

# Theory for cause of metastable state

- Establishing causality in nature again -

Wolfhart Willimczik

2106 72<sup>nd</sup> St W, Bradenton, Florida 34209

E-mail : Wolfhart@tampabay.rr.com

**Abstract** : Searching for the cause of the existence of metastable states the author offers a first hypothesis:  
Nature will not start any process basically ready to start, but with several exact equal ways to go until one way distinguishes itself from all others by a noticeable value.

An electron in an excited state, what has basically the freedom to choose any direction and any time of emitting light, will not do it by "chance", but only if a specific time and direction is given; for instance by a collision with another atom coming from a certain direction by thermal movement in a gas.

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**Keywords** : Metastability; Causality; Probability; chance; Einstein; new law of physics; spark chamber; light emission; decay, excited electron; radioactive decay; boiling water;

**PACS No.** : 03.65.-w, 33.90.+h, 34.10.+x, 13.15.+g, 13.20.-v

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## 1. Introduction

Since about 100 years lingers the question of causality in nature over the physical society: Is there always a reason if something happens in nature or may something happen simply by chance as claimed at the radioactive decay?

No solutions reported in the literature can be found.

This is the first attempt to solve this problem establishing causality in nature again as Einstein demanded this.

## 2. The problem

About 100 years ago several physicists - including Albert Einstein - created the Quantum mechanic. But nobody could explain why a single excited electron emit light just this time and just in a specific direction. Calculations are only exact for a great number of atoms.

The term "probability" was introduced by dropping causality. Einstein had a problem with it, because it is unthinkable that something happens in nature without any reason.

Einstein believed an Electron has no own will to decide when to emit a light quanta and in what direction. "The thing about causality plagues me very much," Einstein wrote Max Born in 1920. [1]

Einstein was not ready abandoning continuity and causality in nature.

Niels Bohr was also against Einstein's opinion and countered to him, "abandoning strict causality was the only way open." Einstein lamented, "but if all this is true then it means the end of physics." [2]

In spite of all the progress in physics this problem has not been solved in the last 100 years. I think the leap from: "We are unable to determine or to calculate when a single atom will emit a photon and in what direction" to the conclusion: "This happens only by chance" is wrong.

Our lack of knowledge about a possible reason for a phenomenon is never a proof that there is non. Instead of saying it happens by chance we have to say "We don't know yet." Ergo - we have to search for a reason:

According to the law an excited electron must give up the surplus energy by emitting light and falling back in the stable orbit of lower energy. But observations show it will often not happen in time. Single atoms left alone in quasi empty space have often very long durations of metastable states. They live without any influence from the outside. The reason is unknown. This phenomenon is called "metastable state".

If we would know the reason for the existence of metastable states we would be able to determine why a single electron emits light in a specific time and direction namely in the moment of discontinuation of the reason for the metastable state. We would find the reason while light is emitted just in this time and in this specific direction.

### **3. Observation of metastable state and light emission**

I observed metastable states in the lab in a special spark chamber with inner light amplification. I observed that the metastable state ended always, if the atom hit another one by the thermal movement in the gas. (The number of collisions can be manipulated by temperature and pressure of the gas.) It seems an excited electron waited of a signal from another atom to emit light, but why?

The electrons of a gas has been excited by a low energy alpha particle. The light of the electrons has been amplified by an inner light amplification and the emitted light was measured by an SEV (secondary electron amplifier). This signal triggered high voltage sparks between both transparent walls of the chamber along the light and ionization sources and a picture of the track of a single alpha particle could be made. Fig. 1 and Fig. 2 show such pictures. The difference between them is a time delay of 600 ns.

(While most physicist smash particles with highest energy possible this experiment is on the other end of this scale – to obtain a picture of a track from a single lowest energetic particle possible. The problem is they are unable to penetrate an even very thin wall of any counter. The source of alpha radiation must be put directly in the spark chamber and a special trigger mechanism must be found. A detailed description is in:

<http://www.wolfhartindustries.com/band1/kernphys.htm>

This picture of Fig. 2 is taken a "long time" after the alpha particle flew across the chamber. (600 ns are a long time for the atomic time scale and nothing should be found from a passing particle 600 ns before.) Nevertheless there are some light emissions indicating the track of the alpha particle even better. It seems some atoms remember where the track of the alpha particle has been, which can only be explained with the existence of metastable states. There was a clear connection between the duration of the metastable states and the frequency of occurrence of collisions between the atoms in the chamber. The less the pressure in the chamber, the less the collisions between the atoms, the longer the metastable states exist.

The big question is: Why are the electrons not able to emit light right away?

A possible answer: they have an entirely free parameter, the direction of emitting light and they are not able to decide by itself in what direction they should emit. They have not a free will, as Einstein said.

Only if the specific atom gets hit by another one from a certain direction the electrons are free from making a decision by itself and is able to emit the light with the now given information from the outside. It seems nature is waiting of an information which way to go, if there are a number of exact homogeneous ways to go in time and space (for instance the direction in space).

#### **4. Formulating a new law in physics**

With this knowledge a new law in physics can be postulated.

Metastable state (Old definition): A metastable state defines a halted process which according to our knowledge should start. (An electron remains longer in an excited state as expected.)

New definition **Any physical process basically ready to start will be halted as long as more than one of exact equal chose able parameters in time and space of the**

**process exist.** As soon as any singular parameter distinguishes himself from all others the process will start with these input (information) from the outside.

(Nature has no free will to decide which way to go between total equal ways. Nature is waiting of information. "God doesn't play dice" as Einstein said.)

### **5. Test of this new hypothesis:**

If this is right it should be true not only in the quantum mechanic, but in the entire nature.

And there will be also practical applications, for instance a possible avoidance of devastating tornados etc. (Einstein would be happy for these opportunity to establish causality in nature again.)

#### **5.1 Water:**

Cooking clean water in a clean container in labs lead sometimes to an metastable state, that overheated water will not boil, because any point on the bottom has the same chance to create the first steam bubble. There is no singularity. This is a free choose able parameter for the first bubble. Chemist solve this problem simply by putting a small stone on the bottom. Now exist a singularity - a point on the bottom, what distinguishes itself from all other spots. An explosive boiling is prevented. It seems also the more the normal boiling is delayed the more explosive is the ending of the metastable state. The more extended the delay the higher the difference in the temperature over the normal boiling point of water, the more urgency exists for ending the metastable state and the smaller differences in the parameters may trigger the delayed process. The greater the delay, the more energy is suddenly released, the greater the water explosion, but In the laser technique this effect is desirable.

On the other end very clean water can also exist below the freezing temperature, what is also a metastable state. The free parameter is the location, where the first crystal will occur. Throwing in a small stone defines a certain value of the free parameter and the crystallization begins and goes fast. Normally are there impurities which do the same.

### **5.1.1. Tensile strength of water:**

A water column in a vertical pipe has a certain tensile strength like rope, but only if the water is extremely clean. (absolute clean water in the atomic scale is very expensive to make.) Any contamination defines a breaking point along the column. A very small phenomenon can trigger a big one.

Could a string be strengthened only by making it very evenly - down to the size of atoms?

A string with carbon tubes may show it in the future.

### **5.1.2. Condensation:**

If the humidity in clear air gets over a certain point (dew point) it should condensate as water or fog, but some times nothing happens. A high flying airplane starts the process of condensation with particles in the exhaust and we see the well known stripes in the sky. The free parameter of a metastable state was the exact location of condensation, where the water droplet shell be created. Every particle defines such a point. Every droplet has a particle in it.

### **5.2 Inversion:**

A similar effect exist in the air called inversion: Cold air is moving over warm air and the warm air is not rising and the cold air is not falling down respectively. But it should, because cold air is denser, but any vertical wind is missing. The free parameter in this metastable condition is again the location if there is not a single mountain peak. (In a mountain area there was never a tornado, or does somebody has data?) The warm air simply don't start upwards in a flat landscape, because there is no location distinguishing itself from all others and - like the case of the boiling water - it ends up in a delayed, but violent event called tornado. The greater the delay the greater the destructive power of a tornado.

Should this theory be right there is a chance to avoid destructive tornados by punching vertical holes in the lower warm air layer earlier in an inversion with it the warm air has a

chance to rise up or/and the cold air find a way to go down. On the end there is the warm air over the cold one and no big tornados any more.

To pull the plug on an inversion a vertical stream must be established - up or down. To start at certain points strong vertical winds is a technical challenge, but not impossible. High rising stacks, which are open on the bottoms, on the right places could already help. A driven windmill inside the stack could perhaps already trigger the stream. Later a steady stream of air could also generate electricity as a byproduct. If it works there are probably still great numbers of these stacks needed, to cover a great country and it doesn't look good.

Mobile units with bundles of the greatest turbines available could also be tried to start an vertical wind in the right places.

If this itself generates tornados they will be smaller in an early state of an inversion and not in rural areas.

In Tornados the air goes generally upwards, but it could also tried out the other direction. Several strong helicopters stacked over each other though the entire warm air layer could perhaps generate a stream of cold air down to the earths surface.

After a while this stream should go on alone and enlarge itself. With warm air going up and cold air going down - and on the end - destructive tornados should be avoided.

### **5.3 Avalanche:**

There may be more metastable states in our daily live. For instance snow on a slope may under certain condition run in a metastable state that it is getting that loose it should run downwards, but nothing happens. Than a small outside event as a sound wave (bang) may trigger the avalanche. A very small event is able to trigger a large event, if there has been a metastable state involved.

### **5.4 Radioactive decay:**

Radioactive decay seems to work without any influence from the outside. It will be perhaps the center of the debate, because we don't know yet the reason why a nucleus emits nucleons or/and radiation just this time and just in a specific direction.

Some nucleus can be - as electrons - in an excited state - and perhaps also in a metastable state. Then there is the same problem: direction in space are not predetermined, but total free - and a nucleus has no free will to choose a direction in space as long every direction is equal. The micro-Brownian molecular movement (no plasma) has no influence to the nucleus of an atom, but hard radiation, cosmic rays, neutrinos and high energetic particle could react with the nucleus to determine time and direction of the decay. According to this new law radioactive decay needs outside help. In an absolute empty space without any radiation and without any particles like neutrinos radioactive decay should stop. Experiments must decide about this theory. (The recently discovery of a certain dependency of the radioactive decay from the distance from the sun seems to support this theory.)

## 6. Conclusions

Nature is unable to choose between equal ways and is waiting of an information input. Nature has not a free will or as Einstein said: "God doesn't play dice." Causality is established again.

## 7. Perspective

Metastable states will likely be found everywhere if nature is waiting of the necessary information which way to go, ergo not only in physics, but also in chemistry and perhaps even in electronics, societies etc.

It seems that the ending of a metastable state is often violent and even more so if the release of a metastable state is more delayed. What about the most violent processes in the cosmos? Are some of them the result of a metastable state? The most violent event was the big bang. Was before the big bang some sort of metastable state? There must have been a priori some exact equal parameters for a free choosing.

## References

- [1] W. Isaacson, *ISBN-13: 978-0-7432-6473-0*, page 324, 2007
- [2] N. Bohr, *Schilpp*, page 205-206, 1920
- [3] A. Z. Devdariani und E. A. Chesnokov, *Optics and Spectroscopy*, **Vol. 99** page 858-865, 2005



Fig. 1 shows one of the first pictures of a track of an low energetic alpha particle in my special spark chamber. The alpha particle moves from left to right.

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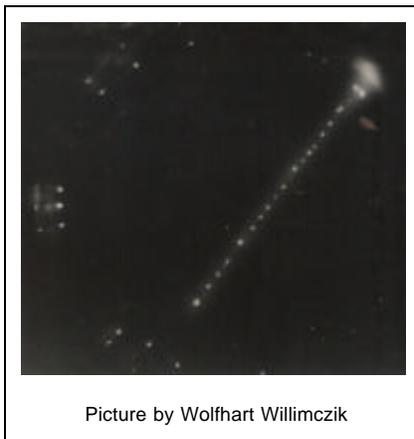


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