Age, Amplitude of accommodation and the Graphical law

Anindya Kumar Biswas*
Department of Physics;
North-Eastern Hill University,
Mawkynroh-Umshing, Shillong-793022.

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Abstract

We look into the Age(in years) vs Amplitude of accommodation(in Diopters) of eye. We draw the natural logarithm of the age, normalised, starting with an amplitude of accommodation of an eye vs the natural logarithm of the the amplitude of accommodation of the eye, normalised. We conclude that the Age vs Amplitude of accommodation of eyes, can be characterised by a magnetisation curve of a Spin-Glass in the presence of an external magnetic field.

* anindya@nehu.ac.in

I. INTRODUCTION

"The eye is a piece of brain that is touching light, so to speak, on the outside"
....Richard P. Feynman,[1].

We look through the eyes towards the outside. An eye is composed of two spherical parts, cornea and sclera, joined together along the limbus. At the limbus, attached to the ciliary muscles, through zonular fibers, the lens. The lens is composed of twenty two thousand layers, almost concentric, making the incoming light travel through it in bent zigzag path, allowing an image of an outside object to be formed on the fovea centralis in the macula on the retina. As we stare at the far distance, the lens is in the static or unaccommodated state. As we try to see closer and closer objects, the lens goes to the accommodated or, dynamic state, bulging in the equator. The difference of the accommodated and unaccommodated refractivity(bending power) is referred to as the amplitude of accommodation, expressed in the unit called Diopter,[2].

Alexander Duane, an ophthalmologist, one hundred years back, studied his patients' amplitudes of accommodation over a span of five years and expressed in the tabular form the maximum, minimum and mean amplitudes of accommodation as a function of age, [3]. R. F Fisher, [4], following him and others, examined the variation of the amplitude of accommodation with age taking the eyes, probably, from the eye banks and put forward a comparative study of different in vivo and in vitro results, in the Figure, Text-fig.12, [4].

With this in the perspective, we inquire, is there a magnetic field pattern behind this set? The answer is in the affirmative. The rest of the paper goes to elaborate on the affirmation. We have started considering magnetic field pattern in [5], in the languages we converse with. We have studied there, a set of natural languages, [5] and have found existence of a magnetisation curve under each language. We have termed this phenomenon as the Graphical Law.

Then, we moved on to investigate into, [6], dictionaries of five disciplines of knowledge and found existence of a curve magnetisation under each discipline. This was followed by finding of the graphical law behind the bengali language,[7] and the basque language[8]. This was pursued by finding of the graphical law behind the Romanian language, [9], five more disciplines of knowledge, [10], Onsager core of Abor-Miri, Mising languages,[11], Onsager Core of Romanised Bengali language,[12], the graphical law behind the Little Oxford English

Dictionary, [13], the Oxford Dictionary of Social Work and Social Care, [14], the Visayan-English Dictionary, [15], Garo to English School Dictionary, [16], Mursi-English-Amharic Dictionary, [17] and Names of Minor Planets, [18], A Dictionary of Tibetan and English, [19], Khasi English Dictionary, [20], Turkmen-English Dictionary, [21], Websters Universal Spanish-English Dictionary, [22], A Dictionary of Modern Italian, [23], Langenscheidt's German-English Dictionary, [24], Essential Dutch dictionary by G. Quist and D. Strik, [25], Swahili-English dictionary by C. W. Rechenbach, [26], Larousse Dictionnaire De Poche for the French, [27], the Onsager's solution behind the Arabic, [28], the graphical law behind Langenscheidt Taschenwörterbuch Deutsch-Englisch / Englisch-Deutsch, Völlige Neubearbeitung, [29], the graphical law behind the NTC's Hebrew and English Dictionary by Arie Comey and Naomi Tsur, [30], the graphical law behind the Oxford Dictionary Of Media and Communication, [31], the graphical law behind the Oxford Dictionary Of Mathematics, Penguin Dictionary Of Mathematics, [32], the Onsager's solution behind the Arabic Second part, [33], the graphical law behind the Penguin Dictionary Of Sociology, [34], behind the Concise Oxford Dictionary Of Politics, [35], a Dictionary Of Critical Theory by Ian Buchanan, [36], the Penguin Dictionary Of Economics, [37], the Concise Gojri-English Dictionary by Dr. Rafeeq Anjum, [38], A Dictionary of the Kachin Language by Rev.O.Hanson, [39], A Dictionary Of World History by Edmund Wright, [40], Ekagi-Dutch-English-Indonesian Dictionary by J. Steltenpool, [41], A Dictionary of Plant Sciences by Michael Allaby, [42], respectively. The graphical law was pursued more in Along the side of the Onsager's solution, the Ekagi language ,[43], Along the side of the Onsager's solution, the Ekagi language-Part Three, [44], Oxford Dictionary of Biology by Robert S. Hine and the Graphical law, [45], A Dictionary of the Mikir Language by G. D. Walker and the Graphical law, [46], A Dictionary of Zoology by Michael Allaby and the Graphical Law, [47], Dictionary of all Scriptures and Myths by G. A. Gaskell and the Graphical Law, [48], Dictionary of Culinary Terms by Philippe Pilibossian and the Graphical law, [49], A Greek and English Lexicon by H.G.Liddle et al simplified by Didier Fontaine and the Graphical law, [50], Learner's Mongol-English Dictionary and the Graphical law, [51], Complete Bulgarian-English Dictionary and the Graphical law, [52], A Dictionary of Sindhi Literature by Dr. Motilal Jotwani and the Graphical Law, [53], Penguin Dictionary of Physics, the Fourth Edition, by John Cullerne, and the Graphical law, [54], Oxford Dictionary of Chemistry, the seventh edition and the Graphical Law, [55], A Burmese-English Dictionary, Part I-Part V, by J. A. Stewart and C. W. Dunn et al, head entries and the Graphical Law, [56], The Graphical Law behind the head words of Dictionary Kannada and English written by W. Reeve, revised, corrected and enlarged by Daniel Sanderson, [57], Sanchayita and the Graphical Law, [58], Samsad Bangla Abhidan and The Graphical Law, [59], Bangiya Sabdakosh and The Graphical Law, [60], Samsad Bengali-English Dictionary and The Graphical Law, [61], Rudyard Kipling's Verse and the Graphical Law, [62], W. B. Yeats, The Poems and the Graphical Law, [63], The Penguin Encyclopedia of Places by W. G. Moore and the Graphical law, [64], The Poems of Tennyson and the Graphical Law, [65], Khasi-Jaintia Jaids(Surnames) and the Graphical law, [66], respectively.

The planning of the paper is as follows. We give an introduction to the standard curves of magnetisation of Ising model in the section II. In the section III and IV we describe the graphical law analysis of the representative points,[4] and all points,[3], of Alexander Duane related to the age dependence of amplitude of accommodation of human eyes. Sections V, VI are Acknowledgment and Bibliography respectively.

II. MAGNETISATION

A. Bragg-Williams approximation

Let us consider a coin. Let us toss it many times. Probability of getting head or, tale is half i.e. we will get head and tale equal number of times. If we attach value one to head, minus one to tale, the average value we obtain, after many tossing is zero. Instead let us consider a one-sided loaded coin, say on the head side. The probability of getting head is more than one half, getting tale is less than one-half. Average value, in this case, after many tossing we obtain is non-zero, the precise number depends on the loading. The loaded coin is like ferromagnet, the unloaded coin is like paramagnet, at zero external magnetic field. Average value we obtain is like magnetisation, loading is like coupling among the spins of the ferromagnetic units. Outcome of single coin toss is random, but average value we get after long sequence of tossing is fixed. This is long-range order. But if we take a small sequence of tossing, say, three consecutive tossing, the average value we obtain is not fixed, can be anything. There is no short-range order.

Let us consider a row of spins, one can imagine them as spears which can be vertically up or, down. Assume there is a long-range order with probability to get a spin up is two third. That would mean when we consider a long sequence of spins, two third of those are with spin up. Moreover, assign with each up spin a value one and a down spin a value minus one. Then total spin we obtain is one third. This value is referred to as the value of long-range order parameter. Now consider a short-range order existing which is identical with the long-range order. That would mean if we pick up any three consecutive spins, two will be up, one down. Bragg-Williams approximation means short-range order is identical with long-range order, applied to a lattice of spins, in general. Row of spins is a lattice of one dimension.

Now let us imagine an arbitrary lattice, with each up spin assigned a value one and a down spin a value minus one, with an unspecified long-range order parameter defined as above by $L = \frac{1}{N}\Sigma_i \sigma_i$, where σ_i is i-th spin, N being total number of spins. L can vary from minus one to one. $N = N_+ + N_-$, where N_+ is the number of up spins, N_- is the number of down spins. $L = \frac{1}{N}(N_+ - N_-)$. As a result, $N_+ = \frac{N}{2}(1+L)$ and $N_- = \frac{N}{2}(1-L)$. Magnetisation or, net magnetic moment , M is $\mu\Sigma_i\sigma_i$ or, $\mu(N_+ - N_-)$ or, μNL, $M_{max} = \mu N$. $\frac{M}{M_{max}} = L$. $\frac{M}{M_{max}}$ is referred to as reduced magnetisation. Moreover, the Ising Hamiltonian,[68], for the lattice of spins, setting μ to one, is $-\epsilon\Sigma_{n.n}\sigma_i\sigma_j - H\Sigma_i\sigma_i$, where n.n refers to nearest neighbour pairs. The difference $\triangle E$ of energy if we flip an up spin to down spin is, [69], $2\epsilon\gamma\bar{\sigma} + 2H$, where γ is the number of nearest neighbours of a spin. According to Boltzmann principle, $\frac{N_-}{N_+}$ equals $exp(-\frac{\triangle E}{k_B T})$, [70]. In the Bragg-Williams approximation,[71], $\bar{\sigma} = L$, considered in the thermal average sense. Consequently,

$$ln\frac{1+L}{1-L} = 2\frac{\gamma\epsilon L + H}{k_B T} = 2\frac{L + \frac{H}{\gamma\epsilon}}{\frac{T}{\gamma\epsilon/k_B}} = 2\frac{L+c}{\frac{T}{T_c}} \tag{1}$$

where, $c = \frac{H}{\gamma\epsilon}$, $T_c = \gamma\epsilon/k_B$, [72]. $\frac{T}{T_c}$ is referred to as reduced temperature.

Plot of L vs $\frac{T}{T_c}$ or, reduced magentisation vs. reduced temperature is used as reference curve. In the presence of magnetic field, $c \neq 0$, the curve bulges outward. Bragg-Williams is a Mean Field approximation. This approximation holds when number of neighbours interacting with a site is very large, reducing the importance of local fluctuation or, local order, making the long-range order or, average degree of freedom as the only degree of freedom of the lattice. To have a feeling how this approximation leads to matching between experimental and Ising model prediction one can refer to FIG.12.12 of [69]. W. L. Bragg was a professor of Hans Bethe. Rudlof Peierls was a friend of Hans Bethe. At the suggestion of W. L. Bragg, Rudlof

Peierls following Hans Bethe improved the approximation scheme, applying quasi-chemical method.

B. Bethe-peierls approximation in presence of four nearest neighbours, in absence of external magnetic field

In the approximation scheme which is improvement over the Bragg-Williams, [68],[69],[70],[71],[72], due to Bethe-Peierls, [73], reduced magnetisation varies with reduced temperature, for γ neighbours, in absence of external magnetic field, as

$$\frac{ln\frac{\gamma}{\gamma-2}}{ln\frac{factor-1}{factor^{\frac{\gamma-1}{\gamma}}-factor^{\frac{1}{\gamma}}}}=\frac{T}{T_c};factor=\frac{\frac{M}{M_{max}}+1}{1-\frac{M}{M_{max}}}. \tag{2}$$

$ln\frac{\gamma}{\gamma-2}$ for four nearest neighbours i.e. for $\gamma=4$ is 0.693. For a snapshot of different kind of magnetisation curves for magnetic materials the reader is urged to give a google search "reduced magnetisation vs reduced temperature curve". In the following, we describe datas generated from the equation(1) and the equation(2) in the table, I, and curves of magnetisation plotted on the basis of those datas. BW stands for reduced temperature in Bragg-Williams approximation, calculated from the equation(1). BP(4) represents reduced temperature in the Bethe-Peierls approximation, for four nearest neighbours, computed from the equation(2). The data set is used to plot fig.1. Empty spaces in the table, I, mean corresponding point pairs were not used for plotting a line.

C. Bethe-peierls approximation in presence of four nearest neighbours, in presence of external magnetic field

In the Bethe-Peierls approximation scheme , [73], reduced magnetisation varies with reduced temperature, for γ neighbours, in presence of external magnetic field, as

$$\frac{ln\frac{\gamma}{\gamma-2}}{ln\frac{factor-1}{e^{\frac{2\beta H}{\gamma}}factor^{\frac{\gamma-1}{\gamma}}-e^{-\frac{2\beta H}{\gamma}}factor^{\frac{1}{\gamma}}}}=\frac{T}{T_c};factor=\frac{\frac{M}{M_{max}}+1}{1-\frac{M}{M_{max}}}. \tag{3}$$

Derivation of this formula Ala [73] is given in the appendix of [10].

$ln\frac{\gamma}{\gamma-2}$ for four nearest neighbours i.e. for $\gamma=4$ is 0.693. For four neighbours,

$$\frac{0.693}{ln\frac{factor-1}{e^{\frac{2\beta H}{\gamma}}factor^{\frac{\gamma-1}{\gamma}}-e^{-\frac{2\beta H}{\gamma}}factor^{\frac{1}{\gamma}}}}=\frac{T}{T_c};factor=\frac{\frac{M}{M_{max}}+1}{1-\frac{M}{M_{max}}}. \tag{4}$$

BW	BW(c=0.01)	BP(4,βH = 0)	reduced magnetisation
0	0	0	1
0.435	0.439	0.563	0.978
0.439	0.443	0.568	0.977
0.491	0.495	0.624	0.961
0.501	0.507	0.630	0.957
0.514	0.519	0.648	0.952
0.559	0.566	0.654	0.931
0.566	0.573	0.7	0.927
0.584	0.590	0.7	0.917
0.601	0.607	0.722	0.907
0.607	0.613	0.729	0.903
0.653	0.661	0.770	0.869
0.659	0.668	0.773	0.865
0.669	0.676	0.784	0.856
0.679	0.688	0.792	0.847
0.701	0.710	0.807	0.828
0.723	0.731	0.828	0.805
0.732	0.743	0.832	0.796
0.756	0.766	0.845	0.772
0.779	0.788	0.864	0.740
0.838	0.853	0.911	0.651
0.850	0.861	0.911	0.628
0.870	0.885	0.923	0.592
0.883	0.895	0.928	0.564
0.899	0.918		0.527
0.904	0.926	0.941	0.513
0.946	0.968	0.965	0.400
0.967	0.998	0.965	0.300
0.987		1	0.200
0.997		1	0.100
1	1	1	0

TABLE I. Reduced magnetisation vs reduced temperature datas for Bragg-Williams approximation, in absence of and in presence of magnetic field, $c = \frac{H}{\gamma\epsilon} = 0.01$, and Bethe-Peierls approximation in absence of magnetic field, for four nearest neighbours .

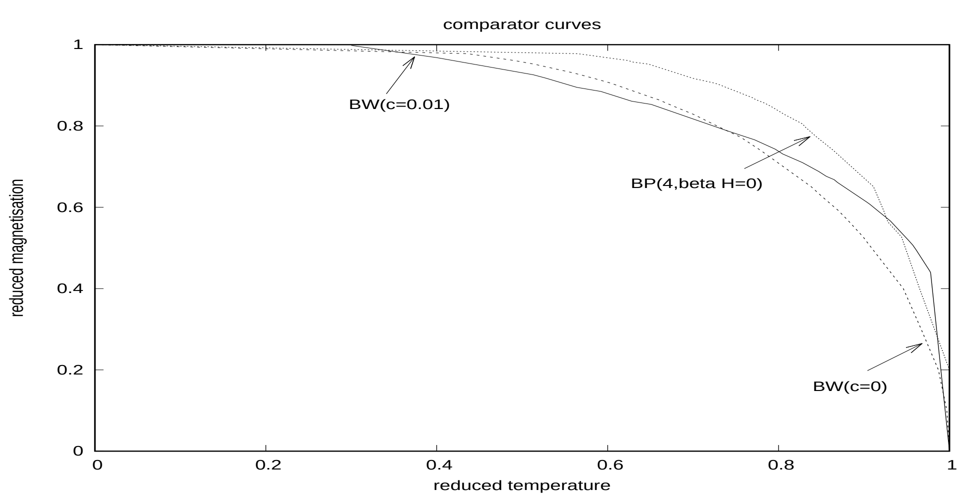

FIG. 1. Reduced magnetisation vs reduced temperature curves for the Bragg-Williams approximation, in the absence(broken line) of, BW(c=0) and the presence(inner in the top) of, BW(c=0.01), the external magnetic field, $c = \frac{H}{\gamma\epsilon} = 0.01$, and the Bethe-Peierls approximation in the absence of external magnetic field, for four nearest neighbours (outer in the top).

In the following, we describe data s in the table, II, generated from the equation(4) and curves of magnetisation plotted on the basis of those data s. BP(m=0.03) stands for reduced temperature in Bethe-Peierls approximation, for four nearest neighbours, in presence of a variable external magnetic field, H, such that $\beta H = 0.06$. calculated from the equation(4). BP(m=0.025) stands for reduced temperature in Bethe-Peierls approximation, for four nearest neighbours, in presence of a variable external magnetic field, H, such that $\beta H = 0.05$. calculated from the equation(4). BP(m=0.02) stands for reduced temperature in Bethe-Peierls approximation, for four nearest neighbours, in presence of a variable external magnetic field, H, such that $\beta H = 0.04$. calculated from the equation(4). BP(m=0.01) stands for reduced temperature in Bethe-Peierls approximation, for four nearest neighbours, in presence of a variable external magnetic field, H, such that $\beta H = 0.02$. calculated from the equation(4). BP(m=0.005) stands for reduced temperature in Bethe-Peierls approximation, for four nearest neighbours, in presence of a variable external magnetic field, H, such that $\beta H = 0.01$. calculated from the equation(4). The data set is used to plot fig.3. Similarly, we plot fig.4. Empty spaces in the table, II, mean corresponding point pairs were not used for plotting a line.

BP(m=0.03)	BP(m=0.025)	BP(m=0.02)	BP(m=0.01)	BP(m=0.005)	reduced magnetisation
0	0	0	0	0	1
0.583	0.580	0.577	0.572	0.569	0.978
0.587	0.584	0.581	0.575	0.572	0.977
0.647	0.643	0.639	0.632	0.628	0.961
0.657	0.653	0.649	0.641	0.637	0.957
0.671	0.667		0.654	0.650	0.952
	0.716			0.696	0.931
0.723	0.718	0.713	0.702	0.697	0.927
0.743	0.737	0.731	0.720	0.714	0.917
0.762	0.756	0.749	0.737	0.731	0.907
0.770	0.764	0.757	0.745	0.738	0.903
0.816	0.808	0.800	0.785	0.778	0.869
0.821	0.813	0.805	0.789	0.782	0.865
0.832	0.823	0.815	0.799	0.791	0.856
0.841	0.833	0.824	0.807	0.799	0.847
0.863	0.853	0.844	0.826	0.817	0.828
0.887	0.876	0.866	0.846	0.836	0.805
0.895	0.884	0.873	0.852	0.842	0.796
0.916	0.904	0.892	0.869	0.858	0.772
0.940	0.926	0.914	0.888	0.876	0.740
	0.929			0.877	0.735
	0.936			0.883	0.730
	0.944			0.889	0.720
	0.945				0.710
	0.955			0.897	0.700
	0.963			0.903	0.690
	0.973			0.910	0.680
				0.909	0.670
	0.993			0.925	0.650
		0.976	0.942		0.651
	1.00				0.640
		0.983	0.946	0.928	0.628
		1.00	0.963	0.943	0.592
			0.972	0.951	0.564
			0.990	0.967	0.527
				0.964	0.513
			1.00		0.500
				1.00	0.400
					0.300
					0.200
					0.100
					0

TABLE II. Bethe-Peierls approx. in presence of little external magnetic fields

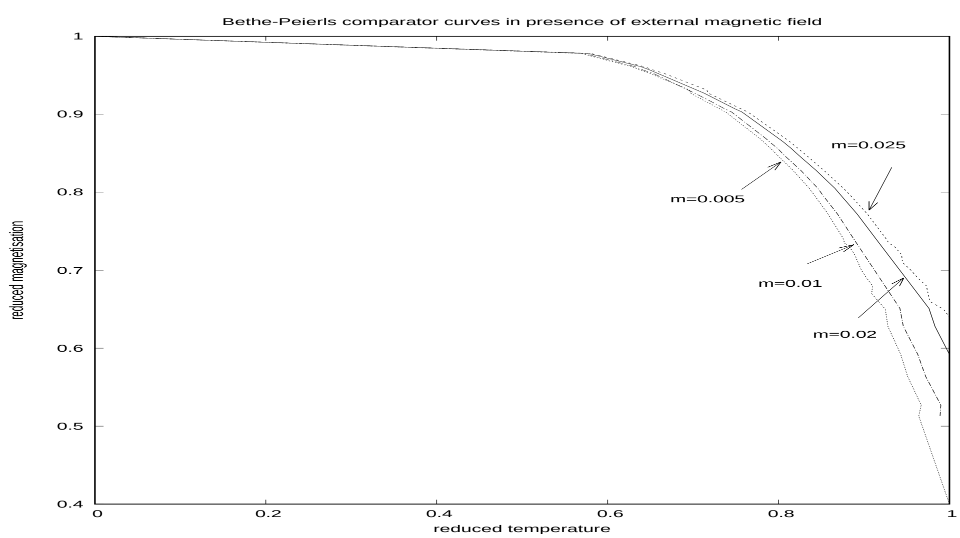

FIG. 2. Reduced magnetisation vs reduced temperature curves for Bethe-Peierls approximation in presence of little external magnetic fields, for four nearest neighbours, with $\beta H = 2m$.

D. Spin Glass

In the case coupling between the spins in the Ising model is random, we get Spin-Glass,[74]. To understand, let us consider a row of coins, unloaded and coupled randomly(alternately a row of spins). Probability to get two heads for the same coin differs from one fourth, however apart in time the coin is "tossed", due to random coupling. At a particular time, net value of of head(alternately net value of spin or, net magnetic moment or, average magnetic moment over the row or, magnetisation) is zero due to random coupling. Long-range order in space is zero. But correlation of two heads for a particular coin over long time is non-zero, due to random coupling. This is long-range order in time. Crudely speaking, existence of this long-range order in time, [75], is referred to as Spin-Glass phase. Going from a row of fixedly coupled unloaded coins(alternately spins) to a row of randomly coupled unloaded coins(alternately spins) is like going over to Spin-Glass phase or, is like occurance of a Spin-Glass phase transition. When a lattice of spins randomly coupled and in an external magnetic field, goes over to the Spin-Glass phase, magnetisation increases steeply like $\frac{1}{T-T_c}$ up to the the phase transition temperature, followed by very little increase,[74], in magnetisation, as the ambient temperature continues to drop.

Amplitude of accommodation(D)	12.5	11	9.8	8.5	7.3	5.8	3.8	1.8	1.2	1.3	1.1	1
Age(years)	14.5	20	25	30	35	40	45	50	56	60	65	70

TABLE III. Age-Power: the first row represents amplitude of accommodation of an eye in the serial order, the second row is the respective age of the eye.

D	lnD	lnD/lnD_{lim}	Y	lnY	lnY/lnY_{max}
1	0	0	70	4.248	1
1.1	0.0.095	0.036	65	4.174	0.983
1.2	0.182	0.099	56	4.025	0.948
1.3	0.262	0.069	60	4.094	0.964
1.8	0.588	0.223	50	3.912	0.921
3.8	1.335	0.506	45	3.807	0.896
5.8	1.758	0.666	40	3.689	0.868
7.3	1.988	0.753	35	3.555	0.837
8.5	2.140	0.811	30	3.401	0.801
9.8	2.282	0.865	25	3.219	0.758
11	2.398	0.909	20	2.996	0.705
12.5	2.526	0.957	14.5	2.674	0.629
14	2.639	1	1	0	0

TABLE IV. Age-Power: ranking, natural logarithm, normalisations

III. THE GRAPHICAL LAW ANALYSIS: REPRESENTATIVE POINTS

We read off from the Figure, Text-fig.12. of the paper, [4], of the following representative data s, of Alexander Duane's, in the tabular form in the table, III.

For the purpose of exploring graphical law, we assort the Amplitude of accommodation(in Diopters), in the ascending order, denoted by D. We attach a limiting Amplitude of accommodation(in Diopters), 14, [2], corresponding to the age, Y, equal to one. The limiting age, Y_{lim}, is one. As a result both $\frac{lnY}{lnY_{max}}$ and $\frac{lnD}{lnD_{lim}}$ varies from zero to one. Then we tabulate in the adjoining table, IV, and plot $\frac{lnY}{lnY_{max}}$ against $\frac{lnD}{lnD_{lim}}$ in the figure fig.3.

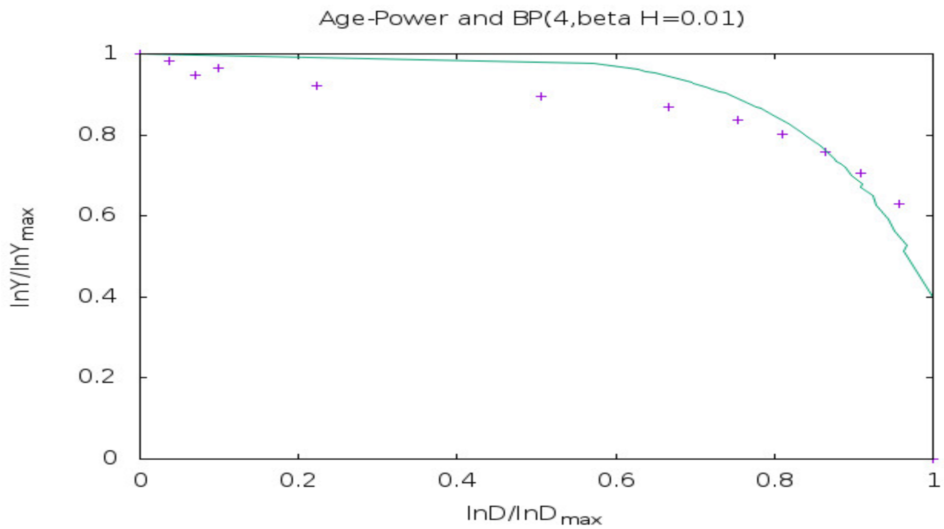

FIG. 3. The vertical axis is $\frac{lnY}{lnY_{lim}}$ and the horizontal axis is $\frac{lnD}{lnD_{lim}}$. The + points represent the representative points of Duane,[3], with the fit curve being Bethe-Peierls curve in presence of four nearest neighbours and little magnetic field, $m = 0.005$ or, $\beta H = 0.01$.

A. tentative conclusion

From the figure fig.3, we observe that there is a curve of magnetisation, behind the Age-Power. This is the magnetisation curve in the Bethe-Peierls approximation of the Ising model, in the presence of four nearest neighbours and little magnetic field, $m = 0.005$ or, $\beta H = 0.01$. Moreover, the associated correspondence is,

$$\frac{lnY}{lnY_{max}} \longleftrightarrow \frac{M}{M_{max}},$$

$$lnD \longleftrightarrow T.$$

Accommodation amplitude, D, corresponds to temperature in an exponential scale, [76]. As temperature decreases, i.e. lnD decreases, age,Y, increases.

IV. THE GRAPHICAL LAW ANALYSIS: ALL POINTS

The representative datas of Alexander Duane, as it appears in the Figure, Text-fig.12., of the paper, [4], coincide with the mean amplitude of accommodation data appearing in the paper of Alexander Duane, [3], as we see in the Figure, fig.4. Moreover, the magnetisation

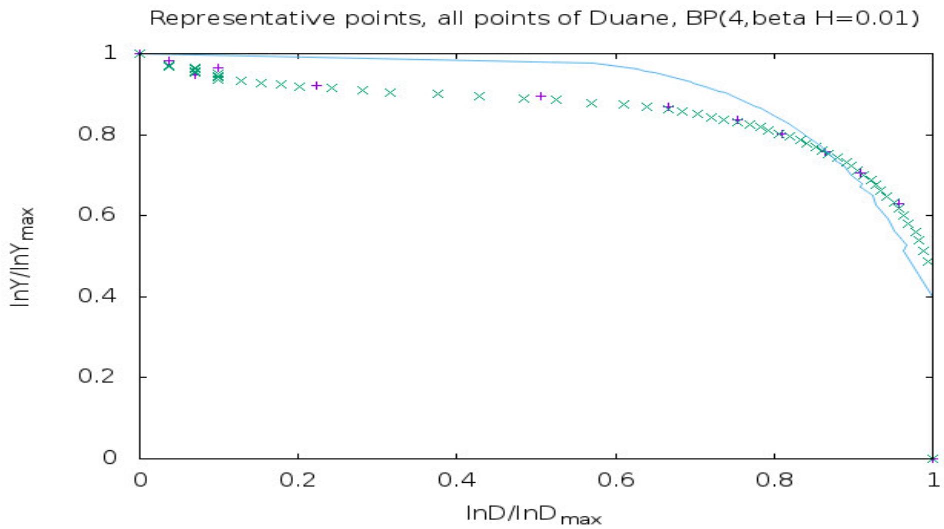

FIG. 4. The vertical axis is $\frac{lnY}{lnY_{lim}}$ and the horizontal axis is $\frac{lnD}{lnD_{lim}}$. The + points represent the representative points of Duane as it appears in the Figure, Text-fig.12., of the paper, [4], the × points representing all points of Duane, [3], with the fit curve being Bethe-Peierls curve in presence of four nearest neighbours and little magnetic field, $m = 0.005$ or, $\beta H = 0.01$.

curve in the Bethe-Peierls approximations of the Ising model, as a fit curve, is with large dispersions from the data points, presented in the table, V, obtained similarly as the table, IV. To explore for the possible existence of a magnetisation curve of a Spin-Glass in presence of an external magnetic field, underlying all points of Duane, [3], we draw the Figures fig.5 and fig.6 respectively.

D	lnD/lnD_{lim}	Y	lnY/lnY_{max}
1	0	72	1
1.1	0.036	64	0.972
1.1	0.036	63	0.969
1.2	0.069	62	0.965
1.2	0.069	61	0.961
1.2	0.069	60	0.957
1.2	0.069	59	0.953
1.3	0.099	58	0.949
1.3	0.099	57	0.945
1.3	0.099	56	0.941
1.3	0.099	55	0.937
1.4	0.127	54	0.933
1.5	0.154	53	0.928
1.6	0.178	52	0.924
1.7	0.201	51	0.919
1.9	0.243	50	0.915
2.1	0.281	49	0.910
2.3	0.316	48	0.905
2.7	0.376	47	0.900
3.1	0.429	46	0.895
3.6	0.485	45	0.890
4	0.525	44	0.885
4.5	0.570	43	0.879
5	0.610	42	0.874
5.4	0.639	41	0.868
5.8	0.666	40	0.863
6.1	0.685	39	0.857
6.4	0.703	38	0.851
6.7	0.721	37	0.844
7	0.737	36	0.838
7.3	0.753	35	0.831
7.6	0.769	34	0.825
7.9	0.783	33	0.818
8.1	0.793	32	0.810
8.4	0.806	31	0.803
8.7	0.820	30	0.795
9	0.833	29	0.787
9.2	0.841	28	0.779
9.5	0.853	27	0.771
9.7	0.861	26	0.762
9.9	0.869	25	0.753
10.2	0.880	24	0.743
10.5	0.891	23	0.733
10.7	0.898	22	0.723
10.9	0.905	21	0.712
11.1	0.912	20	0.700
11.4	0.922	19	0.688
11.6	0.929	18	0.676
11.8	0.935	17	0.662
12	0.942	16	0.648
12.3	0.951	15	0.633
12.5	0.957	14	0.617
12.7	0.963	13	0.600
12.9	0.969	12	0.581
13.2	0.978	11	0.561
13.4	0.983	10	0.538
13.6	0.989	9	0.514
13.8	0.995	8	0.486
14	1	1	0

TABLE V. Age-Power: ranking, natural logarithm, normalisations

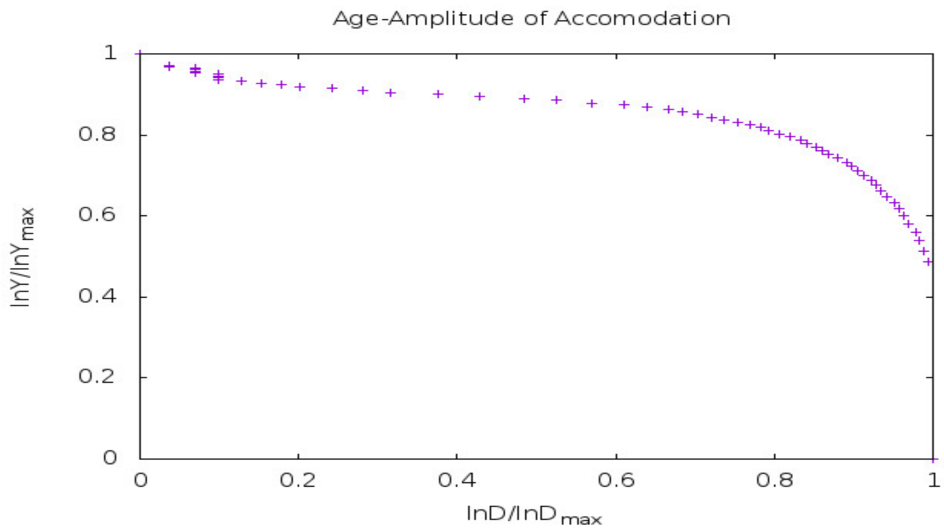

FIG. 5. The vertical axis is $\frac{lnY}{lnY_{lim}}$ and the horizontal axis is $\frac{lnD}{lnD_{lim}}$. The + points represent the points of Duane,[3].

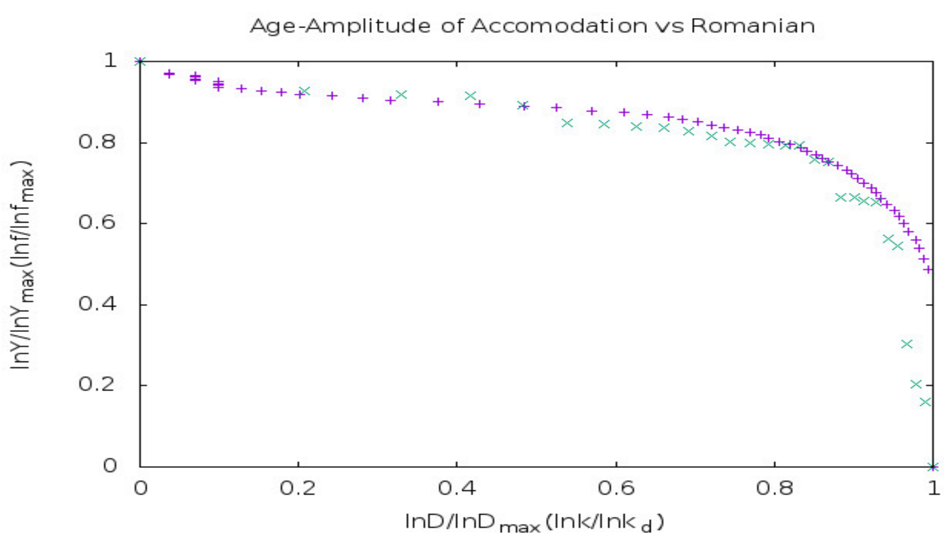

FIG. 6. The + points represent the data points of Duane,[3] with the vertical axis being $\frac{lnY}{lnY_{max}}$ and the horizontal axis being $\frac{lnD}{lnD_{max}}$. The $\times$ points with the vertical axis being $\frac{lnf}{lnf_{max}}$ and the horizontal axis being $\frac{lnk}{lnk_{lim}}$, represent the words of the Romanian language, [9].

A. conclusion

In our earlier paper, [9], on the Romanian language, we have concluded that a magnetisation curve of a Spin-Glass in the presence of an external magnetic field, underlies Romanian words. From the Figure fig.6, where the two sets of points almost go in unison, we surmise that a magnetisation curve of a Spin-Glass in the presence of an external magnetic field also underlies the age vs accommodation amplitude curve in human being. In other words, Spin-Glass transition in the presence of an external magnetic field with respect to temperature characterises aging transition related to presbyopia.

V. ACKNOWLEDGEMENT

We have used gnuplot for drawing the figures. It will be interesting to do this analysis for the other works, [77],[78]. Unfortunately, we do not have these two references with us.

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