The Standard Urdu-English Dictionary by Abdul Haq and The Graphical Law

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Abstract

We study the entries of the Standard Urdu-English Dictionary by Abdul Haq. We draw the natural logarithm of the number of entries, 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 BP(4,$\beta H = 0.02$), the magnetisation curve for the Bethe-Peierls approximation of the Ising model with four nearest neighbours with $\beta H = 0.02$. β is $\frac{1}{k_B T}$ where, T is temperature, H is external magnetic field and k_B is the Boltzmann constant.

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alif	be	pe	te(1)	te(2)	se	jim	che	he(1)	khe	dal	dāl	zāl	re(1)	re(2)	ze	zhe	sin
902+2525	2478	1497	1459	317	55	1114	1007	523	723	1307	228	94	856	0	357	13	1513
shin	sad	zad	toe	zoe	ain	ghain	fe	qaf	kaf	gaf	lam	mlm	nun	vao	he(2)	ye	
574	295	106	249	42	600	244	513	563	1892	1189	735	3549	1460	426	810	173	

TABLE I. The Standard Urdu-Englsh Dictionary entries: the odd rows represent letters of the Urdu alphabet,[1], in the serial order; the even rows represent the number of entries of the Standard Urdu-Englsh Dictionary[1].

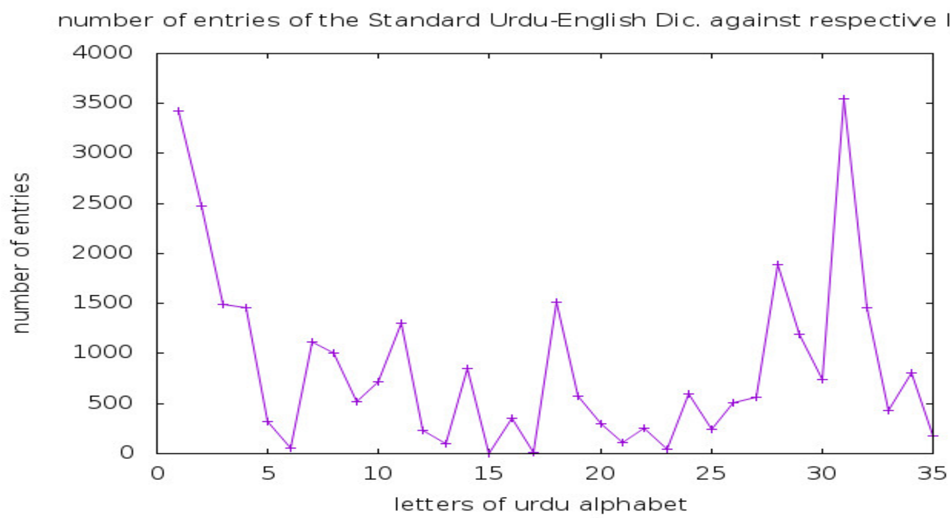

FIG. 1. The vertical axis is the number of entries of the Standard Urdu-Englsh Dictionary[1]. The horizontal axis is the letters of the Urdu alphabet. Letters are represented by the sequence number in the alphabet as it appears in the dictionary, [1].

I. INTRODUCTION

The Standard Urdu alphabet is composed of thirty five letters, starting with Alif and ending with Ye(Yā). We study the Standard Urdu-English Dictionary by Abdul Haq, [1]. We count one by one all the entries, in this Dictionary,[1]. The Dictionary includes the entries, numbering nine hundred two, of the lengthened form of Alif separately. We put it into the entries of the letter Alif. The result is the table, I. To visualise we plot the number of entries against the respective letters in the dictionary sequence,[1], in the adjoining figure, fig.1.

Looking for the Graphical Law in this dictionary, we proceed narrating the development. 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 existence of a magnetisation curve under each language. We have termed this phenomenon as the Graphical Law. Then, we moved on to investigate into, [3], 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 in references from [4] to [72].

The planning of the paper is as follows. In the next section, we describe the Graphical Law analysis of the entries of the Standard Urdu-Englsh Dictionary[1]. 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 entries, in the descending order, denoted by f and the respective rank, [73], denoted by k. k is a positive integer starting from one. Moreover, the minimum non-zero number of entries is thirteen. Hence, we attach a limiting entry number one. The limiting rank is maximum rank plus one, here it is thirty five. As a result both $\frac{lnf}{lnf_{max}}$ and $\frac{lnk}{lnk_{lim}}$ varies from zero to one. Then we tabulate in the adjoining table,II, and plot $\frac{lnf}{lnf_{max}}$ against $\frac{lnk}{lnk_{lim}}$ in the figure fig.2. We then ignore the letter with the highest of entries, tabulate in the adjoining table,II,and redo the plot, normalising the lnfs with lnf_{n-max}, and starting from $k = 2$ in the figure fig.3. Normalising the lnfs with lnf_{2n-max}, we tabulate in the adjoining table,II, and starting from $k = 3$ we draw in the figure fig.4. Normalising the lnfs with lnf_{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	lnk/lnk_{lim}	f	lnf	lnf/lnf_{max}	lnf/lnf_{n-max}	lnf/lnf_{2n-max}	lnf/lnf_{3n-max}	lnf/lnf_{4n-max}	lnf/lnf_{5n-max}
1	0	0	3549	8.174	1	Blank	Blank	Blank	Blank	Blank
2	0.69	0.194	3427	8.139	0.996	1	Blank	Blank	Blank	Blank
3	1.10	0.309	2478	7.815	0.956	0.960	1	Blank	Blank	Blank
4	1.39	0.390	1892	7.545	0.923	0.927	0.965	1	Blank	Blank
5	1.61	0.452	1513	7.322	0.896	0.900	0.937	0.970	1	Blank
6	1.79	0.503	1497	7.311	0.894	0.898	0.936	0.969	0.998	1
7	1.95	0.548	1460	7.286	0.891	0.895	0.932	0.966	0.995	0.997
8	2.08	0.584	1459	7.286	0.891	0.895	0.932	0.966	0.995	0.997
9	2.20	0.618	1307	7.175	0.878	0.882	0.918	0.951	0.980	0.981
10	2.30	0.646	1189	7.081	0.866	0.870	0.906	0.939	0.967	0.969
11	2.40	0.674	1114	7.016	0.858	0.862	0.898	0.930	0.958	0.960
12	2.48	0.697	1007	6.915	0.846	0.850	0.885	0.917	0.944	0.946
13	2.56	0.719	856	6.752	0.826	0.830	0.864	0.895	0.922	0.924
14	2.64	0.742	810	6.697	0.819	0.823	0.857	0.888	0.915	0.916
15	2.71	0.761	735	6.600	0.807	0.811	0.845	0.875	0.901	0.903
16	2.77	0.778	723	6.583	0.805	0.809	0.842	0.872	0.899	0.900
17	2.83	0.795	600	6.397	0.783	0.786	0.819	0.848	0.874	0.875
18	2.89	0.812	574	6.353	0.777	0.781	0.813	0.842	0.868	0.869
19	2.94	0.826	563	6.333	0.775	0.778	0.810	0.839	0.865	0.866
20	3.00	0.843	523	6.260	0.766	0.769	0.801	0.830	0.855	0.856
21	3.04	0.854	513	6.240	0.763	0.767	0.798	0.827	0.852	0.854
22	3.09	0.868	426	6.054	0.741	0.744	0.775	0.802	0.827	0.828
23	3.14	0.882	357	5.878	0.719	0.722	0.752	0.779	0.803	0.804
24	3.18	0.893	317	5.759	0.705	0.708	0.737	0.763	0.787	0.788
25	3.22	0.904	295	5.687	0.696	0.699	0.728	0.754	0.777	0.778
26	3.26	0.916	249	5.517	0.675	0.678	0.706	0.731	0.753	0.755
27	3.30	0.927	244	5.497	0.672	0.675	0.703	0.729	0.751	0.752
28	3.33	0.935	228	5.429	0.664	0.667	0.695	0.720	0.741	0.743
29	3.37	0.947	173	5.153	0.630	0.633	0.659	0.683	0.704	0.705
30	3.40	0.955	106	4.663	0.570	0.573	0.597	0.618	0.637	0.638
31	3.43	0.963	94	4.543	0.556	0.558	0.581	0.602	0.620	0.621
32	3.47	0.975	55	4.007	0.490	0.492	0.513	0.531	0.547	0.548
33	3.50	0.983	42	3.738	0.457	0.459	0.478	0.495	0.511	0.511
34	3.53	0.992	13	2.565	0.314	0.315	0.328	0.340	0.350	0.351
35	3.56	1	1	0	0	0	0	0	0	0

TABLE II. The Standard Urdu-English Dictionary by Abdul Haq, Entries: ranking,natural logarithm, normalisations

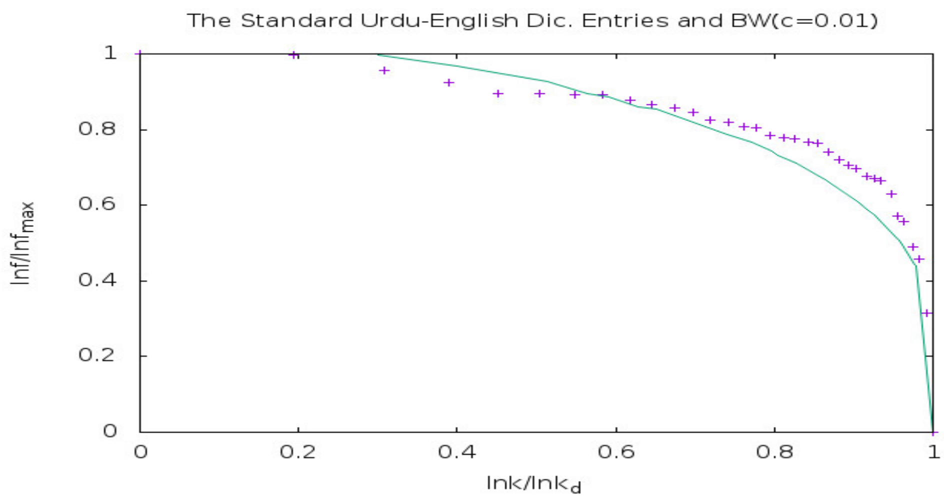

FIG. 2. The vertical axis is $\frac{lnf}{lnf_{max}}$ and the horizontal axis is $\frac{lnk}{lnk_{lim}}$. The + points represent the entries of the Standard Urdu-Englsh Dictionary, [1], with the fit curve, BW(c=0.01), being the Bragg-Williams curve in the presence of external magnetic field, $c = \frac{H}{\gamma\epsilon} = 0.01$.

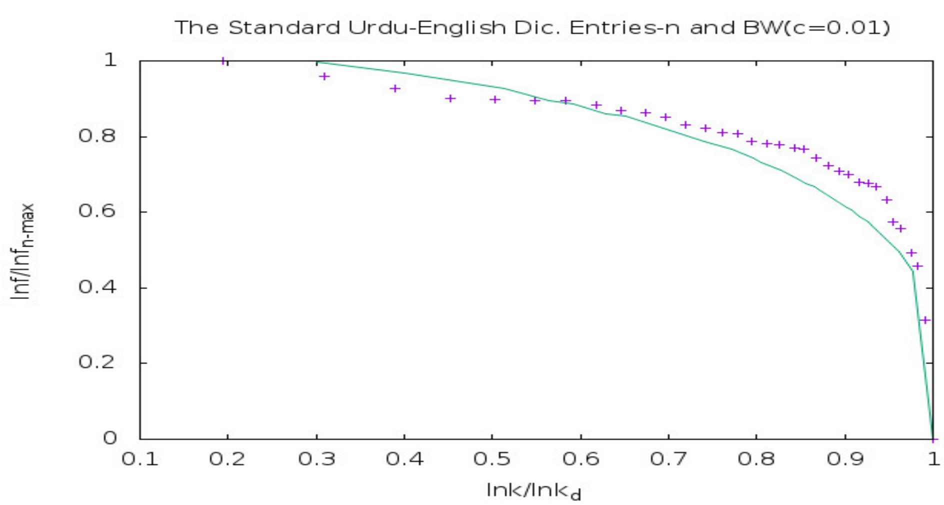

FIG. 3. The vertical axis is $\frac{lnf}{lnf_{n-max}}$ and the horizontal axis is $\frac{lnk}{lnk_{lim}}$. The + points represent the entries of the Standard Urdu-Englsh Dictionary, [1], with the fit curve, BW(c=0.01), being the Bragg-Williams curve in the presence of external magnetic field, $c = \frac{H}{\gamma\epsilon} = 0.01$.

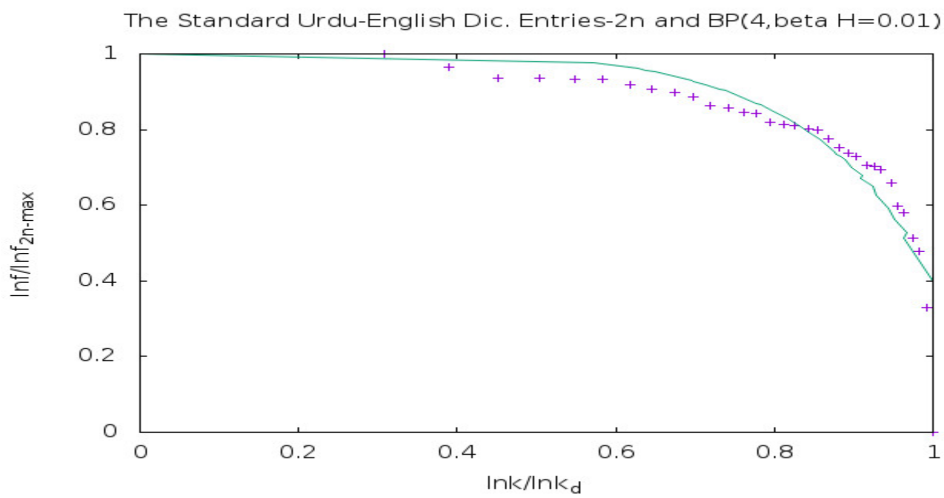

FIG. 4. The vertical axis is $\frac{lnf}{lnf_{2n-max}}$ and the horizontal axis is $\frac{lnk}{lnk_{lim}}$. The + points represent the entries of the Standard Urdu-Englsh Dictionary, [1], with the fit curve, BP(4,βH = 0.01), being the Bethe-Peierls curve in the presence of four nearest neighbours and external magnetic field, $m = 0.005$ or, $\beta H = 0.01$.

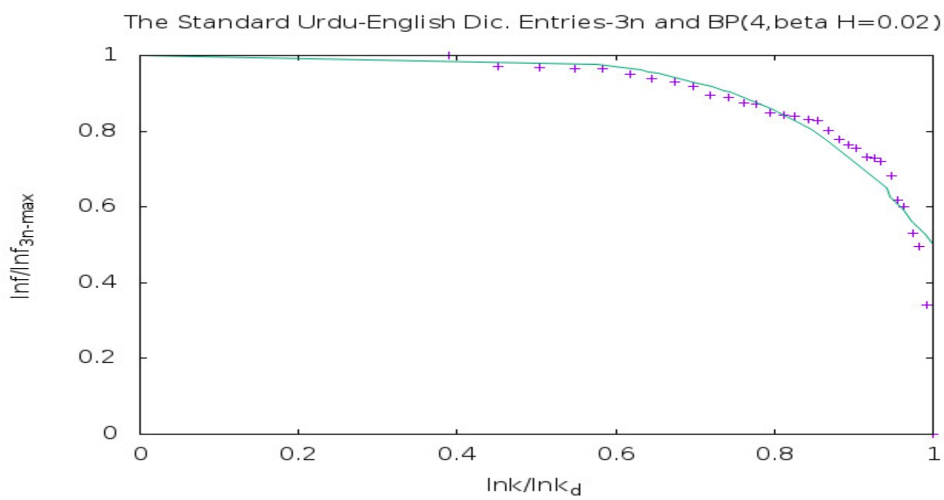

FIG. 5. The vertical axis is $\frac{lnf}{lnf_{3n-max}}$ and the horizontal axis is $\frac{lnk}{lnk_{lim}}$. The + points represent the entries of the Standard Urdu-Englsh Dictionary, [1], with the fit curve, BP(4,βH = 0.02), being the Bethe-Peierls curve in the presence of four nearest neighbours and external magnetic field, $m = 0.01$ or, $\beta H = 0.02$.

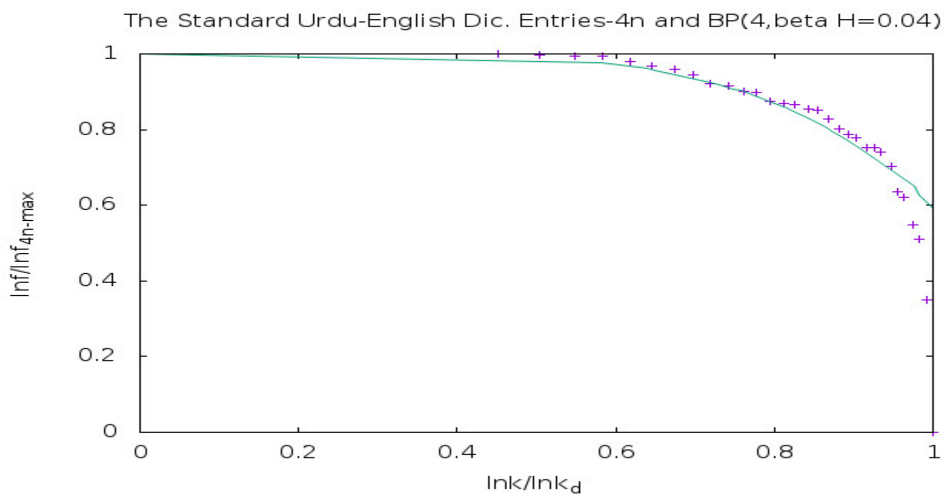

FIG. 6. The vertical axis is $\frac{lnf}{lnf_{4n-max}}$ and the horizontal axis is $\frac{lnk}{lnk_{lim}}$. The + points represent the entries of the Standard Urdu-Englsh Dictionary, [1], with the fit curve, BP(4,$\beta H = 0.04$), being the Bethe-Peierls curve in the presence of four nearest neighbours and external magnetic field, $m = 0.02$ or, $\beta H = 0.04$.

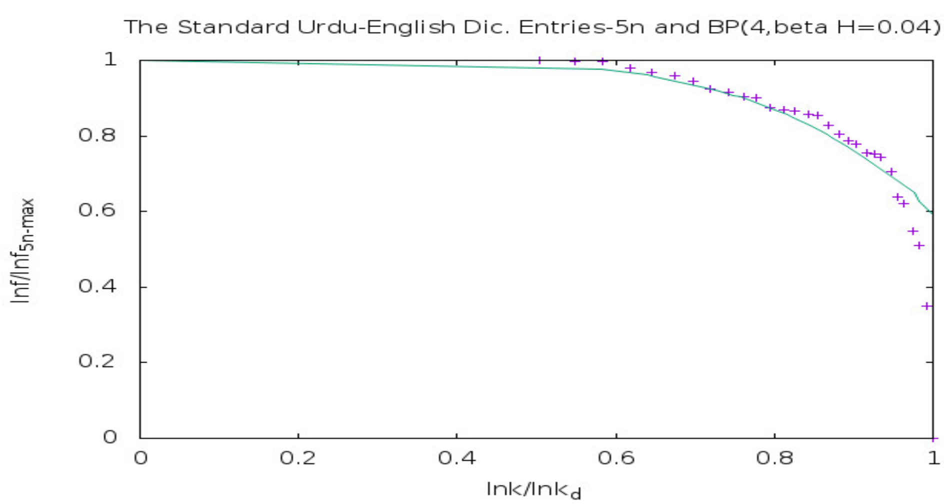

FIG. 7. The vertical axis is $\frac{lnf}{lnf_{5n-max}}$ and the horizontal axis is $\frac{lnk}{lnk_{lim}}$. The + points represent the entries of the Standard Urdu-Englsh Dictionary, [1], with the fit curve, BP(4,$\beta H = 0.04$), being the Bethe-Peierls curve in the presence of four nearest neighbours and external magnetic field, $m = 0.02$ or, $\beta H = 0.04$.

A. conclusion

From the figures (fig.2-fig.7), we observe that there is a curve of magnetisation, behind the entries of the Standard Urdu-English Dictionary,[1]. This is the magnetisation curve, BP(4,$\beta H = 0.02$), in the Bethe-Peierls approximation of the Ising model, in the presence of four nearest neighbours and external magnetic field.
Moreover, the associated correspondence is,

$$\frac{lnf}{lnf_{3n-max}} \longleftrightarrow \frac{M}{M_{max}},$$

$$lnk \longleftrightarrow T.$$

k corresponds to temperature in an exponential scale, [80].
Moreover, we have reached to the same conclusion in a preliminary study of graphical law, [2], about the Standard Urdu-English Dictionary,[1]. We can safely conclude that the Standard Urdu language is characterised by BP(4,$\beta H = 0.02$), the magnetisation curve in the Bethe-Peierls approximation of the Ising model, in the presence of four nearest neighbours and external magnetic field, $\beta H = 0.02$. Neverthless, the language is evolving away towards BP(4,$\beta H = 0.04$), as evidenced in our study of the Concise Urdu to English Dictionary compiled by M. Zaman, Naved Akhtar, 2015, [72].

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 $L = \frac{1}{N}\Sigma_i \sigma_i$, 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, $\mu N L$, $M_{max} = \mu N$. $\frac{M}{M_{max}} = L$. $\frac{M}{M_{max}}$ is referred to as reduced magnetisation. Moreover, the Ising Hamiltonian,[74], 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, [75], $2\epsilon\gamma\bar{\sigma} + 2H$, where γ is the number of nearest neighbours of a spin. According to Boltzmann principle, $\frac{N_-}{N_+}$ equals $exp(-\frac{\triangle E}{k_B T})$, [76]. In the Bragg-Williams approximation,[77], $\bar{\sigma} = L$, 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, $c = \frac{H}{\gamma\epsilon}$, $T_c = \gamma\epsilon/k_B$, [78]. $\frac{T}{T_c}$ 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 [75]. 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 absence of external magnetic field

In the approximation scheme which is improvement over the Bragg-Williams, [74],[75],[76],[77],[78], due to Bethe-Peierls, [79], 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

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 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.

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.

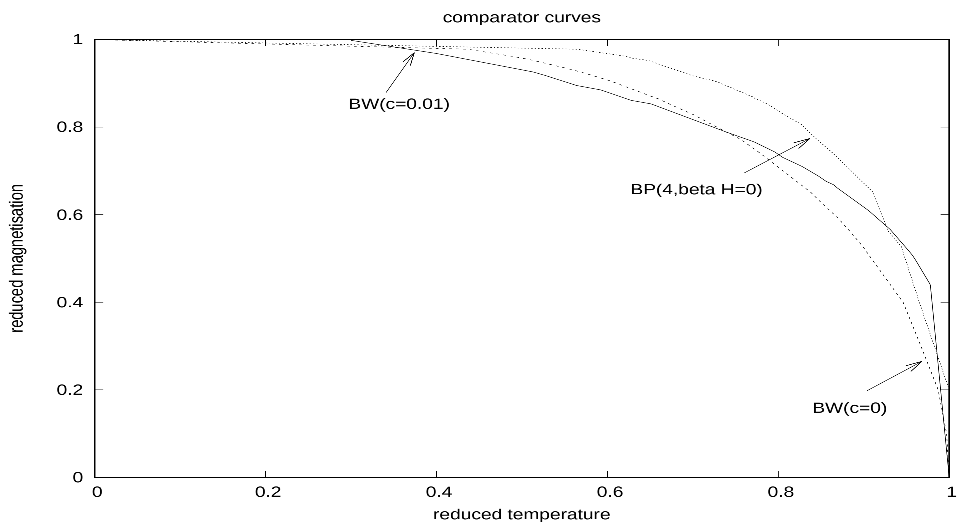

FIG. 8. Reduced magnetisation vs reduced temperature curves for Bragg-Williams approximation, in absence(dark) of and presence(inner in the top) of magnetic field, $c = \frac{H}{\gamma\epsilon} = 0.01$, and Bethe-Peierls approximation in absence of magnetic field, for four nearest neighbours (outer in 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 , [79], 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 [79] 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,

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

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

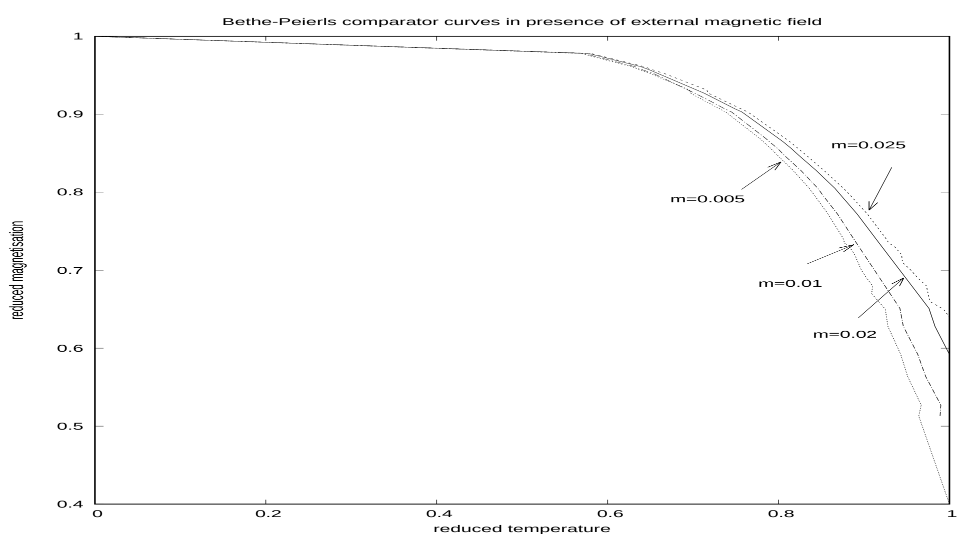

FIG. 9. Reduced magnetisation vs reduced temperature curves for Bethe-Peierls approximation in presence of little external magnetic fields, for four nearest neighbours, with $\beta H = 2m$.

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