

'ADALAH

Buletin Hukum & Keadilan

Ising Model in Human Social Interaction (The Physics Application Theory in Social Field)

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Abstract:

Physics as a natural science is very wide. One of the intriguing topics which was so famous in 1925 is the Ising Model. This model describes the interaction of spins in lattices. A spin is an intrinsic form of angular momentum carried by elementary particles. Elementary particles are very tiny which composed a body. In reality, they always interact with each other and their interactions are so complicated. If we connect this phenomenon with social interaction, where all human beings in daily life always interact with each other. This is an extraordinary fact, that not only humans always interact as social creatures, but also elementary particles interact with each other and the environment around them.

Keywords: *Ising Model, Social Creatures, Interaction*

Abstrak:

Fisika sebagai ilmu alam sangat luas. Salah satu topik menarik yang sangat terkenal pada tahun 1925 adalah Ising Model. Model ini menggambarkan interaksi spin dalam kisi. Spin adalah bentuk intrinsik dari momentum sudut yang dibawa oleh partikel elementer. Partikel-partikel elementer sangat kecil yang membentuk suatu benda. Pada kenyataannya mereka selalu saling berinteraksi dan intereksinya sangat rumit. Jika kita menghubungkan fenomena ini dengan interaksi sosial, di mana semua manusia dalam kehidupan sehari-hari selalu saling berinteraksi. Ini adalah fakta yang luar biasa, bahwa tidak hanya manusia selalu berinteraksi sebagai makhluk sosial, tetapi juga partikel elementer berinteraksi satu sama lain dan lingkungan di sekitar mereka.

Kata Kunci: *Ising Model, Makhluk Sosial, Intercection*

Prologue

Interaction always happens among human beings because we are social creatures who can not live alone. Not only human beings can interact with each other, but elementary particles which are so tiny, they also interact with each other. We study the interaction of elementary particles in physics that we call the interaction of spins. It is so a wonderful fact. So, physics as a natural science gives us a new insight that microscopic objects do interactions too. Natural and social science have an interesting connection which we can study.

What is the Ising model?

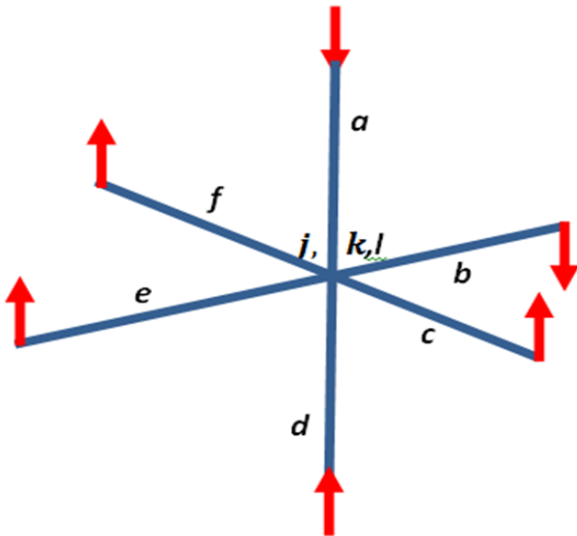
The Ising model, named after the physicist Ernest Ising, is a mathematical model of ferromagnetism in statistical mechanics. The model consists of discrete variables that represent magnetic dipole moments of atomic "spins" that can be in one of two states (+1 or -1). The spins are arranged in a graph, usually a lattice (where the local structure repeats periodically in all directions), allowing each spin to interact with its neighbors. Neighboring spins that agree have lower energy than those that disagree; the system tends to the lowest energy but heat disturbs this tendency, thus creating the possibility of different structural phases. The model allows the identification of phase transitions, as a simplified model of reality. The two-dimensional square-lattice Ising model is one of the simplest statistical models to show a phase transition (Gallavotti, 1999).

The Ising model was invented by the physicist Wilhelm Lenz (1920), who gave it as a problem to his student Ernst Ising. The one-dimensional Ising model was solved by Ising (1925) himself in his 1924 thesis; (Ising, 1925) it has no phase transition. The two-dimensional square-lattice Ising model is much harder and was only given an analytic description much later, by Lars Onsager (1944). It is usually solved by a transfer-matrix method, although there exist different approaches, more related to quantum field theory (Ising, 1925).

Human beings as social creatures

Human beings are as a servant on earth which is composed of three elements, namely: physical (physical, lust), reason (ratio), and spiritual (psychic, spirit). As a consequence of man as servant and vicegerent of God on earth, then the human being is: the creature of God's creation, creatures are born in a helpless condition (clean paper), requires the assistance of another person, a creature that can think (Umanailo, 2014), sentient beings, creatures who have always wanted to know about everything, beings who can speak, a creature

that can make equipment device (Coleman, 2009), social creatures that can work together, creatures that can organize themselves to meet the needs of life, creatures that live based on economic principles, a creature of the religious, rational beings free to act based on moral reasons, a creature with a social contract to respect and maintain the rights of others.



The interactions of spins

Ising Model in Human Social Interaction

Ising model which we study in the physics field gives us a description, that everything in the world always interacts with each other. The Ising model gives us an example on a microscopic scale. On the macroscopic scale, we can find the best example of the interactions, that is the interactions of human beings. We know, that we can not live alone without interactions with others because we are social creatures. In this case, we found that there is a connection between natural dan social science. Both of them (spins and social interactions) are so complicated. We need to do research deeply to describe them.

Epilogue

Everything in the world not only on the macroscopic scale but also on the microscopic scale always interacts with each other. This is the law of nature which we can find dan study in physics or social field. Their connection gives us new insight, that social dan natural science has a connection.

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