More achievements in the set theoritical model of magnetism according to the theoritical and experimantal advances in material science.

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Abstract:

It has been verified theoritically the residual magnetic domains has 2 power aleph cardinality. It has also been verified theoritically that ferro para magnetic phase transitions can be explained by revision of belief mathematics. Experimentally,it has been verified nano Nd2FeB14 permanent magnet has the predominant role in the mechanical proberties in duplex stainless steel 2205 and magnetic composite materials.In this paper,more advances in the set theoritical model for magnetism will be achieved..Algebric geometry will be used to achieve the equilibrium relations between the torus in ecluidian space and riemannian manifold related to the torus defined in them .Tensor triangulated category will be used to discover the logical relations between the ecluidian torus and riemannian manifold torus.Bakehausen effect will be explained in a new mathematical approach related to the order of cardinalities by model theory mathematics. The barkhausern effect related to Nd2FeB14 materials will be mathematically approached .Landau levels will be deeply related to the problastic functions and conditional functions.

Key words :T3 Space-Algebric Torus –Tensor triangulated Category –Erdos*Rado theory-Pinning down numberpd(X)-Abelian topological groups –Lee Yang Zero- Revision of Belief -Residual magnetic domains-Heisenberg model –Ising model –Neel Lines -Barkhausen effect-Landau Levels .

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82B44 Disordered systems (random Ising models, random Schrödinger operators, etc.)

Introduction:

Spin models tried hard to capture the dimensionality problem of spins in Heisenberg model and Ising model.It has been verified theoritically that the residual magnetic domain has the cardinality 2 power aleph and their motion is explained by fixed brouwer theory to solve the problem ofdimensionality.Also,we have used belief revision

mathematics to solve the ferro para magnetic phase transition .[seeRef1,Ref2].

This new theoritical advance must be extended to explain the Barkhausen effect and Landau levels.

It will be a great deal with the torus mathematics to define an equilibrium of magnetic domain motions by algebric topological mathematics.Tensor triangulated category will be used to describe the geometrical description of magnetic fields more precisely.

Spinodal reactions will be hindered by magnetic treatment by using lusternik schirlmen category theory in Duplex stainless steel 2205.[see Ref 3]

It will be redifined mathematically and will be proved in general formula using another experimental data found recently in Moscow university researches .[See Ref 4]

The set theoritical model that have been verified recently must be generalized to explain another phenomological magnetic transitions.We will review the theoritical advances in the set theoritical model related to the magnetism and ferro para revision of belief mathematics in chapter 1 ,chapter 2

chapter 1 ,the set theoritical model of magnetism .

We will call the chapter 2 belief revision mathematics of ferro para transitions.

In chapter 3,we will define the equilibrium concept of magnetic domain using the mathematical torus and tensor triangulated category.

In chapter 4,the bakenhausen effect will be rexplained mathematically.

In chapter5,the bakehausen jumps will be deeply related with the experimental advances in material science.

In chapter6,Landau levels on torus will be linked with probability functions and conditional functions.

1.Set theoritical model for magnetism :

In his research *some proposition that links ferromagnetic models with cantorian set theory*,Mohamed atef has made this model to solve the dimensionality problem of Heisenberg model that consider the spins in x,y,z dimensions and Ising model that restrict the spins in z axis and he has proved that the magnetic domains has the cardinality of 2 power aleph by the comparison with the landau lifshits model using what is proved by Danial Kapovich in the Riemannian manifold:

1.After applying and removing magnetic field H = 0, we can assume that there are magnetic domains in XYZ directions and these domains can be written as: $[a_1,b_1]\times[a_2,b_2]\times[a_3,b_3]\subset\mathbb{R}^3$

2. These domains have the cardinality 2 power aleph

3. We will use the theory of invariance of dimensions which is proved by Brouwer as the domains $[a_1,b_1]\times[a_2,b_2]\times[a_3,b_3]\subset\mathbb{R}^3$

4. Using Brouwer theory, there will be no bijection if magnetic domains $[a_1,b_1]\times[a_2,b_2]\times[a_3,b_3]\subset\mathbb{R}^3$ are transported to z axis

5. The reason of restriction of the spins of Ising model in z axis is that there is $T:H_{XYZ}\rightarrow H_z$ (continous or injective). But in the case of Heisenberg Hamiltonian there will be no restriction as there is no function

6. In the case of materials that is explained by Ising model, temperature will have the concept of the function that transport magnetic domain to z – axis

7. In phase transitions that are explained only by Ising model,we can expect fractal behavior in general in these materials.

8. These fractal motions belong to space – filling curve category (Peano, Hilbert, ... etc) curve will explain it.

9.Space filling curves like Hilbert Space are continous functions will appear in Ising model materials as

11. Heisenberg model shows the spins in (Sx, Sy, Sz),so there will be no fractal behavior in the material that exhibit phase transitions under it.

13. The phase transitions of thin films are exhibited by Ising model mainly and they cannot be explained by Heisenberg Model.

14.Summary of magnetic model, where d/D (dimension of spins /dimension of lattice)

15. We can say Ising Model can explain thin films but Heisenberg Model cannot explain thin films. Spin flucations are strongly dependent on temperature, so we can consider it as a tool to describe the phase transitions. The assumption of the existence of magnetic domain with cardinality (2 power aleph) solve the problem of dimensionality of the spin models and give the proper explanation to the difference between Heisenberg model and Ising model.

We consider the case of materials that is explained by Ising model, temperature will have the concept of the function that transport magnetic domain to z – axis, T: HXYZ→HZ
, so we can expect fractal motion in these materials. The fractal properties of spin clusters and boundries which are cluster themselves are described by percolation theory. Asymptotically, cluster distributions take a general form: $t_n \sim n^{-\tau}\exp(-\theta n)$

There is a tendancy to the fractal motion in Landau Lifshits model (Henriksen, 1953; Piette & Zakrzewski, 1998; Ding & Wang, 1998). Magnetic bubbles is a small round magnetic domain induced by magnetic field in a thin film of magnetic material. Let us investigate solutions in a 2 dimensional Landau- Lifshits model. We look at Landau -Lifshits model for the anistropic Heisenberg model when the external magnetic field is switched off A=0,the staticsolution is given by holomorphic functions (Jiang, 1953).

2.Ferro-Para magnetic phenomena by belief revision mathematics:

In his book,Set theoretical model for magnetism ,Mohamed atef has linked the ferro para magnetic phenomena with the belief revision mathematics and XOR functions.

He has demonstrated that Chiu Fan Lee∗and Neil F. Johnson clearified that the spins of Ising model is like noncoperative game.So,Nash Equilibrium is some essential concept.He has built XOR indetermined games that are consistent with his assumption of magnetic domain has the cardinality of 2 power aleph in the solution of Landau Lifshits equations.[2]

Revision and merging differ in that the first operation is done when the new belief to incorporate is considered more reliable than the old ones; therefore, consistency is maintained by removing some of the old beliefs. Merging is a more general operation, in that the priority among the belief sets may or may not
be the same. he AGM postulates for revision are:

1.Closure: $K * P$ is a belief base (i.e., a deductively closed set of formulae);

2.Success: $P \in K * P$

3.Inclusion: $K * P \subset K + P$

4.Vacuity:, $\neg P \notin K then K + P$

5. $K * P$ isinconsistentonly ifPis inconsistent orK is inconsistent

6.Extensionality: $K * P = K * Q$

Let us design a model that explain the ferro -para magnetic phase transition as + operation as it transfer of magnetic domains from XYZ directions or XY direction to Z axis:from Z axis toXYZ directions and XY directions. These domains have the cardinality 2 power aleph.So it can be consider a language (L,+,-) .This model satisfy the rules of revision belief model .Postulates for conditional revision(We have supposed that magnetic phase Ferro,Para is
an epistemic state):Suppose Ψ is an epistemic state and (B|A), (D|C) are conditionals. Let Ψ ∗(B|A) denote the result of revising Ψ by (B|A).(CR0) Ψ ∗(B|A) is an epistemic state.

Chiu Fan Lee∗and Neil F. Johnson has showed how non-cooperative phenomena can emerge from Ising Hamiltonians, even though the individual spins behave cooperatively.They consider Ising spin models because they serve as basic models in condensed matter physics, and focus on the classical regime to avoid the complication of quantum entanglement. [40]By treating each site or subset of sites in the Ising model as a game-playing agent, we show that non-cooperative behaviour is indeed possible. In particular, we show the emergence of a prisoner's dilemma game being played' within a multi-spin system. So can macroscopic non-cooperative behavior ever arise? We now show that it can, if the subsystem under consideration has several possible configurations and hence more states from which to choose. In particular, we will search for non-cooperative phenomena in two subsystems each containing many spins. We concentrate on the specific example of non-cooperation offered by the prisoner's dilemma, since this is the only symmetric two-player two-strategy game with a unique Nash equilibrium
which never coincides with the global optimum
.We start by specifying more precisely the criterion for the existence of non-cooperative behaviour. A system composed of two-body Ising Hamiltonians such asH = a | ↑↑ih↑↑| −| ↑↓ih↑↓| −| ↓↑ih↓↑| + |↓↓ih↓↓| .
Is there a tool to express about these phenomena by Belief models and is thereDepending on how beliefs are represented and what kinds of inputs are accepted, different typologies of belief changes are possible. In the most common case, when beliefs are represented by sentences in some code, and when a belief is either accepted or rejected in a belief system Kone can distinguish three main kinds of belief changes.

Solutionsof Landau Lifshitz model inRiemannian manifold and XOR functions
complete information models):Magnetic bubbles is a small round magnetic domain induced by magnetic field in a thin film of magnetic material.Let us investigate solutions in a 2 dimensional Landau-Lifshits model .We look at Landau -Lifshits model for the anistropic Heisenberg modelKapovich proved the striking result :if M has a non constant holomorphic function then the ring of holomorpbhic function on M has a chain of prime ideals of the length of continuum(2 power aleph).
Critical properties of the Ising models on some two dimensional deterministic Sperinski fractals with different Haussdorff measures. Haussdorff measures are strongly related with the axiom of martin, Theorem.: Let s≥0and let H^s be the s-dimensional Haussdorff measure in n. The union of less than continuum manysHnegligible subsets of H^s is negligible .Søren Riis showed by using the axiom of choice ,the construction of a symmetrical and self similar subset A ⊆[0, 1] ⊆R.
Then by an elementary strategy stealing argument it is shown that A is not determined. The (possible) existence of fractals like A clarifies the status of the controversial Axiom of Determinacy.

Definition : An infinite XOR function f : Bω →B is a function with the following property: if hd(w 1w2) = 1 then f(w 1)≠f(w 2).

Theorem : There exist 2^c infinite XOR functions.

Theorem :No player has a winning strategy in an infinite XOR game Gf. There is a unique functor between the chain of prime ideals and the 2cinfinite XOR functions.

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3.The equilibrium concept of magnetic domains and tensor triangulated category and Cox Particle :

Let us describe why it is so important to make an equilibrium concept of magnetic domains that have 2 power aleph and the tool of tensor triangulated category.

First of all,we have solved landau lifshitz equations by holonomic functions when there is no applied magnetic field.

Also we have described their motion by fixed brouwer theory

4. Using Brouwer theory, there will be no bijection if magnetic domains $[a_1,b_1]\times[a_2,b_2]\times[a_3,b_3]\subset\mathbb{R}^3$ are transported to z axis

5. The reason of restriction of the spins of Ising model in z axis is that there is $T:H_{XYZ}\rightarrow H_z$

(continous or injective). But in the case of Heisenberg Hamiltonian there will be no restriction as there is no function

We have used the mathematical achievement of Daniel Kapovich proved the striking result :if M has a non constant holomorphic function to the complex number then the ring of holomorpbhic function on M has a chain of prime ideals of the length of continuum(2 power aleph).So the magnetic domains that have the cardinality of 2 power aleph can be redifined as M has a non constant holomorphic function to the complex number then the ring of holomorpbhic function on M has a chain of prime ideals of the length of continuum(2 power aleph).So there are two opposite ways to describe the magnetic domains:

The first way when the magnetic domains are transferred and move $T:H_{XYZ}\rightarrow H_z$

The second way when the magnetic domains are formed as a a chain of prime ideals of the length of continuum(2 power aleph) which is appear when the manifold is transferred to complex number.The first way means the transfer and the second way means the formation .There must be an equilibrium between the two different ways.When we use the tensor triangulated category to make an algebric construction for the holonomic function hyper geometric series that are the solutions of Landau Lifshitz equations .There will be an obvious establishment for the concept of ideals.Also the tensor triangulated category will be defined after introduction for the algebric torus .This algebric torus is a must for studying the the conserved current associated to the U(1) symmetry of a complex field related to **Klein–Gordon–Fock equation**.[see Ref 57]

Klein Jordan equations and cox particle will be describe well in the scope of tensor triangulated category.

The formation of magnetic domains is related to riemannian manifold that is described by danial kapovich theorems.

This riemannian manifold can be embbeded into ecludian space **according to nash embeeding theorems.**

The **Nash embedding theorems** (or **imbedding theorems**), named after John Forbes Nash, state that every Riemannian manifold can be isometrically embedded into some Euclidean space. Isometric means preserving the length of every path. For instance, bending without stretching or tearing a page of paper gives an isometric embedding of the page into Euclidean space because curves drawn on the page retain the same arclength however the page is bent.[See Ref57]

The first theorem is for continuously differentiable (C^1) embeddings and the second for analytic embeddings or embeddings that are smooth of class C^k, $3\le k\le\infty$. These two theorems are very different from each other; the first one has a very simple proof and leads to some very counterintuitive conclusions, while the proof of the second one is very technical but the result is not that surprising.

The C^1 theorem was published in 1954, the C^k-theorem in 1956. The real analytic theorem was first treated by Nash in 1966; his argument was simplified considerably by Greene & Jacobowitz (1971). (A local version of this result was proved by Élie Cartan and Maurice Janet in the 1920s.) In the real analytic case, the smoothing operators (see below) in the Nash inverse function argument can be replaced by Cauchy estimates. Nash's proof of the C^k- case was later extrapolated into the h-principle and Nash–Moser implicit function theorem. A simplified proof of the second Nash embedding theorem was obtained by Günther (1989) who reduced the set of nonlinear partial differential equations to an elliptic system, to which the contraction mapping theorem could be applied.

Theorem. Let (M,g) be a Riemannian manifold and $f: M^m\rightarrow \mathbf{R}^n$ a short C^∞-embedding (or immersion) into Euclidean space $\mathbf{R}^n$, where $n\ge m+1$. Then for arbitrary $\varepsilon>0$ there is an embedding (or immersion) $f_\varepsilon: M^m\rightarrow\mathbf{R}^n$ which is□ in class C^1,

□ isometric: for any two vectors $v,w\in T_x(M)$ in the tangent space at $x\in M$,

1. $g(v,w)=(df_{\varepsilon}(v),df_{\varepsilon}(w))$

2.ε-close to $\left|f(x)-f_{\varepsilon}(x)\right|\le\varepsilon$ **[45]**

The Nash embedding theorem is a global theorem in the sense that the whole manifold is embedded into $\mathbf{R}^n$. A local embedding theorem is much simpler and can be proved using the implicit function theorem of advanced calculus in a coordinate neighborhood of the manifold. The proof of the global embedding theorem relies on Nash's far-reaching generalization of the implicit function theorem, the Nash–Moser theorem and Newton's method with postconditioning. The basic idea of Nash's solution of the embedding problem is the use of Newton's method to prove the existence of a solution to the above system of PDEs. The standard Newton's method fails to converge when applied to the system; Nash uses smoothing operators defined by convolution to make the Newton iteration converge: this is Newton's method with postconditioning. The fact that this technique furnishes a solution is in itself an existence theorem and of independent interest. There is also an older method called Kantorovich iteration that uses Newton's method directly (without the introduction of smoothing operators).The motion of magnetic domain and its transfer is described by brouwer theory on ecludian spaces . $[a_1,b_1]\times[a_2,b_2]\times[a_3,b_3]\subset\mathbb{R}^3 T:H_{XYZ}\to H_z$,So we have two ecludian spaces one of them is the ecludian space of formation which is well defined by nash embeeding theorem of daniel kapovich riemannian manifold and the second is the ecludian space of transfer.To achieve the precise description of the formation and transfer of magnetic domains ,we must use the tensor triangulate category.This can be achieved by definning the algebric torus.

In mathematics, an **algebraic torus** is a type of commutative affine algebraic group. These groups were named by analogy with the theory of *tori* in Lie group theory (see Cartan subgroup).[See Ref 61]

Tori are of fundamental importance in the theory of algebraic groups and Lie groups and in the study of the geometric objects associated to them such as symmetric spaces and buildings.If F is a field then the *multiplicative group* overis a field F s the algebraic group G_m such that for any field extension E/F theEare isomorphic to the group E^* .Let F be a field with algebraic closure F^- Then a F *torus* is an algebraic group defined over F which is isomorphic over F^- to a finite product of copies of the multiplicative group Over any algebraically closed field there is up to isomorphism a unique torus of any given rank. Over the field of real numbers $\mathbb{R}$ there are exactly (up to isomorphism) two tori of rank 1: the split torus $\mathbb{R}^*$

So let us define the algebric torus on ecludian space related to Nash Embeeding and related to the fixed brouwer theory. **torus embedding** is an algebraic variety containing an algebraic torus as an open dense subset, such that the action of the torus on itself extends to the whole variety. **Toric variety**over any field are **Cohen–Macaulay Ring.**

$$F:\mathbb{R}^3_{relatedtoNashembeedingandmagneticdomainformation}\to\mathbb{R}^3_{relatedtoBrouwertheoryandmagneticdomainmotion}$$

Where F is a functor.

We have established above the algebric torus and the concept of toric variety ,we have also verified the exsitence of magnetic domain and their hypergeometric and holonomic charachterstic.So, we can use what is called tensor triangulated category to achieve the geometrical concept of magnetic domains. A **Gorenstein ring** is a commutative Noetherian ring such that each localization at a prime ideal is a Gorenstein local ring, as defined above. A Gorenstein ring is in particular Cohen–Macaulay.

CM(R) is atriangulated category ifRis Gorenstein. Let SpecRdenote the prime ideal spectrum ofR, that is, the set of prime ideals ofR, and let S ing Rdenote the singular locus ofR, thatis, the set of prime idealspofRsuchthat the local ringRpis singular. Main Theorem.(1)LetRbe an abstract hypersurface local ring (i.e., the completion of Ris isomorphic toS/(f)for some complete regular local ringSand some element fofS). Then one has the following one-to-one correspondences:

$$\{thick\ subcategories\ ofCM(R)\}$$
$$\uparrow Supp^{-1}\quad Supp\downarrow$$
$$\{specialization-closed\ subsets\ ofSpecRcontained\ inSingR\}$$

(2)LetRbe ad-dimensional Gorenstein singular local ring with residue ldk which is locally an abstract hypersurface on the punctured spectrum. Then one has the following

$$\{thick\ \ subcategories\ \ of CM\ (R) containing\, \Omega(k)\}$$

$$\uparrow Supp^{-1}\ Supp \downarrow$$

$$\{nonempty\ \ specialization - closed\ \ subsets\ \ of SpecR contained\ \ in SingR\}$$ [See54]

In his paper,Mohamed Atef has verified his theoretical assumptions by what is verified experimentally in Nd2FeB14 and what is achieved by Antena scientists to achieve the Hilbert fractal motion .

Also the spectra that is verified by Daniel kapovich can be comparable by the Spec R of the previous tensor triangulated category.

The torsion group expresses the fractal motion of this magnetic domains .

Theorem.LetR=K[X1………XN+1]be the polynomial ring inN+1variablesover an algebraically closed eld K of characteristic zero. suppose that $F \in R$ defines a reduced hypersurfaceA with isolated singularities in the affine space A_K^{N+1} .Let J $-(\frac{\partial F}{\partial X_i}, ..., \partial F / \partial X_n))$

denote the Jacobian ideal, letI:= (J;F) denote theideal de ning the singular locus Sing

(A) in A_K^{N+1} .Then the following conditions are equivalent:

(a) The torsion module Torsion $(\Omega^N_{A/K})$ Is a cyclicA-module

(b) dim $(\Omega^N_{A/K})$ is a maximal

The fractal motion of magnetic domain can be described by this $n^{th} syzygy$ between $F : \square^3_{related to Nash em beeding and magnetic doma\inf ormation} \rightarrow \square^3_{related to Brouwer theory and magnetic domain motion}$

The symbol Supp, which we call thestable support, is a support for the stable categoryof Cohen-Macaulay modules.

$\rightarrow^{\partial_{n+1}} F_{n+1} \rightarrow^{\partial_n} F_n \rightarrow^{\partial_{n-1}} F_{n-1} \rightarrow .... \rightarrow F_1 \rightarrow F_0 \rightarrow M$ be a minimal free resolution of M

1.The $n^{th} syzygy$ ofM is de ned as the image of the map ∂_n and we denote it by $\Omega^n M$

2. The(Auslander) transposeofMis de ned as the cokernel of the map HomR(∂ ;R).

Now ,let us describe **the cox particles and Klein–Gordon–Fock equation by the common rules of algebric torus .**

The algebric torus is deeply related with the compact form, which can be realised as the unitary group U(1) or as the special orthogonal groupSO(2) It is an anisotropic torus. As a lie group it is also isomorphic to the 1-torus T1which is where the designation of diagonalisable algebraic groups as tori comes from.

The conserved current associated to the U(1) symmetry of a complex field $\phi(x) \in \mathbb{C}$ satisfying the Klein Gordon equation reads $\partial_\mu J^\mu(x) = o, J^\mu(x) = \phi^*(x)\partial^\mu\phi(x) - \phi(x)\partial^\mu\phi^*(x)$

So there is a key word betweeen the algebric torus and Klein –Gordon equations that is called unitary group U(1).

The algebraic torus is deeply related with cohen maccaulay hyper surface as we have defined in the tensor triangulated category.

Also, **Klein Gordon equation** is deeply related with cox particles and their solutions can be comparable with analytical rings and functorial charachteristics.

K.V. KAZMERCHUK, E.M. OVSIYUK gives a precise describtion for Cox's Particle in a Magnetic Field in the Spherical Riemann Space In the cylindric coordinate system of a spherical Riemann space (for little r and z, the metric coincides with the known one in the Minkowski space) $dS2 = dt2 - \cos 2\, z$ ($dr2 + \sin 2\, r\, d\varphi 2$) $- dz2$, An analog of the uniform magnetic field is given by the relations $A_\phi = B\rho^2(\cos r - 1), F_{r\phi} = B\rho \sin r$

We have established that magnetic domains are formed in $\mathbb{R}^3$ and their motion is described by brouwer theory as fractals move.[seeRef57].Then we have established functorial relation between what is embeeded in $\mathbb{R}^3$ by nash embeeding and the $\mathbb{R}^3$ by

$$F : \mathbb{R}^3_{relatedtoNashembeedingandmagneticdoma\inf ormation} \to \mathbb{R}^3_{relatedtoBrouwertheoryandmagneticdomainmotion}$$

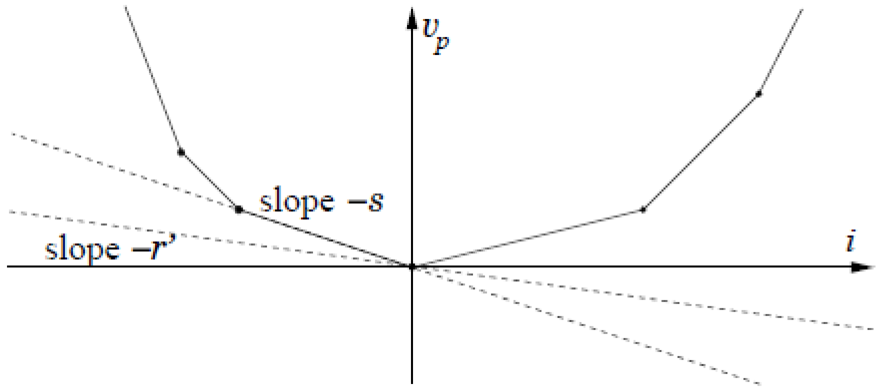
Then we described fractal motion by $n^{th} syzygy$.

So,the best description for Cox's Particle in a Magnetic Field in the Spherical Riemann Space in this functorial relation that uses the term of cohen macculay hypersurface is what is described by analytical rings and their geometrical charachteristics have a high similarity index with Cox's Particle in a Magnetic Field in the Spherical Riemann Space.

As the motion has been described by $n^{th} syzygy$,so we can consider it as finitely generated.The magnetic domain can be described as ideal and is very related with the theme of spectra and ideals.The radial equation is solved exactly in hypergeometric functions, but the equation in the z-variable can be examined qualtivaley.

Definition. A domain is called a Bezout ring when every finitely generated ideal is principal. [See Ref58]

The motion of magnetic domain can be parameterized by valuation field .A valued _eld is an algebraic extension K of k((t)) We put $\Gamma^k = \left\{ \sum_{i \in \mathbb{N}} x_i u^i \right\}$ is a discrete valuation ring, which is complete for the π adic topology. $x \in \Gamma^K_{con} / \pi\Gamma^K_{con}$ $andshowthatxis \text{ in}vertible \Gamma^K_{con}$ .The uniform magnetic field that is described by K.V. KAZMERCHUK, E.M. OVSIYUK can be summeriazed as newoton polygon in this figure below.



An analog of the uniform magnetic field is given by the relations $A_{\phi} = B\rho^2(\cos r - 1), F_{r\phi} = B\rho \sin r$ can be compared with the newton polygon can be compared with the graph and sin ,cos of the newton polygon.

This comparison comes from the similarity index for algebraic torus and klein Jordon equations related to the U(1). The magnetic domain have 2 power aleph .An important theme in computable model theory isthe study of computable models of complete firstorder theories. More precisely, given a complete firstordertheory T, one would like to know which modelsof T have computable copies and which do not. A special case of interest is when T is an ℵ 1-categoricaltheory. In this paper we are interested in computable models of ℵ 1- categorical theories, and we always assume that these theories are not ℵ 0-categorical. In addition, since we are interested in computable models, all the structures in this paper are countable.We assume that all languages we consider are computable.

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After making a countable partitioning for the magnetic domains .We can establish the nash equilibrium between the functorial relation of $F:\square^3_{relatedtoNashembeedingandmagneticdomainformation} \to \square^3_{relatedtoBrouwertheoryandmagneticdomainmotion}$

By this theorem:If M and N are countable, then thesecond player has a winning strategy in Gω(M, N) if and only if M ~= N.

4.Barkhausen effect and partitioning of magnetic domains to topological spaces:

Roland Roeder in his research*The Ising model for magnets and the mysterious Lee-Yang zeros* showed the deep relations between magnetism and discountinous jumps .
He showed also the importance of LY Zeros and partionning in the magnetic phase transitions.[see Ref94,95 and 96]
This tough result is so related with what is proved by Mohamed atef as he showed that residual magnetic domains has 2 power aleph power.
Using Brouwer theory ,he showed the magnetic phase transitions and the discountinuty term importance in magnetic domain motions .
Now we link the partition that is enlighted by LY Zeros with the set theoretical partitions of magnetic domains.

The **Barkhausen effect** is a name given to the noise in the magnetic output of a ferromagnet when the magnetizing force applied to it is changed. Discovered by German physicist Heinrich Barkhausen in 1919, it is caused by rapid changes of size of magnetic domains (similarly magnetically oriented atoms in ferromagnetic materials). Barkhausen's work in acoustics and magnetism led to the discovery, which became the main piece of experimental evidence supporting the domain theory of ferromagnetism proposed in 1906 by Pierre-Ernest Weiss. The Barkhausen effect is a series of sudden changes in the size and orientation of ferromagnetic domains, or microscopic clusters of aligned atomic magnets (spins), that occurs during a continuous process of magnetization or demagnetization. When an external magnetizing field through a piece of ferromagnetic material is changed, for example by moving a magnet toward or away from an iron bar, the magnetization of the material changes in a series of discontinuous changes, causing "jumps" in the magnetic flux through the iron. These can be detected by winding a coil of wire around the bar, attached to an amplifier and loudspeaker. The sudden transitions in the magnetization of the material produce current pulses in the coil, which when amplified produce a sound in the loudspeaker. This makes a crackling sound, which has been compared to candy being unwrapped, Rice Krispies, or the sound of a log fire. This sound, first discovered by German physicist Heinrich Barkhausen, is called **Barkhausen noise**. Similar effects can be observed by applying only mechanical stresses (e.g. bending) to the material placed in the detecting coil.y pinned between two points A and B.For X aset and λ, κ cardinals,we let $[X]^{\kappa}$ be the collection of all subsets with cardinals κ .We call $f : [X]^{\kappa} \rightarrow \lambda$ apartition of $[X]^{\kappa}$.We say $X \subseteq Y$ is homogeneous for the partition f , $\alpha \prec \lambda, f(A) = \alpha$ [See65]

We must again mention we have proved that magnetic domains has the cardinality of 2 power aleph.

We can partition the magnetic domains to sets with less cardinality by Erdos Rado theory:

Erdos – Rado theorem : $\tilde{o}_n (\kappa)^{+} \rightarrow (\kappa^{+})^{n+1}_{\kappa}$ **[See Ref66]**

These sets can be formed topological spaces with small cardinalities less than 2 power aleph

We can explain the barkhausern effect by this partitionning as when we partition the magnetic domains of 2 power aleph we can verify that magnetic domains can be changed and then the bakehausern effect is produced.

Now we must explain the bake hausen jumpes also by this theory:

The pinning down number pd(X) of a topological space X is the smallest cardinal κ such that for any neighborhood assignment U:X$\rightarrow \tau_X$,there is a set $A \in [X]^{\kappa}$ with A $\cap U(x) \neq \varphi$ for all $x \in X$

Let us mention that we can express the bakehausern jumps as a variation on the pinning down number pd(X) **[See 64]**

As it can be different from jump to jump and can be written in the form of different cardinalities.In a metric space, the separation between two points is quantified very precisely- by the metric. It is not so in any topological space. The separation axioms, $T1 \cdots T6$ characterize the *degree of separation* between two points in a topological space. T3.5 is a degree of separation "in between" T3 and T4. Therefore, let us go through T3 and T4 before T3.5.**[See65]**

T3 stands for *regular hausdorff:* Every pair of points can be separated by disjoint open sets and a point and a closed set can also be separated by disjoint open sets.

T4 stands for *normal hausdorff*: Every pair of points can be separated by disjoint open sets and every pair of closed sets can also be separated by disjoint open sets.

Separation by disjoint open sets is one way of separating. Now there is a big qualitative difference between T3 and T4, that is given by the Urysohn's lemma .It says that in a T4 space, for any pair of disjoint closed sets, one can define a continuous function from the space to [0,1] that takes the value 0 in one of the closed sets and 1 in the other.

It seems, two closed sets in a T4 space are *so separated* that a function can continuously drop from 1 to 0 between them. This is a different degree of separation than separation by open sets- it is called separation by a continuous function. Therefore, the natural question is, is a similar theorem true about regular spaces?. Can we separate a point and a closed set in a T3 space by a continuous function? The answer is no.

A point and a closed set in a T3 space are *not separated enough* for a function to fall from 1 to 0 between them; Therefore there must be an intermediate between T3 and T4 where points and closed sets *start* to be separated by a function. Therefore we define T3.5 as the intermediate axiom.

T3.5 stands for *Tychonoff*: A closed set and a point not in it can be separated by a function; i.e., one can define a continuous function with codomain [0,1] such that it takes the value 0 at the point and 1 in the closed set. Sometimes it is called $T\pi$

We can regulate the magnetic domains to be $T\pi$ I think it is so easy to make a topological regulation for the magnetic domains . The motion of magnetic domain and its transfer is described by brouwer theory on ecludian spaces .

$[a_1,b_1]\times[a_2,b_2]\times[a_3,b_3]\subset\square^{3} T : H_{XYZ} \rightarrow H_z$,So we have two ecludian spaces one of them is the ecludian space of formation which is well defined by nash embeeding theorem of daniel kapovich riemannian manifold and the second is the ecludian space of transfer. In his paper,Mohamed Atef has verified his theoretical assumptions by what is verified experimentally in Nd2FeB14 and what is achieved by Antena scientists to achieve the Hilbert fractal motion .Also the spectra that is verified by Daniel kapovich can be comparable by the Spec R of the previous tensor triangulated category.The torsion group expresses the fractal motion of this magnetic domains .

Riemannian manifold in itself can be treated as hausdroff space. High rank set theoretical topologist Danial Kaspovich have verified his results by ZFC axioms which is in consistent with the axiom of determinancy.So if we want to make a revision of belief model it must be a complete information model by XOR functions .Let B = {0, 1}. For two words v,w ∈ B m, where m ≤ ω, let hd(v,w) = |{i : v i 6= w i}| be the Hamming distance between v and w. For v,w ∈ Bω, we let v ∼w i hd(v,w) < ω

Definition : An infinite XOR function f : Bω →B is a function with the following property: if hd(w 1w2) = 1 then f(w 1)≠f(w 2).

Theorem : There exist 2^c infinite XOR functions.

Theorem :No player has a winning strategy in an
infinite XOR game Gf. There is a unique functor between the chain of prime ideals and the 2cinfinite XOR functions.

So the pinning down number for *Tπ* regulation of magnetic domain of 2 power aleph is deeply related to the partitioning theorems of erdos radon .

If X is a T3.5-space, then F(X) and A(X) denote the free topologicalgroup and the free abelian topological group on X.
F(X) is a topological group containing (a homeomorphic copy of) Xsuch that
1. X generates F(X) algebraically,
2. every continuous function f : X → H, where H is any topologicalgroup, can be extended to a continuous homomorphism ¯f: F(X) → H.Similarly for A(X).The existence of these groups was proved by Markov.
Theorem (JvMSSz) Let X be a T3.5-space. Then d(X) = d(F(X)) = d(A(X)).If X is neat, then so are A(X) and F(X), and pd(X) = pd(A(X)) = pd(F(X)).

By the partionning of T3.5-space into small groups by erdos-rado theorem into small cardinalities.
We can use these partitioned T3.5-space to create a generated free abelian groupsY.After that,we can regulate this pinning number by gp,(Y,,) is *the set of words of length not exceeding n in the subgroup generated*.

In recent years ,Eli katz ,S.A.Morris and Peter Nicolas have investigated the question of which free abeliantopological groups can be embedded as subgroups of the free abelian topologicalgroup on the closed unit interval I and, more generally, the closed ball B", for positive integers n.**[See 67 and 68]**
Definition. If X is a topological space with distinguished point e, the abelian topological group F(X) is said to be the (Graev) free *abelian topological group onX* if(a) X is a subspace of F(X), and
(b) any continuous map $ from X into any abelian topological group H, sending eto the identity of *H,* extends uniquely to a continuous homomorphism f : F(Y) →*H.*

Theorem A (Mack et al.)*Let Y= UY, be any k,-space with distinguished point e. Then F(X) is a k,-space and F(Y) has km-decomposition F(Y)=U,* gp,(Y,,), *where* gp,(Y,,) is *the set of words of length not exceeding n in the subgroup generated by Y,.* **[See 67 and 68]**

Definition. Let Y= U X,, be a k,-space, and let Z= U Z, be a closed k,-subspaceof *F(X).* Then Y is said to be regularly *situated* with respect to X if for each natural number *n* there is an integer tn such that gp(Y) fl gp,(X,) C_ gp,(Y,).

Theorem B (Mack et al.)ZfX *is a km-space, and Y is a closed subset of F(Y)containing e such that Z \ {e} is a free algebraic basis for* gp(Z) *and Z is regularly situated with respect to Y, then* gp(Z) *is F(Z).*

Let T be a L-theory with infinite model.For any $\kappa \geq |L| + aleph$,there is N $\models$ T of cardinality κ with 2^κ automorphisms.

So the pinning structures can be saved in all the partition methodologist into different finite cardinals .

5.Barkhausen jumps according to the advances in experimental material science:

In the absence of an externalmagnetic field the magnetic moments of the soft magneticfiller particles are close to zero. Thus, the ME materials haveno net magnetization and in static experiments (static shear,elongation or compression) demonstrate usual elastic behaviorcharacterized by linear Hookean stress–strain dependenceat small strains. We have synthesized recently ME based on hard magneticparticles of NdFeB alloy . In contrast to MEfilled with carbonyl iron or magnetite, magnetically hardmagnetic elastomers (MHME) have non-zero magnetizationin the absence of external magnetic field and demonstrate thestriking properties which MSME acquire only in a magneticfield. In particular, the preliminary studies have shown thatbeing pre-magnetized MHME are characterized by a straindependentmodulus and demonstrate the shape memory effect. Besides, we have found a strong magnetodielectriceffect in MHME displayed as 150% increase of effectivedielectric permittivity in the magnetic field of 10 kOe.Thus, these materials could be used in numerous applicationsin various areas and understanding of their behavior inmagnetic field is challenging. we analyze in deta ils the influence of themagnetizing field on the magnetic and viscoelastic propertiesof MHME based on NdFeB powder of different particle s ize and concentration. The NdFeB and carbonyl iron powders were used asmagnetic fillers. To study the influence of magnetic parti clesize on the ME properties the two types of NdFeB powderswere chosen with the average particle sizes of 50 μm and2 μm. The image of the NdFeB particles is presented infigure 1. Carbonyl iron particles have the average sizeof 3 μm.**[See Ref4]**

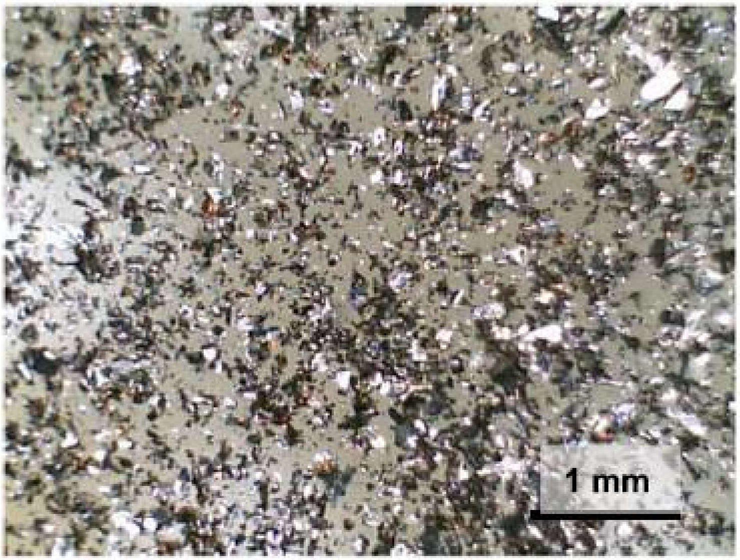

Figure 1. The optical microscopy image of NdFeB particles.

I t is proved that there was many enhancing in the surface energy of this composite. In his paper heat treatment of duplex stainless steel 2205 by inserting nano Nd2FeB14 inHIP manifold ,Mohamed atef succeded to verify experimentally that the impact energy increased from 20-25J to be 100 Joule after applying magnetic field and solve the problem of losing impact energy during aging treatment of duplex stainless steel 2205. **[See Ref3]**

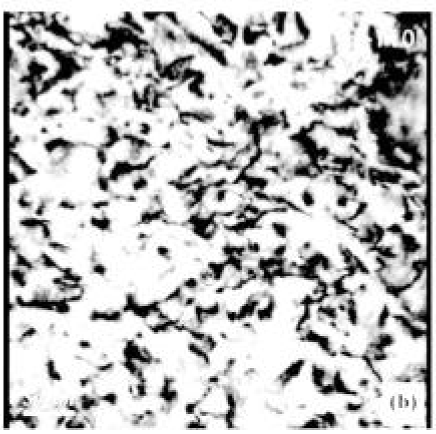

Fig 2: Aged □-ferrite grain after impact test after inserting Nd2 Fe B14 particles in HIP manifold and the application of high magnetic field

Mohamed Atef has used Lusternik Schnierelman category in his paper to formulate the thermal content OF DUPLEX STAINLESS 2205 .The same mathematics can be extended to cover The NdFeB and carbonyl iron powders.[See Ref3,4]

DEFINITION. The Lusternik-Schnirelman category of A in X, cat(A: X), is the least integer n such that A can becovered by n closed subsets of X each of which is contractible in X. If no such integer n exists we put cat (A; X) =∞□. We define cat(X) = cat(X; X)

The Lusternik-Schnirelman category is used for finslers spaces especially. As we mentioned above, solobev space where Ising model and cahn hillard equations are highly related to it. Solobev space is suppoed to be defined on finsler manifold (Antonelli, Ingarden, & Matsumoto, 2013; Bao, Chern, & Shen, 1996).Using the MAIN THEOREM OF LUSTERNIK-SCHNIRBLMANTHEORY,we can write the entire thermal content of the system as $CT(M) = \square D(c(m))E(\mathrm{c(n)})$**[See Ref3]**
D(c(m)) is fractal measurement depends on c(m) as defined in main theorem of Lusternik Schnirbl main theory E(c(n)) is dipolar field interaction depends on c(n) as defined in main theory of lusternik schinirby main theorem.

We must mention that Mohamed atef work was deeply related with dislocation dynamics and their properties that has been changed after magnetic filling Nd2FeB14 in HIPed duplex stainless steel 2205.

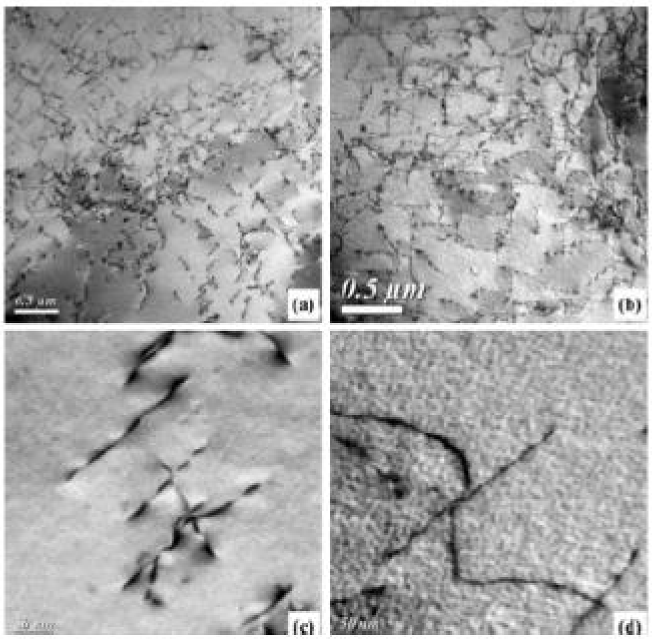

Fig 3: Transmission electron micrographs of the: (a) unaged □-ferrite; (b) aged □-ferrite; (c) unaged □-ferritewith high magnification; (d) aged □-ferrite with higher magnification

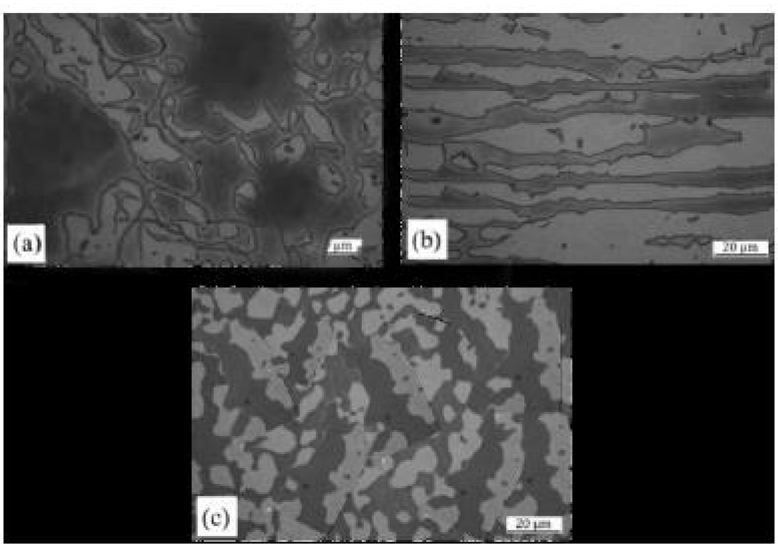

Fig 4:Optical micrographs of the 2205 duplex stainless steel bar after inserting Nd2Fe B14 particles in HIPmanifold.(dislocation densities vary considerably) : (a) transverse section of the unaged specimen; (b) longitudinalsection of the unaged specimen; (c) transverse section of the aged specimen

A new theory of Barkhausen jumps is proposed, which depicts the movement of 180° Bloch walls as due to kinks bounded by Néel lines. **[See Ref 70]**These lines can be pinned on dislocations. Two activation energies are introduced, one of them for small jumps in low fields and low temperatures (pinning energy), the other one for line nucleation energy. An expression of the coercive field is given. After-effect phenomena can be explained by the same physical processes. Comparison is made with recent experiments .It is suggested that the variation in size of Barkhausen jumps with field partially reflects the short-range order of pinning defects, and also a change in behaviour with the density of Néel lines (flexible when they behave independently one from the other, rigid when they interact).

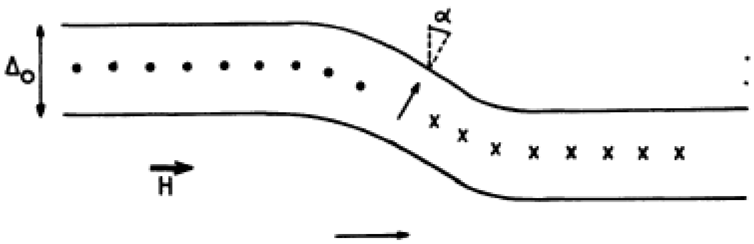

Figure 5:The displacement of the wall segement on the left under the action of applied magnetic fieldH.The line energy increases by a quantity of the order.[See Ref 70]

This new theory that is proposed is deeply related with our charachteristic structures for duplexstainless steel 2205 and NdFeB and carbonyl iron powders.

So ,We can make a coomon formula for the surface energy that is related to LS category and T3 space that is related with bakehausern effect and the fiolation. There is only one partion for T3 Space such that:
Every Borel set of the first category in T3 space is no where dense and the support of each regular borel measure on T3 is nowhere dense. Then we introduce two versions of the tangential category for a measurable lamination.For a spaceXwhich are new evenFis the underlying measurable lamination of a (topological)lamination. The first one, simply called its (LS) category, is a direct adaptation tomeasurable laminations of the tangential (or even the usual) category. The second one is called the Λ-category because it involves a transverse invariant measure Λ, whose existence is a restriction.
Proposition :
LetTbe a measurable transversal which meets each leaf at mostin one point. ThenΛ(T)≤Cat(F,Λ) **[See Ref 71,72,76]**
.
Proposition :Let(X,F,Λ)be a measurable lamination with a transverse in-variant measure. If(X,F)is a measurable suspensionfM×hS, thenCat(F,Λ)≤Cat(M)·Λ(S)
.
Proposition :For a manifold and a standard Borel spaceT, letM×Tbefoliated as a product. Then
Cat(M×T,Λ) = Cat(M)·Λ(T)for every measureΛonT, considered as an invariant measure ofM×T. **[See Ref 71,72,76]**

6.Set theoretical model for Landau Levels on torus and probability functions:

Here is an apparent paradox here: infinitesimal translations should be associated to canonical operators[px,py]∝iℏB, and, at the same time, live in a Landau levelof finite dimension B= L1L2/(hc/e), which is impossible from Wintner's theorem.

Let$T^2 = □^2 / □^2$denote the two-torus; we describe it in physical terms by identifying an atlas of four local charts specified as follows:
1.Uα={0< x < L1,0< y < L2}
2.Uβ={x < x < L1+¯x,0< y < L2}2
3.Uγ={0< x < L1,y < y < L2+¯y}
4.Uδ={x < x < L1+¯x,y < y < L2+¯y}
with some choice of constants¯xand¯y. A uniform magnetic field B transverse to the surfaceT2is represented by the translation invariant two-formB=B dx∧dy

Aβ(x,y) =Aα(x,y)(¯x < x < L1)Aγ(x,y) =Aα(x,y)(¯y < y < L2)
Aδ(x,y) =Aα(x,y)(¯x < x< L1,y < y < L2)Aβ(x+L1,y) =Aα(x,y) +d(.5B(L1y-L2x) . Markov processes are stochastic processes that have the property that the next value of the process depends on the current value, but it is conditionally independent of the previous values of

the stochastic process – in other words, the behavior of the process in the future is stochastically independent of its behavior in the past, given the current state of the process. For a stochastic process to be a Markov process, it must have this property, which is referred to as the **Markov property.**

It is deeply related with landau levels.When we define the landau levels in torus,we mean that there is a deep meaning of convexity. [See Ref90]

So to calaculate the probability of a particle to occupy landau levels,you must calculate it in hitting property .

Uwe Basel [See 91,92]obtain symmetric formulae for the probabilities that a plane convex body hits exactly 1, 2, 3, 4, 5 or 6 triangles of a lattice of congruent triangles in the plane. Furthermore,a very simple formula for the expectation of the number of hit triangles is derived.

In the following, we choose ϕ as the angle between the direction perpendicular to the sides b and segment σ (see Fig. 7). We assume that for every angle ϕ ,_ $0 \le \phi \le 2\pi$, there is a position of the reference point O so that C with angle ϕ denoted as C_ϕ is entirely contained in exactly one triangle **T** of **R**a; b; c.

$$c^*(\phi) = s(\phi)\csc\alpha + s(\phi+\alpha+\beta)\csc\beta + s(\phi+\alpha+\pi)(\cot\alpha + \cot\beta)\,.$$

…………………………………………………………………………………………………..(1)

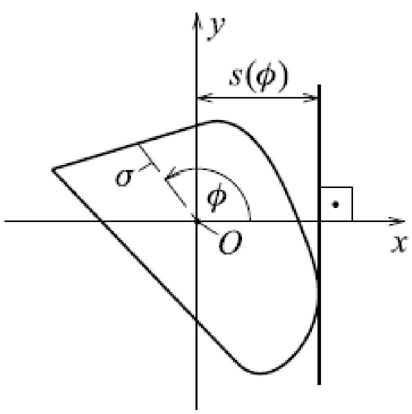

Fig7:Support function s

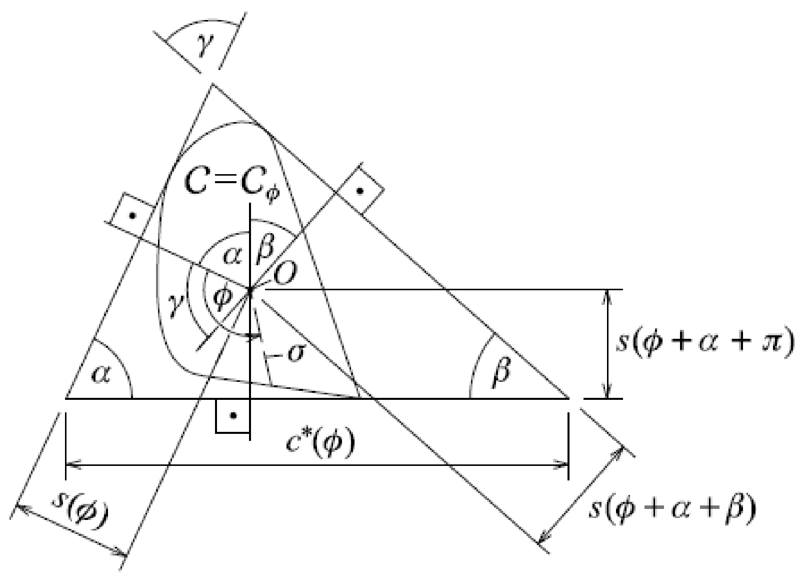

Figure8:Trinagle(ϕ)

These triangulation formula and their probabilistic field is deeply related to two things :

1.Tensor triangulated category approach for magnetic fields on torus conditions.

2.The propabilty nature of landau levels as they donot related with a specific laws in the case of torus and deeply related with probability. **[See91]**

The best probalistic interruption when the relation (1) holds followed by this in the next page .And also we give the randomness of particle distribution by Z number related with landau levels.

If you practice the equations you will find they are deeply related with the uniform distribution in figure 6 even if in the E(Z)formula . In figure 6 ,we have partitioned them into N with different scales.

Also we we have calculated p(1),p(2),……………..,p(6).**[See91,92]** **These triangulation formula and their probabilistic field is deeply related to two things :**

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Also we we have calculated p(1),p(2),…………….,p(6). **[See91,92]**

$$p(1) = 1 - \frac{(a+b+c)u}{\pi Q} + \frac{(a^2+b^2+c^2)J(0)}{2\pi Q^2} + \frac{bcf_1(\alpha)+caf_1(\beta)+abf_1(\gamma)}{\pi Q^2},$$

$$p(2) = \frac{(a+b+c)u}{\pi Q} - \frac{3(a^2+b^2+c^2)J(0)}{2\pi Q^2} - \frac{bcf_2(\alpha)+caf_2(\beta)+abf_2(\gamma)}{\pi Q^2},$$

$$p(3) = \frac{3(a^2+b^2+c^2)J(0)}{2\pi Q^2} + \frac{bcf_3(\alpha)+caf_3(\beta)+abf_3(\gamma)}{\pi Q^2},$$

$$p(4) = \frac{bcJ(\alpha)+caJ(\beta)+abJ(\gamma)}{\pi Q^2} - \frac{(a^2+b^2+c^2)J(0)}{2\pi Q^2} - \frac{F}{Q},$$

$$p(5) = 0, \quad p(6) = \frac{F}{Q},$$

with

$$f_1(x) = I(x) - J(x), \quad f_2(x) = 2I(x) - 3J(x), \quad f_3(x) = I(x) - 3J(x),$$

$$I(x) = \int_0^{\pi} w(\phi)w(\phi+x)\,\mathrm{d}\phi, \quad J(x) = \int_0^{2\pi} s(\phi)s(\phi+x)\,\mathrm{d}\phi,$$

and the expectation for the random number Z of hit triangles by

$$\mathrm{E}(Z) = 1 + \frac{(a+b+c)u}{\pi Q} + \frac{2F}{Q}.$$

Donot forget the probability function related to landau levels in finite dimensions has been solved as follow:

$$\psi_\nu(z) = \mathcal{N}_\nu e^{\frac{1}{2}z^2 + 2\pi i\nu z/L_1} \sum_{n=-\infty}^{\infty} \exp\{-(z + nL_1/N + i\nu L_2/N)^2\}.$$

And the denisity matrix with $\rho_N(z) = \sum_\nu |\psi_\nu(z)|^2$
So you can partition the density to N=1,2,…………………….,6

Also donot forget we define them in torus and it is easy to obtain probability distribution in convex body.
In his book ,Gabriele Isberner **[See93]** described rules for conditional states and it is also the best way to describe the problem of landau levels in torus as we have mentioned it is impossible from Wintner's theorem.In his work ,he described the conditional functions as a solution of the problem of nonmontonicity **[See Ref 93].** Donot forget that there is a high monotonic behavior for the charged particles to occupy landau levels.Also ,we have proved that magnetic domains have the cardinality of 2 power aleph and we can regulate them to k -ordinals . Also donot forget we define them in torus and it is easy to obtain probability distribution in convex body.

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Theorem 4.2.1. *The conditional revision operator $*$ satisfies* (CR5) *iff for each epistemic state* $(\Psi, \leqslant_\Psi)$ *and for each conditional* $(B|A)$ *it holds that:*

$$\omega \leqslant_\Psi \omega' \quad \textit{iff} \quad \omega \leqslant_{\Psi*(B|A)} \omega' \tag{4.1}$$

for all worlds ω, ω' *both being elements of* $Mod(AB)$ *(or of* $Mod(A\overline{B})$*, or of* $Mod(\overline{A})$*, respectively).*

As an immediate consequence, equation (4.1) yields

Lemma 4.2.1. *Suppose (4.1) holds for all worlds* ω, ω' *both being elements of* $Mod(AB)$ *(or of* $Mod(A\overline{B})$*, or of* $Mod(\overline{A})$*, respectively). Let* $E \in \mathcal{L}$ *be a proposition such that either* $E \leqslant AB$*, or* $E \leqslant A\overline{B}$*, or* $E \leqslant \overline{A}$*. Then*

$$min(E;\Psi) = min(E;\Psi * (B \mid A))$$

Lemma 4.3.1. *Let* $(B|A)$ *be a conditional in* $(\mathcal{L} \mid \mathcal{L})$*, let* κ *be an ordinal conditional function. The following three statements are equivalent:*

(i) $\kappa \models (B|A)$.
(ii) $\kappa(AB) < \kappa(A\overline{B})$.
(iii) $\kappa(\overline{B}|A) > 0$.

[See93]So, we have the mathematical tools like set theory to solve the problem of landau levels on torus as the ordinals for landau levels. **[See90]**

References:

1.Mohamed Atef Mohamed Gebril,Some proposition that links ferromagnetic models with cantorian set theory,Applied Physics research ,Candian Center of Science and Education,Vol8No6(2016) http://dx.doi.org/10.5539/apr.v8n6p1

2.Mohamed Atef Mohamed Gebril,Set theoretical model for magnetism ,Ominiscriptum Publishing group,LAP academic,Feb 2017

3.Mohamed Atef Mohamed Gebril, Heat Treatment of Duplex Stainless Steel 2205 by Inserting NanoNd2FeB14 in HIP Manifolds Under the Scope of Category Theory,Journal of Material Science research,Candian Center of Science and Education,Vol6No(1) http://dx.doi.org/10.5539/jmsr.v6n1p1

4.E Yu Kramarenko,A V Chertovich, G V Stepanov, A S Semisalova,L A Makarova, N S Perovand A R Khokhlov,Magnetic and Visoealstic response of elastomers with hard magnetic filler, Smart Mater. Struct. 24 (2015) 035002 (11pp)

5.Aharoni, A. (1995). Introduction to the theory of ferromagnetism (International Series of Monographs in Physics,pp. 60-80). Oxford Science Publication. http://dx.doi.org/10.1063/1.881916

6.Akıncı, Ü. (2014). Anisotropic Heisenberg model in thin film geometry. *Thin Solid Films*, *550*, 602-607.http://dx.doi.org/10.1016/j.tsf.2013.10.002

7.Aurongzeb, D. (2006). Self-assembly of fractal nanowires and stripe magnetic domain on stretchable substrate.*Applied physics letters*, *89*(12), 123128. http://dx.doi.org/10.1063/1.2353825

8.Bathany, C., Le Romancer, M., Armstrong, J. N., & Chopra, H. D. (2010). Morphogenesis of maze-like magnetic domains. *Physical Review B*, *82*(18), 184411. http://dx.doi.org/10.1103/PhysRevB.82.184411

9.Carlen, E. A., & Loss, M. (1993). Sharp constant in Nash's inequality. *International Mathematics ResearchNotices*, *1993*(7), 213-215.
10.Carmona, J. M., Marconi, U. M. B., Ruiz-Lorenzo, J. J., & Tarancón, A. (1998). Critical properties of the Isingmodel on Sierpinski fractals: A finite-size scaling-analysis approach. *Physical Review B*, *58*(21), 14387.http://dx.doi.org/10.113/PhysRevB58.14387
11.Coey, J. M. D. (2009). Magnetism and Magnetic Materials (pp. 128-174). Cambridge University Press.http://dx.doi.org/10.1017/CBO9780511845000
12.Cullity, B. D. (1972). *Introduction to Magnetic Materials* (pp. 275-300). Addison-Wesley, London. http://dx.doi.org/10.1002/9780470386323
13.Davies, E. B. (1990). Heat kernels and spectral theory. *Cambridge Tracts in Mathematics* (volume 92).Cambridge University Press.
14.Davies, R. O., & Rogers, C. A. (1969). The problem of subsets of finite positive measure. *Bulletin of the LondonMathematical Society*, *1*(1), 47-54. http://dx.doi.org/10.1112/blms/1.1.47
15.Lee, J. M. (1997). Riemannian Manifolds: An Introduction to Curvature (Graduate Texts in Mathematics).Springer. http://dx.doi.org/10.1007/b98852
16.Lee, K. S., Kim, D. H., & Choe, S. B. (2010). Fractal Dimension of Magnetic Domain Walls in CoFe/PtMultilayers. *Journal of Magnetics*, *15*(3), 99-102. http://dx.doi.org/10.4283/JMAG.2010.15.3.099
17.Li, Y., & Wang, Y. (2006). Bubbling Location for F harmonic maps and inhomogeneous Landau Lifshits equations. *Math Helv, 81*(2006), 433-448. http://dx.doi.org/10.4171/CMH/57.
18.Meyer, D. A. (1999). Quantum strategies. *Physical Review Letters*, *82*(5), 1052.
19.Myceilsky, J. (1964). On the axiom of determinateness Fund. *Math. 54*(1964), 05-224. http://dx.*doi*.org/10.2307/2272655
20.Nash, J. (1958). Continuity of solutions of parabolic and elliptic equations. *American Journal of Mathematics*,*80*(4), 931-954.
21.Osborne, M. J., & Rubinstein, A. (1994). *A course in game theory*. MIT press.
22.Piette, B. M. A. G., & Zakrzewski, W. J. (1998). Localized solutions in a two-dimensional Landau-Lifshitz model.*Physica D: Nonlinear Phenomena*, *119*(3), 314-326. http://dx.doi.org/10.1016/S0167-2789(98)00084-0
23.Adams, F. V., Olubambi, P. A., Potgieter, J. H., & Van Der Merwe, J. (2010). Corrosion resistance of duplexstainless steels in selected organic acids and organic acid/chloride environments. *Anti-Corrosion Methodsand Materials*, *57*(3), 107-117. http://dx.doi.org/10.1108/00035591011040065
24.Akbar-Zadeh, H. (1988). Sur les espaces de Finsler à courbures sectionnelles constantes. *Acad. Roy. Belg. Bull. Cl.Sci.(5)*, *74*(10), 281-322.
25.Alvarez-Armas, I., & Degallaix-Moreuil, S. (Eds.). (2009). *Duplex stainless steels*. John Wiley & Sons.
26.Antonelli, P. L., Ingarden, R. S., & Matsumoto, M. (2013). *The theory of sprays and Finsler spaces with applications in physics and biology* (Vol. 58). Springer Science & Business Media.
27.Bahuaud, E., & Helliwell, D. (2011). Short-time existence for some higher-order geometric flows. *Communications in Partial Differential Equations*, *36*(12), 2189-2207.
28.Bao, D., Chern, S. S., & Shen, Z. (1996). Preface for "Finsler geometry over the reals" (pp. 3–13).
29.Basyigit, A. B., & Kurt, A. (2014). Corrosion Properties and Impact Toughness of 2205 Duplex Stainless Steelafter TIG Welding*. *Materials Testing*, *56*(10), 786-794. doi: 10.3139/120.110628
30.Bejancu, A., & Blair, D. E. (1990). *Finsler geometry and applications*. New York: Ellis Horwood.
31.Bidabad, B., & Shahi, A. (2013). On Sobolev spaces and density theorems on Finsler manifolds. *arXiv preprintarXiv:1310.8027*.
32.Borceux, F. (1994). *Handbook of Categorical Algebra I: Basic Category Theory (Encyclopedia of Mathematics and Its Applications)*. Cambridge University Press.
33.Bucur, I., Deleanu, A., & Hilton, P. J. (1968). *Introduction to the Theory of Categories and Functors* (Vol. 13, p.13). London: Wiley.
34.Burch, D., & Bazant, M. Z. (2009). Size-dependent spinodal and miscibility gaps for intercalation in nanoparticles.*Nano letters*, *9*(11), 3795-3800. DOI: 10.1021/nl9019787 ·
35.Palais, R. S. (1966). Lusternik-Schnirelman theory on Banach manifolds. *Topology*, *5*(2), 115-132. DOI: 10.1016/0040-9383(66)90013-9
36.Park, H., & De Cooman, B. C. (2014). Creep Deformation of Type 2205 Duplex Stainless Steel and its ConstituentPhases. *ISIJ international*, *54*(4), 945-954. http://doi.org/10.2355/isijinternational.54.945
37.Phillips, N. S., Chumbley, L. S., & Gleeson, B. (2009). Phase transformations in cast superaustenitic stainlesssteels. *Journal of Materials Engineering and Performance*, *18*(9), 1285-1293.
38.Rudraraju, S., Van der Ven, A., & Garikipati, K. (2015). Mechano-chemical spinodal decomposition: A phenomenological theory of phase transformations in multi-component, crystalline solids. *arXiv preprintarXiv:1508.05930*.
39.Stanley, D. (2002). On the Lusternik-Schnirelmann category of maps. *Canadian Journal of Mathematics*, *54*(3),608-633. http://dx.doi.org/10.4153/CJM-2002-022-6

40. Chiu Fan Lee*and Neil F. Johnson, Efficient quantum computation within a disordered Heisenberg spin-chain, Centre for Quantum Computation and Physics DepartmentClarendon Laboratory, Oxford UniversityParks Road, Oxford OX1 3PU, U.K

41. C. E. Alchourròn, P. Gärdenfors, and D. Makinson (1985). On the logic of theory change: Partial meet contraction and revision functions. *Journal of Symbolic Logic*, 50:510–530.

42.C. Boutilier (1995). Generalized update: belief change in dynamic settings. In *Proceedings of the Fourteenth International Joint Conference on Artificial Intelligence (IJCAI'95)*, pages 1550–1556.

43. M. Dalal (1988). Investigations into a theory of knowledge base revision: Preliminary report. In *Proceedings of the Seventh National Conference on Artificial Intelligence (AAAI'88)*, pages 475–479.

***44.*Fletcher, William (1980). An engineering approach to digital design. Prentice-Hall. p. 98. *ISBN 0-13-277699-5*.**

***45.* Han, Qing; Hong, Jia-Xing (2006). Isometric Embedding of Riemannian Manifolds in Euclidean Spaces. Mathematical Surveys and Monographs. 130. Providence, RI: American Mathematical Society. *doi:10.1090/surv/130*. *ISBN 0-8218-4071-1*. *MR 2261749*.**

46. Cohen, I. S. *(1946), "On the structure and ideal theory of complete local rings",* Transactions of the American Mathematical Society*, 59: 54–106,* doi:10.2307/1990313, ISSN 0002-9947, JSTOR 1990313, MR 0016094 Cohen's paper was written when "local ring" meant what is now called a "Noetherian local ring".

47. Fulton, William *(1993), Introduction to Toric Varieties,* Princeton University Press, ISBN 978-0-691-00049-7, MR 1234037

48. P. Balmer. The spectrum of prime ideals in tensor triangulated categories. J. Reine Angew. Math., 588:149{168, 2005.

49. P. Balmer. Witt groups. In Handbook of K-theory. Vol. 2, pages 539{576. Springer,Berlin, 2005.

50. D. J. Benson, Representations and cohomology I&II, volume 30&31 of Cambridge Studiesin Advanced Mathematics. Cambridge University Press, 1998.
51. L.L. Avramov; H.-B. Foxby, Homological dimensions of unbounded complexes, *J. Pure Appl. Algebra* 71 (1991),129{155
52.. W. Bruns; J. Herzog, Cohen{Macaulay rings, revised edition, Cambridge Studies in Advanced Mathematics, 39,*Cambridge University Press, Cambridge*, 1998.
53 .L. W. Christensen, Gorenstein dimensions, Lecture Notes in Mathematics, 1747, *Springer-Verlag, Berlin*, 2000.
54 .I. Dell'Ambrogio; G. Tabuada, Tensor triangular geometry of non-commutative motives, *Adv. Math.* 229 (2012),no. 2, 1329{1357.
55. E. S. Devinatz; M. J. Hopkins; J. H. Smith, Nilpotence and stable homotopy theory, I, *Ann. of Math. (2)* 128(1988), no. 2, 207{241.
***56.* Davydov, A.S. (1976). Quantum Mechanics, 2nd Edition. *Pergamon Press*. *ISBN 0-08-020437-6*.**
57. K.V. Kazmerchuk, E.M. Ovsiyuk, SCALAR PARTICLE WITH INTRINSIC STRUCTURE IN THE ELECTROMAGNETIC FIELD IN CURVED SPACE-TIME, I.P. Shamyakin Mozyr State Pedagogical University, Mozyr, Belarus
58. O. Brinon, Analytic rings and their algebraic properties(after K. Kedlaya), Workshop on F-isocrystals and rigid geometry
59. K. Kedlaya. A p-adic local monodromy theorem, preprint (December 31, 2002), to appear in Annals of Math. (2004). Availableon ArXiv: math.AG/0110124.
60. P. Colmez. Les conjectures de monodromie p-adique, S_eminaire Bourbaki, 54-_eme ann_ee, n_ 897, (2001-2002).
61. T. Ono, *On the Tamagawa number of algebraic tori* Annals of Mathematics 78 (1) 1963.
***62.* Tits, Jacques (1966). "Classification of algebraic semisimple groups". In Borel, Armand; Mostow, George D. Algebraic groups and discontinuous groups. Proceedings of symposia in pure math. 9. American math. soc. pp. 33–62.**
63. Munkres, James R. *(2000). Topology (2nd ed.).* Prentice Hall. ISBN 0-13-181629-2.
64.. I. Juh_asz, L. Soukup, Z. Szentmikl_ossy: Pinning Down versus Den-sity, Israel J. Math, to appear.
65.David Marker,Model Theory:An Introduction,Graduate Texts in mathematics,Springer
66. Erdős, Paul*;* Hajnal, András*; Máté, Attila;* Rado, Richard *(1984), Combinatorial set theory: partition relations for cardinals, Studies in Logic and the Foundations of Mathematics, 106, Amsterdam: North-Holland Publishing Co.,* ISBN 0-444-86157-2, MR 0795592
67. Eli katz ,S.A.Morris and Peter Nicolas,Free abelian topological groups and adjunction spaces,Journal of Pure and Applied Algebra (68).
68. E. Katz, Free topological groups and principal fiber bundles, Duke Math. J. 42 (197.5) 83-90.
69. S.A. Morris, Free abelian topological groups, in: Categorical Topology, Proc. Conference Toledo,Ohio, 1983 (Heldermann, Berlin, 1984) 375-391.
70.M.Kleman ,Barkhausen Jumps in soft magnetic materials at lowfields,J.Physique42(1981)1263-1267.
71. CARLOS MENINO COTON, MEASURABLE VERSIONS OF THE LS CATEGORY ONLAMINATIONS.

72. M. BermudezLaminations Bor´eliennes. Tesis, Universit´e Claude Bernard-Lyon 1 (2004).

73.M. Bermudez, G. HectorLaminations hyperfinies et revˆetements. Ergod. Th. Dynam. Sys.26, 305–339 (2006).
74.A. Candel, L. ConlonFoliations I. Amer. Math. Soc. (1999)
75.H. ColmanCategor´ıa L-S en foliaciones. Tesis, Departamento de Xeometr´ıa e Topolox´ıa,Universidad de Santiago de Compostela (1998).
76.H. Colman, E. Macıas VirgosTangential Lusternik-Schnirelmann category of foliationsJ. London Math. Soc. 2, 745–756 (2002)
77. M. TakesakiTheory of Operator AlgebrasSpringer-Verlag, New York, Heidelberg, Berlin(1979).
78. O. Alvarez, Topological Quantization and Cohomology, Commun.Math.Phys. 100 (1985), 279–309.
79. H. Aoki, Quantized Hall Effect, Rep. Progr. Phys. 50 (1987), 655–730.
80. B.A. Dubrovin, Theta functions and non–linear equations, Russian Math. Surv. 36 (1981), no. 2,11–92.
81. R. Ferrari, The Quantum Hall Effect, Elementary Particles, Quantum Fields and Statistical Me-chanics (M. Bonini, G. Marchesini, and E. Onofri, eds.), Universit`a di Parma, 1994, pp. 155–201.
82. S. Fubini, Finite Euclidean magnetic group and theta functions, Int.J.Mod.Phys. A7 (1992), 4671–4692.
83. F. Hirzebruch, Topologial Methods in Algebraic Geometry, Grundlehren der mathematischen Wis-senschaften, no. 131, Springer-Verlag, 1978.
84. J. R. Klauder and E. Onofri, Landau Levels and Geometric Quantization, Int. J.Mod. Phys. A (1989), 3939–3949.
85. M. J. Lighthill, Fourier Analysis and Generalized Functions, Cambridge University Press, Cam-bridge, 1964.
86. L. D. Landau and E. M. Lifshitz, Quantum mechanics, Addison Wesley, Reading, Mass., 1958.
87.C. R. Putnam, Commutation Properties of Hilbert Space Operators and related topics, Erg.d.Math.und i.Grenz., vol. 36, Springer-Verlag, New York, 1967.
88. D.J. Simms and N.M. Woodhouse, Lectures on Geometric Quantization, Lecture Notes in Physics,vol. 53, Springer-Verlag, Berlin, 1976.
89. Andr´e Weil, Vari´et´es k¨ahleriennes, Actualit´es scientifiques et industrielles, no. 1267, Hermann,Paris, 1958.
90. E. Onofri ,Landau levels on a torus
91. Uwe Basel, Hitting Probabilities for Random Convex Bodiesand Lattices of Triangles, Applied Mathematical Sciences, Vol. 8, 2014, no. 166, 8295 – 8307.
92. U. Basel, A. Duma, Intersection probabilities for random convex bodiesand lattices of parallelograms (II), Fernuniversit• at Hagen: Seminar-berichte aus der Fakult• at f• ur Mathematik und Informatik 86 (2014), 101-108.
93. Gabriele Kern-Isberner ,Conditionals inNonmonotonic Reasoningand Belief Revision, Lecture Notes in Artificial Intelligence 2087,springer.
94.Pavel Bleher, Mikhail Lyubich, and Roland Roeder. Lee-Yang Zeros forthe DHL and 2D Rational Dynamics, I. Foliation of the Physical Cylinder.To appear in Journal de Mathématiques Pures et Appliquées (104 pages).
95. T. Asano. Lee-Yang theorem and the Gri_ths inequality for the anisotropic Heisenberg ferromagnet. PhysicalReview Letters, 24(25):1409–1411, June 1970.
96.A. Sinclair and P. Srivastava. Lee-Yang theorems and the complexity of computing averages. In Proc. 45th AnnualACM Symposium on Theory of Computing (STOC), pages 625–634. ACM, 2013. To apear in Communications inMathematical Physics.