

The Vietnamese-English Dictionary by Mrs. Le Van Hung and Dr. Le Van Hung and The Graphical Law

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(Dated: May 15, 2025)

Abstract

We study the Vietnamese words of the Vietnamese-English Dictionary, by Mrs. Le Van Hung and Dr. Le Van Hung. We draw the natural logarithm of the number of words, normalised, starting with a letter vs the natural logarithm of the rank of the letter, normalised. We conclude that the dictionary can be characterised by the magnetisation curve, $BP(4, \beta H = 0.01)$, in the Bethe-Peierls approximation of the Ising Model, in the presence of four nearest neighbours and little external magnetic field, H , with $\beta H = 0.01$. β is $\frac{1}{k_B T}$ where, T is temperature and k_B is the tiny Boltzmann constant.

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A	Ă	Â	B	C	D	Đ	E	Ê	G	H	I	K	L	M	N	O	Ô	Ơ	P	Q	R	S	T	U	Ư	V	X	Y
214	110	208	2170	3570	1033	2027	33	28	1079	2326	38	1800	1975	1274	3400	121	133	40	1356	826	540	1285	6719	227	186	1500	904	142

TABLE I. The words of Vietnamese-English Dictionary, by Mrs. Le Van Hung and Dr. Le Van Hung

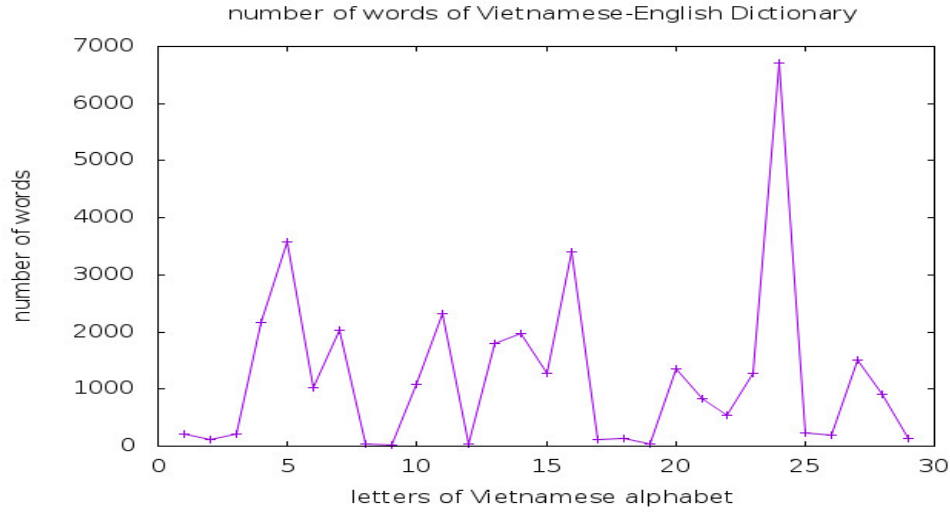


FIG. 1. The vertical axis is number of the the words of Vietnamese-English Dictionary, by Mrs. Le Van Hung and Dr. Le Van Hung, [1]. The horizontal axis is the letters of the Vietnamese alphabet. Letters are represented by the sequence number in the alphabet as it appears in the dictionary, [1].

I. INTRODUCTION

Name of the country situated in the South-East Asia is Vietnam. People are Vietnamese. Here, we go into the language they converse in. A monosyllabic language, [1], it is. As we came across a Vietnamese-English Dictionary, we start going through the words of the dictionary. This is Vietnamese-English Dictionary, prepared by Mrs. Le Van Hung, Fellow of the Institute of Linguists, London and Dr. Le Van Hung, [1], way back in 1955. We count all the Vietnamese words of the dictionary, [1], one by one from the beginning to the end. The result is the table, tableI. To visualise we plot the number of words against the respective letters in the dictionary sequence, [1], in the adjoining figure, fig.1.

Next we look for the graphical law. We have started considering magnetic field pattern in [2], in the languages we converse with. We have studied there, a set of natural languages, [2] and

have found the existence of a magnetisation curve under each language. We have termed this phenomenon as the Graphical Law. Then, we moved on to investigate, [3], into dictionaries of five disciplines of knowledge and found the existence of a curve of magnetisation under each discipline. This was followed by finding of the graphical law in the references from [4] to [99].

The planning of the paper is as follows. In the next section, we describe the Graphical Law analysis of the words of the Vietnamese-English Dictionary, by Mrs. Le Van Hung and Dr. Le Van Hung, [1]. In the section III, we give an introduction to the standard curves of magnetisation of Ising model. The section IV is Acknowledgment. The last section is Bibliography.

II. THE GRAPHICAL LAW ANALYSIS

For the purpose of exploring graphical law, we assort the letters according to the number of words, in the descending order, denoted by f and the respective rank, [100], denoted by k . k is a positive integer starting from one. Moreover, the minimum non-zero number of words is twenty eight. Hence, we attach a limiting word number one. The limiting rank is maximum rank plus one, here it is thirty. As a result both $\frac{\ln f}{\ln f_{max}}$ and $\frac{\ln k}{\ln k_{lim}}$ varies from zero to one. Then we tabulate in the adjoining table, II, and plot $\frac{\ln f}{\ln f_{max}}$ against $\frac{\ln k}{\ln k_{lim}}$ in the figure fig.2. We then ignore the letter with the highest number of words to start with, tabulate in the adjoining table, II, and redo the plot, normalising the $\ln f$ s with $\ln f_{n-max}$, and starting from $k = 2$ in the figure fig.3. Normalising the $\ln f$ s with $\ln f_{2n-max}$, we tabulate in the adjoining table, II, and starting from $k = 3$ we draw in the figure fig.4. Normalising the $\ln f$ s with $\ln f_{3n-max}$ we record in the adjoining table, II, and plot starting from $k = 4$ in the figure fig.5. In this way we obtain up to the figure fig.7.

k	lnk	$\ln k / \ln k_{lim}$	f	lnf	$\ln f / \ln f_{max}$	$\ln f / \ln f_{n-max}$	$\ln f / \ln f_{2n-max}$	$\ln f / \ln f_{3n-max}$	$\ln f / \ln f_{4n-max}$	$\ln f / \ln f_{5n-max}$
1	0	0	6719	8.813	1	Blank	Blank	Blank	Blank	Blank
2	0.69	0.203	3570	8.180	0.928	1	Blank	Blank	Blank	Blank
3	1.10	0.324	3400	8.132	0.923	0.994	1	Blank	Blank	Blank
4	1.39	0.409	2326	7.752	0.880	0.948	0.953	1	Blank	Blank
5	1.61	0.474	2170	7.682	0.872	0.939	0.945	0.991	1	Blank
6	1.79	0.526	2027	7.614	0.864	0.931	0.936	0.982	0.991	1
7	1.95	0.574	1975	7.588	0.861	0.928	0.933	0.979	0.988	0.997
8	2.08	0.612	1800	7.496	0.851	0.916	0.922	0.967	0.976	0.985
9	2.20	0.647	1500	7.313	0.830	0.894	0.899	0.943	0.952	0.960
10	2.30	0.676	1356	7.212	0.818	0.882	0.887	0.930	0.939	0.947
11	2.40	0.706	1285	7.159	0.812	0.875	0.880	0.924	0.932	0.940
12	2.48	0.729	1274	7.150	0.811	0.874	0.879	0.922	0.931	0.939
13	2.56	0.753	1079	6.984	0.792	0.854	0.859	0.901	0.909	0.917
14	2.64	0.776	1033	6.940	0.787	0.848	0.853	0.895	0.903	0.911
15	2.71	0.797	904	6.807	0.772	0.832	0.837	0.878	0.886	0.894
16	2.77	0.815	826	6.717	0.762	0.821	0.826	0.866	0.874	0.882
17	2.83	0.832	540	6.292	0.714	0.769	0.774	0.812	0.819	0.826
18	2.89	0.850	227	5.425	0.616	0.663	0.667	0.700	0.706	0.713
19	2.94	0.865	214	5.366	0.609	0.656	0.660	0.692	0.699	0.705
20	3.00	0.882	208	5.338	0.606	0.653	0.656	0.689	0.695	0.701
21	3.04	0.894	186	5.226	0.593	0.639	0.643	0.674	0.680	0.686
22	3.09	0.909	142	4.956	0.562	0.606	0.609	0.639	0.645	0.651
23	3.14	0.924	133	4.890	0.555	0.598	0.601	0.631	0.637	0.642
24	3.18	0.935	121	4.796	0.544	0.586	0.590	0.619	0.624	0.630
25	3.22	0.947	110	4.700	0.533	0.575	0.578	0.606	0.612	0.617
26	3.26	0.959	40	3.689	0.419	0.451	0.454	0.476	0.480	0.485
27	3.30	0.971	38	3.638	0.413	0.445	0.447	0.469	0.474	0.478
28	3.33	0.979	33	3.497	0.397	0.428	0.430	0.451	0.455	0.459
29	3.37	0.991	28	3.332	0.378	0.407	0.410	0.430	0.434	0.438
30	3.40	1	1	0	0	0	0	0	0	0

TABLE II. Words of The Vietnamese-English Dictionary, by Mrs. Le Van Hung and Dr. Le Van Hung: ranking, natural logarithm, normalisations

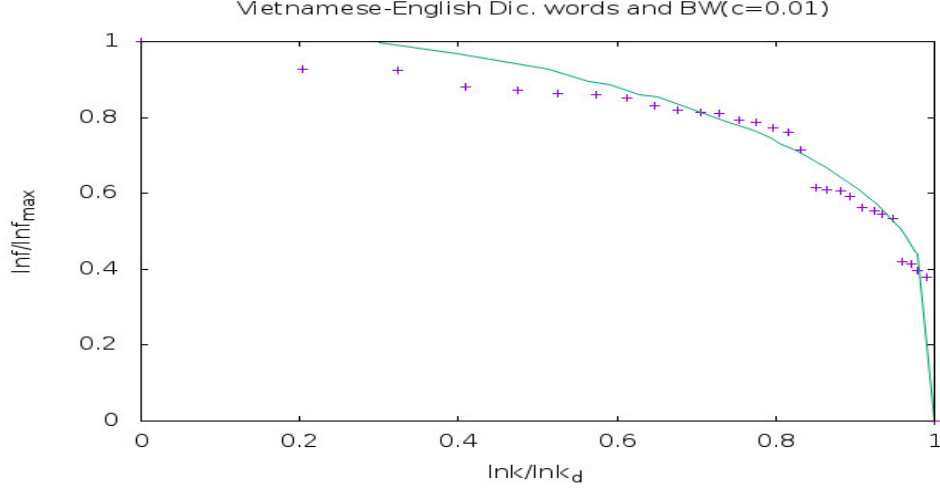


FIG. 2. The vertical axis is $\frac{\ln f}{\ln f_{\max}}$ and the horizontal axis is $\frac{\ln k}{\ln k_{\lim}}$. The + points represent the words of the Vietnamese-English Dictionary, by Mrs. Le Van Hung and Dr. Le Van Hung, with the fit curve being the Bragg-Williams curve, BW($c=0.01$), in the presence of external magnetic field, H , with $c = \frac{H}{\gamma^\epsilon} = 0.01$.

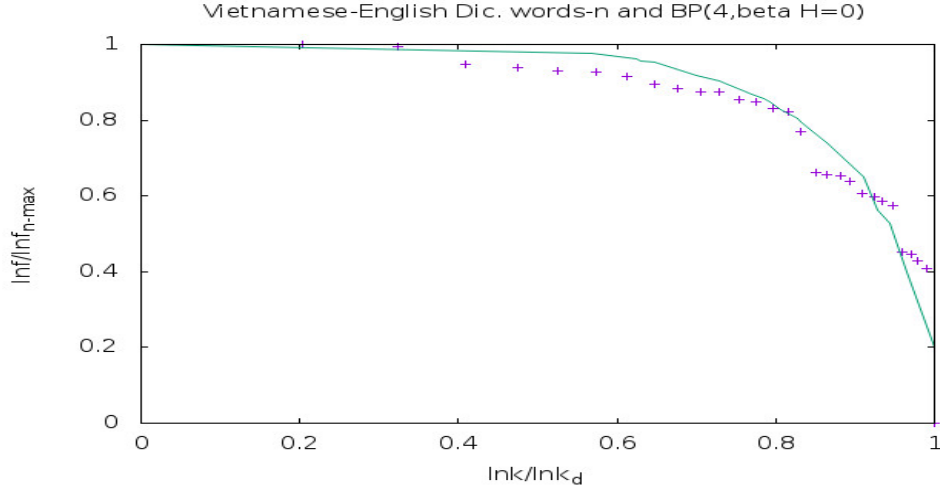


FIG. 3. The vertical axis is $\frac{\ln f}{\ln f_{n-\max}}$ and the horizontal axis is $\frac{\ln k}{\ln k_{\lim}}$. The + points represent the words of the Vietnamese-English Dictionary, by Mrs. Le Van Hung and Dr. Le Van Hung, with the fit curve, BP($4, \beta H = 0$), being the Bethe-Peierls curve in the presence of four nearest neighbours and in the absence of external magnetic field i.e. $m = 0$ or, $\beta H = 0$.

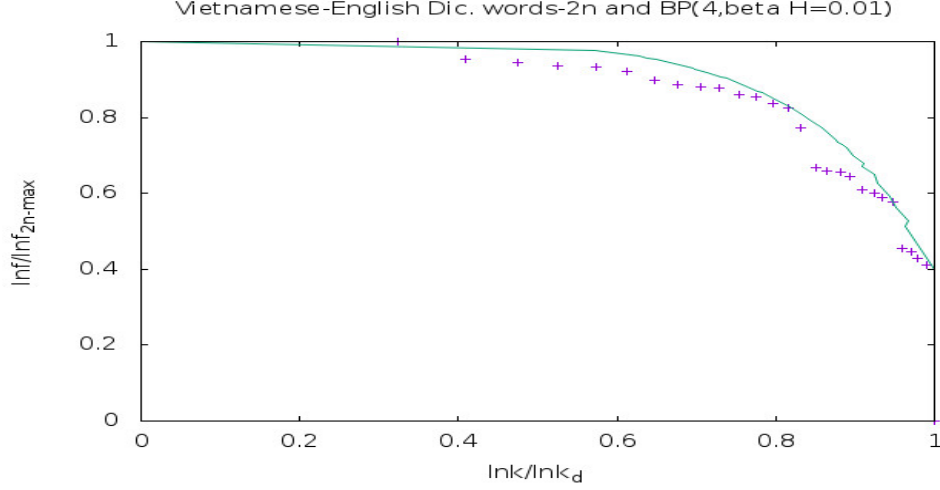


FIG. 4. The vertical axis is $\frac{\ln f}{\ln f_{2n-\max}}$ and the horizontal axis is $\frac{\ln k}{\ln k_{lim}}$. The + points represent the words of the Vietnamese-English Dictionary, by Mrs. Le Van Hung and Dr. Le Van Hung, with the fit curve, $BP(4, \beta H = 0.01)$, being the Bethe-Peierls curve in the presence of four nearest neighbours and external magnetic field, $m = 0.005$ or, $\beta H = 0.01$.

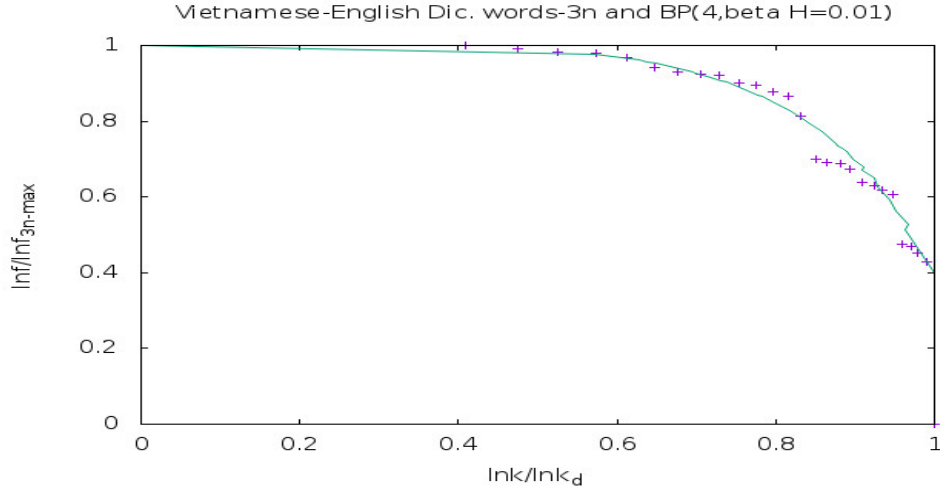


FIG. 5. The vertical axis is $\frac{\ln f}{\ln f_{3n-\max}}$ and the horizontal axis is $\frac{\ln k}{\ln k_{lim}}$. The + points represent the words of the Vietnamese-English Dictionary, by Mrs. Le Van Hung and Dr. Le Van Hung, with the fit curve, $BP(4, \beta H = 0.01)$, being the Bethe-Peierls curve in the presence of four nearest neighbours and external magnetic field, $m = 0.005$ or, $\beta H = 0.01$.

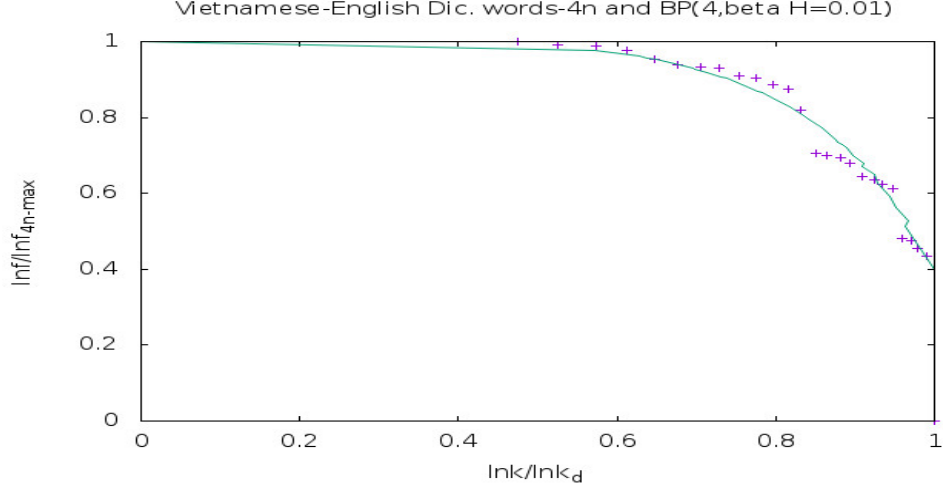


FIG. 6. The vertical axis is $\frac{\ln f}{\ln f_{4n-\max}}$ and the horizontal axis is $\frac{\ln k}{\ln k_{lim}}$. The + points represent the words of the Vietnamese-English Dictionary, by Mrs. Le Van Hung and Dr. Le Van Hung, with the fit curve, BP(4, $\beta H = 0.01$), being the Bethe-Peierls curve in the presence of four nearest neighbours and external magnetic field, $m = 0.005$ or, $\beta H = 0.01$.

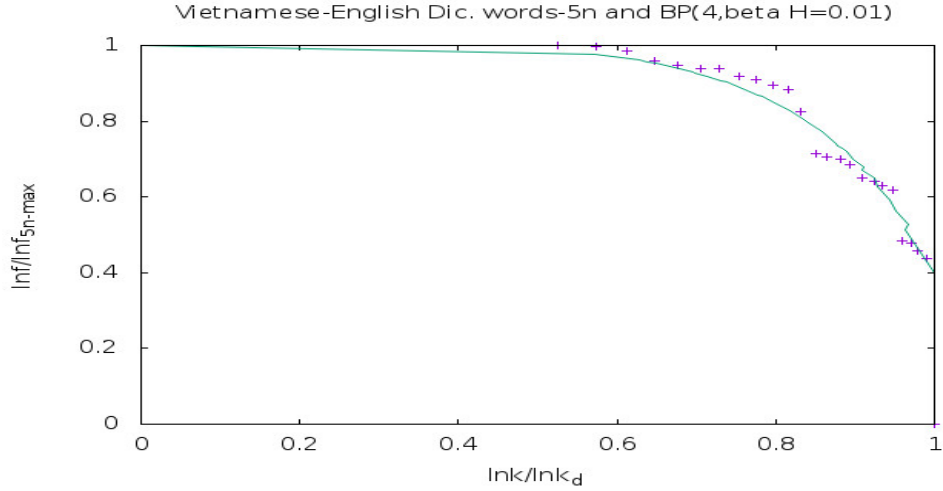


FIG. 7. The vertical axis is $\frac{\ln f}{\ln f_{5n-\max}}$ and the horizontal axis is $\frac{\ln k}{\ln k_{lim}}$. The + points represent the words of the Vietnamese-English Dictionary, by Mrs. Le Van Hung and Dr. Le Van Hung, with the fit curve, BP(4, $\beta H = 0.01$), being the Bethe-Peierls curve in the presence of four nearest neighbours and external magnetic field, $m = 0.005$ or, $\beta H = 0.01$.

A. conclusion

From the figures (fig.2-fig.7), we observe that there is a curve of magnetisation, behind the words of the Vietnamese-English Dictionary, by Mrs. Le Van Hung and Dr. Le Van Hung,[1]. This is the magnetisation curve in the Bethe-Peierls approximation of the Ising model, BP(4, $\beta H = 0.01$), in the presence of four nearest neighbours and little external magnetic field, $m = 0.005$ or, $\beta H = 0.01$

Moreover, the associated correspondence is,

$$\frac{\ln f}{\ln f_{3n-max}} \longleftrightarrow \frac{M}{M_{max}},$$
$$\ln k \longleftrightarrow T.$$

k corresponds to temperature in an exponential scale, [107].

III. APENDIX: 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 para magnet, 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 $L = \frac{1}{N} \sum_i \sigma_i$, 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 $\mu \sum_i \sigma_i$ or, $\mu(N_+ - N_-)$ or, $\mu N L$, $M_{max} = \mu N$. $\frac{M}{M_{max}} = L$.

$\frac{M}{M_{max}}$ is referred to as reduced magnetisation. Moreover, the Ising Hamiltonian,[101], for the lattice of spins, setting μ to one, is $-\epsilon \sum_{n,n} \sigma_i \sigma_j - H \sum_i \sigma_i$, where n.n refers to nearest neighbour pairs.

The difference ΔE of energy if we flip an up spin to down spin is, [102], $2\epsilon\gamma\bar{\sigma} + 2H$, where γ is the number of nearest neighbours of a spin. According to Boltzmann principle, $\frac{N_-}{N_+}$ equals $\exp(-\frac{\Delta E}{k_B T})$, [103]. In the Bragg-Williams approximation,[104], $\bar{\sigma} = L$, considered in the thermal average sense. Consequently,

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

where, $c = \frac{H}{\gamma\epsilon}$, $T_c = \gamma\epsilon/k_B$, [105]. $\frac{T}{T_c}$ is referred to as reduced temperature.

Plot of L vs $\frac{T}{T_c}$ or, reduced magnetisation 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 [102]. W. L. Bragg was a professor of Hans Bethe. Rudolf Peierls was a friend of Hans Bethe. At the suggestion of W. L. Bragg, Rudolf Peierls following Hans Bethe improved the approximation scheme, applying quasi-chemical method.

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

In the approximation scheme which is improvement over the Bragg-Williams, [101],[102],[103],[104],[105], due to Bethe-Peierls, [106], reduced magnetisation varies with reduced temperature, for γ neighbours, in absence of external magnetic field, as

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

$\ln \frac{\gamma}{\gamma-2}$ 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

BW	BW($c=0.01$)	BP($4, \beta H = 0$)	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 III. Reduced magnetisation vs reduced temperature data s 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.

search "reduced magnetisation vs reduced temperature curve". In the following, we describe data s generated from the equation(1) and the equation(2) in the table, III, and curves of magnetisation plotted on the basis of those data s. 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.8. Empty spaces in the table, III, mean corresponding point pairs were not used for plotting a line.

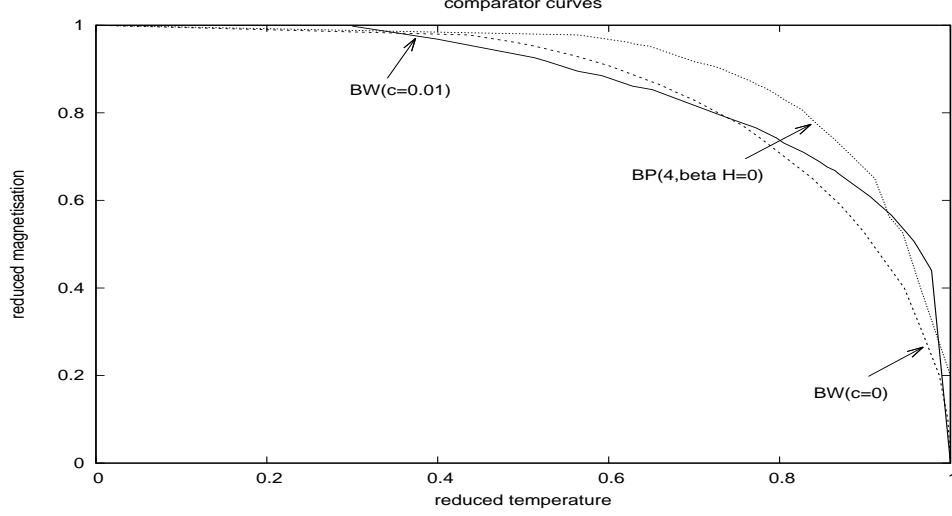


FIG. 8. Reduced magnetisation vs reduced temperature curves for Bragg-Williams approximation, in absence(dark) of and presence(inner in the top) of magnetic field, $c = \frac{H}{\gamma\epsilon} = 0.01$, and Bethe-Peierls approximation in absence of magnetic field, for four nearest neighbours (outer in the top).

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

In the Bethe-Peierls approximation scheme , [106], reduced magnetisation varies with reduced temperature, for γ neighbours, in presence of external magnetic field, as

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

Derivation of this formula ala [106] is given in the appendix of [7].

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

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

In the following, we describe datas in the table, IV, generated from the equation(4) and curves of magnetisation plotted on the basis of those datas. 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.9. Empty spaces in the table, IV, 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 IV. Bethe-Peierls approx. in presence of little external magnetic fields

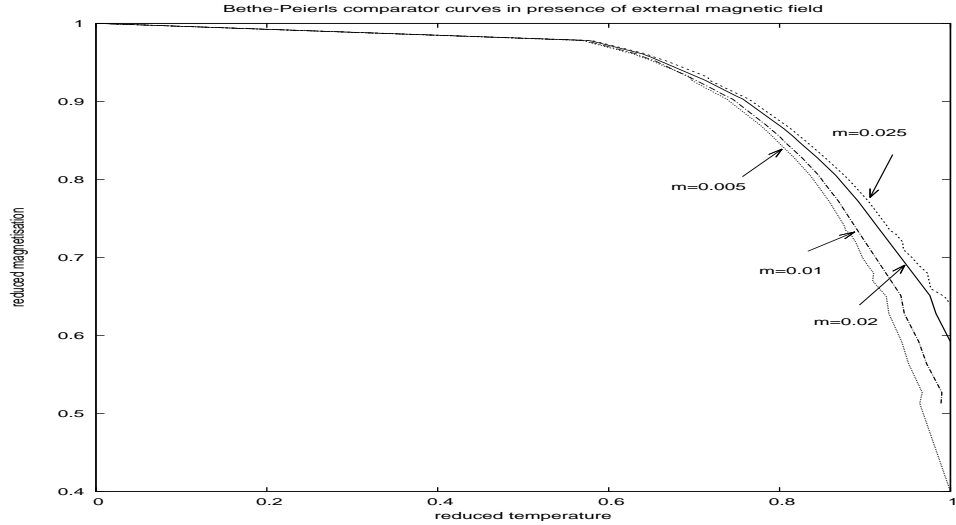


FIG. 9. Reduced magnetisation vs reduced temperature curves for Bethe-Peierls approximation in presence of little external magnetic fields, for four nearest neighbours, with $\beta H = 2m$.

IV. ACKNOWLEDGMENT

The author would like to thank the National Library(Government of India), Kolkata, to allow us to use Vietnamese-English Dictionary by Mrs. Le Van Hung and Dr. Le Van Hung, [1], in its premises. We have used gnuplot for plotting the figures in this paper.

- [1] Vietnamese-English Dictionary, prepared by Mrs. Le Van Hung, Fellow of the Institute of Linguists, London and Dr. Le Van Hung; Editions Europe-Asie 95, rue dela Folie-Mericourt, Paris; First Published in France 1955, Copyright by Le Van Hung.
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