logarithmic LCD for AB and for all passbands.

T	U	v	b	y	U	B
5000	0.885	0.865	0.865	0.804	0.863	0.854
5100	0.863	0.866	0.894	0.804	0.86	0.853
5200	0.883	0.862	o.867	0.803	0.857	0.852

5300	0.898	0.872	0.858	0.793	0.874	0.852
5400	0.897	0.871	0.859	0.794	0.872	0.851
5500	0.901	0.872	0.847	0.779	0.881	0.846
5600	0.91	0.872	0.848	0.779	0.879	0.846
5700	0.901	0.872	0.849	0.78	0.878	0.847
5800	0.895	0.866	0.833	0.762	0.8.78	0.837
5900	0.896	0.867	0.834	0.763	0.878	0.838
6000	0.88	0.865	0.815	0.815	0.87	0.827

T	V	R	I	J	Rc
5000	0.8	0.713	0.616	0.543	0.736
5100	0.799	0.713	0.616	0.543	0.736
5200	0.798	0.712	0.616	0.544	0.735
5300	0.79	0.701	0.604	0.526	0.723
5400	0.79	0.701	0.605	0.527	0.724
5500	0.777	0.685	0.59	0.507	0.707
5600	0.777	0.685	0.59	0.508	0.707
5700	0.778	0.686	0.591	0.509	0.708
5800	0.76	0.668	0.574	0.49	0.689
5900	0.761	0.669	0.575	0.491	0.69
6000	0.743	0.65	0.557	0.471	0.671

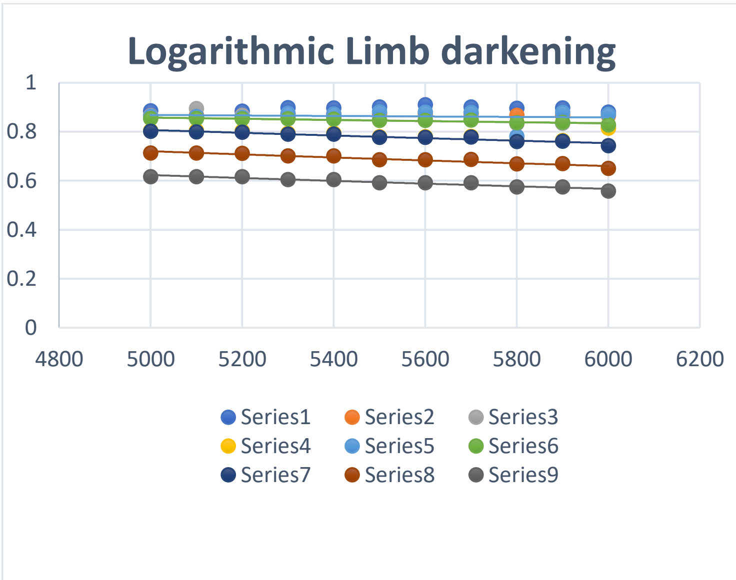

Figure 8: logarithmic LCD for AB And for all passbands.

Table 5: Square root LCD for AB And for all passbands.

T	u	v	b	y	U	B
5000	1.386	1.14	0.773	0.543	1.307	0.894
5100	1.369	1.135	0.775	0.547	1.307	0.893
5200	1.405	1.132	0.776	0.551	1.308	0.892

5300	1.146	0.961	0.639	0.433	1.308	0.761
5400	1.161	0.958	0.638	0.436	1.115	0.759
5500	0.896	0.797	0.518	0.332	0.898	0.638
5600	0.918	0.794	0.517	0.335	0.91	0.636
5700	0.94	0.791	0.516	0.338	0.923	0.634
5800	0.696	0.654	0.419	0.252	0.712	0.532
5900	0.721	0.649	0.415	0.254	0.726	0.282
6000	0.499	0.42	0.342	0.187	0.527	0.443

T	V	R	I	J	Rc
5000	0.549	0.334	0.195	0.027	0.369
5100	0.554	0.338	0.199	0.029	0.372
5200	0.559	0.341	0.202	0.032	0.375
5300	0.438	0.256	0.141	0.037	0.284
5400	0.441	0.259	0.144	0.026	0.287
5500	0.335	0.18	0.084	0.039	0.203
5600	0.339	0.184	0.088	0.037	0.207
5700	0.342	0.187	0.092	0.035	0.201
5800	0.255	0.119	0.937	0.064	0.141
5900	0.258	0.124	0.4200	0.061	0.143
6000	0.191	0.671	0.096	0.085	0.085

Table 6: Adapted auxiliary parameters for present work for our binary system.

Star AB Andromeda	B	V
u1	0.743	0.6051
u2	0.822	0.683
τ_1	1.48522	1.22152
τ_2	1.52065	0.7559
E_1	1.41631	3.35945
E_2	1.59463	0.27485

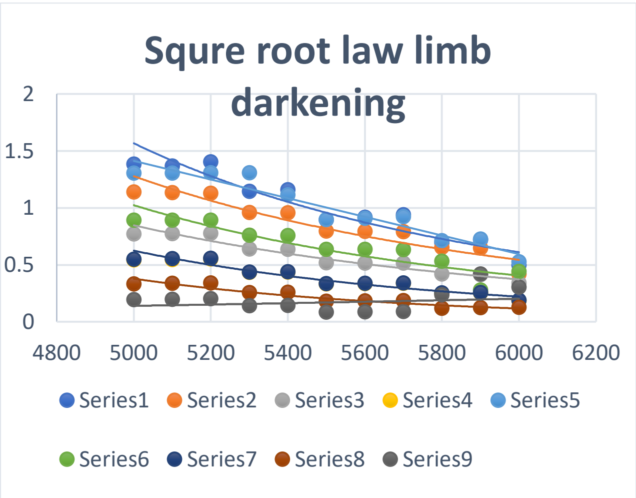

Figure 9: Square root LCD for AB And for all passbands.

9. CONCLUSION

In this paper. Van Hamm's latest interpolation has been used to evaluate LD for different monochromatic passbands. As well as radiative LD coefficients for linear and nonlinear logarithmic and square root LD rules. These coefficients and bolometric coefficients. Required to model binary starlight curves computed based on the latest ATLAS stellar atmosphere model. The following points have been concluded:

The LD picture is fairly simple, with radiation from the center of the stellar disk corresponding to approximately higher temperatures than radiation from the limbs. Therefore, under all conditions, one should expect the limbs to be darker than the center.

1- The majority of the authors who worked on the analysis stated that the effect of the learning difficulty is that linear approximate solution isn't the best. In each of our programmed learning difficulty laws, linear and nonlinear are presented. Non-linear LD laws were used in the present work to avoid the potential negative impact of false development of LD parameters.

2- The LDC is calculated for an effective temperature in the range 4000k to 10000k and a model atmosphere with log (g) = 4, surface of the star isn't uniformly bright in most stars, but it accompanies the distance from the center. Characteristic changes are observed.

3- Compared to Al-Niamey's table, referring to the graph, the logarithm law works best in the UV model, At expanded wavelengths, the square root law works well, with very low mass.

4- The mentioned figure show the results for linear LDC as a function of effective temperature in the rang 4000k - 30000k and log (g) in the range (2, 3, 3.5, 4, 4.5). In order to compare them with previous calculations (Al-Naimiy traditional 1978) tables for LDC.

5- Computed the LD (u) , gravity darkening (t) reflection effect for the star AB , and log(g)=4 the temperature of it is $T_1 = 5821k$ and $T_2 = 5450k$, where chosen the LD (u_1, u_2) by Van Hamme program was compute only choosing BV pass bands and the reflection effect calculated by equation (11) and the gravity darkening calculated by equation (12).

6- Finally, the understanding of LD is that as the temperature rises, the LD is inversely proportional to the temperature, the LD of any star or any disk decreases, and it depends on the passband, wavelength, and surface gravity of each star, occurs because of.

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