

# The connotation of the Quantum Traditional Chinese Medicine and the exploration of its experimental technology system for diagnosis

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**ABSTRACT:** Traditional Chinese Medicine (TCM) developed based on ancient Chinese philosophy. Its characteristics include abstract theories, fuzzy concepts, subjective diagnostic methods and it lacks clarity, and rigor as well as vindication from modern sciences, which makes development of TCM remain stagnant. Thus, how to free the theory of TCM from heavy philosophy to achieve separation of medicine and philosophy, and to use the contemporary cutting-edge science and technology to transform the theory of TCM and then to achieve its scientific paradigm shift, is a way for TCM to get out of the woods. This article, focusing on the problems existing in the development of the modernization of TCM, introduces the concept, the connotation as well as the important role of Quantum TCM in the modernization of TCM. Additionally, based on the view that the body's electromagnetic radiation can characterize the human "Qi" in TCM, we discuss several experimental technology systems for the diagnosis of Quantum TCM in detail. By analyzing and comparing these technology systems, we come to the conclusion that the biophoton analytical technology (BPAT) is more worthy of further study in building the experimental technology system for the diagnosis of Quantum TCM.

**Keywords:** TCM, Quantum TCM, experimental technology system, biophoton detection system, superconducting quantum interferometer device (SQUID), infrared thermal imager

## 1. Introduction

Traditional Chinese Medicine (TCM) developed on the basis of ancient Chinese philosophy, and the characteristics of it include abstract theories, fuzzy

concepts, subjective examination methods and it lacks the clarity, and rigor and vindication of modern sciences, which makes development of TCM remain stagnant. Although in the early 80's of the last century, medical providers have carried out lots of research and practice in the modernization of TCM, and have achieved some results, however, they have not yet achieved a qualitative breakthrough. The main reasons are as follows (1): (i) focus has been on the thinking mode of mechanical reductionism theory with logical analysis and accurate demonstration, but ignores the thinking ways of ontology with the integrity and organic characteristics in TCM; (ii) they have not yet realized the conversion of TCM theory using modern or contemporary scientific theory and have not yet realized the establishment of a modern TCM theory system which has international recognition in the premise of self laws and the thinking ways of TCM theory; (iii) they have not yet found a detection indicator system with the characteristics of TCM. Furthermore, a technology system for experiments and quantitative diagnosis, which is suitable for the thinking model of TCM, has not been established. Therefore, how to break the old ideas and to realize the conversion of TCM theory into a scientific paradigm based on TCM's own laws and ways of thinking, and then to establish a technology system for the experiment and quantitative diagnosis of TCM, is an important task in the modernization of TCM.

## 2. Quantum TCM

Quantum theory reveals the basic laws of the microscopic physical world, and provides a new way of formulating and thinking about nature. Marked by quantum theory, the modern discipline whose philosophy is organic and holism coincides with the philosophy of TCM (2), so quantum theory may be used to explain the theory of TCM. Fortunately, the biophoton coherent theory in biological systems put forward by Popp (3) makes it possible to translate the theory of TCM using quantum theory. Based on this theory and combined with the common features of "Qi" and electromagnetic radiation, we propose a view that the electromagnetic radiation from the body can characterize the human "Qi" in TCM (4), and give the theory of TCM a new image - the Quantum TCM theory.

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Quantum TCM theory explains the connotation of TCM theory scientifically: (i) Meridian hypothesis (5): Electromagnetic radiation fields within biological organisms are characterized by non-local interference. With the occurrence of interference, interfering beams form a unitary tridimensional network, with striae (*i.e.*, beams) of varied intensity distributed on the organism surface similar to semi-reflectors. The striae carry bio-information of corresponding organs and integrate all tissues and organs of the organism. (ii) Viscera hypothesis (6): The electromagnetic radiation from the electromagnetic field within the human body is characterized by interference, and the quanta in them have a function of information transference, operating as non-molecular messengers of information communication in tissues, organs, cells, and biological macromolecules, *etc.* in the body, and play a key role in transferring information for life movements. Hence, the quanta in the human body are the "Qi" information for the regulation and adjustment of the viscera network in TCM. (iii) Heaven-human correspondence hypothesis (7): The lives on earth swim in a spatio-temporal electromagnetic field, which can be considered as the "Qi" of the universe. The "heaven-human correspondence" is a resonant interaction between human bodies' electromagnetic field ("Qi" of the human body) and the spatio-temporal electromagnetic field ("Qi" of the universe). (iv) Syndrome differentiation hypothesis (8): The symptom in TCM is the quantum superposition state formed with the body's electromagnetic radiation, and the syndrome differentiation adjusts quantum superposition states of electromagnetic radiation field to turn it into a healthy situation. Based on the above ideas, the concept of Quantum TCM is put forward (I): Guided by the holism and dialectical materialism thought of TCM, regarded by modern sciences, especially quantum theories, as the theoretical basis, and based on the view that the electromagnetic radiation from the body can characterize the human "Qi" in TCM, the Quantum TCM theory uses the quantum forms of electromagnetic radiation, photon (quantum) radiation, energy (caloric), *etc.* to study and explain the scientific principles within the TCM framework, which are concerned with the transformation rules of human health and diseases and their prevention, diagnosis, therapy, rehabilitation and healthcare.

The Quantum TCM converts the only qualitative "Qi" with a strong color of philosophy into the quantitative electromagnetic radiation at the science level by using the existing basic theory and technology. It makes the abstract concepts in TCM theory obvious, makes the fuzzy law clear, and defines the processes and details in the theory of TCM. Additionally, on the premise of the internal rules and thought processes of the TCM theory, the Quantum TCM frees the theory of TCM from heavy philosophy and gives it a modern scientific characteristic basis, including clarity, rigor and vindication. It makes a

scientific paradigm transformation of TCM come true to a certain extent.

However, the realization of TCM modernization not only needs a scientific theoretical system, but also a strict and scientific experimental technology system for diagnosis. The establishment of a theoretical system for Quantum TCM lays the foundation for establishing an experimental technology system of Quantum TCM for diagnosis using the body's quantum electromagnetic radiation, light (quantum) radiation, and energy (heat) radiation in the microscopic state.

### 3. The exploration of an experimental technology system for diagnosis of the quantum TCM

The human swims in the space-time electromagnetic field formed by the celestial bodies and the earth, based on which the human magnetic fields are generated and maintained. The mechanism interacts with the organism and the biological effects are changeable with the variation of the field intensity, frequency and amplitude. According to the spectrum characteristics of electromagnetic waves and the features of biological effects, the electromagnetic spectrum can be separated into the ionization zone, visible zone, infrared and millimeter wave zone, radiation zone and low frequency region. However, there is a common characteristic, which is the presence of a "frequency window", in the interaction between the electromagnetic radiation and biology, that is to say, only when the frequency of the external electromagnetic wave is consistent with the natural vibration frequency of molecules or polymers in the organism and produce resonance between them, the biological macromolecules are enabled to absorb energy from the electromagnetic wave, and then result in significant biological effects (9). Consequently, the corresponding spectrum of the biological magnetic field with the spectrum of the space-time electromagnetic field must exist in the organism.

According to the difference of wavelengths, source and the analytic method of the electromagnetic wave from the electromagnetic field of the organism, the electromagnetic wave can be divided into different spectral intervals, including the ultraviolet-visible zone (ultraweak biophoton emission), infrared zone and other electromagnetic field zones, *etc.* All of these electromagnetic waves with different spectra can be regarded as the "Qi" information of the body, based on the view that the electromagnetic radiation from the body can characterize the human "Qi" in TCM. Besides, the TCM theory holds that "Qi" is the basic substance which constitutes the human body and maintains life activities of the body, and all occurrences and development of the various diseases come from the "Qi" of the body. The syndrome differentiation of TCM, in essence, is to distinguish the deficiency and excess of "Qi" of the main and collateral channels and viscera. Therefore, the

quantum state of the electromagnetic radiation field of the human body should be able to reflect the state of the body (health or disease) to a certain extent (8). Below, we will thoroughly analyze the quantitative detection technologies of electromagnetic waves in different bands and their ability to reflect the health status of the body, and then discuss the feasibility of these technologies in establishing the experimental technology system of Quantum TCM for diagnosis.

### 3.1. The region of ultraviolet-visible (ultraweak biophoton emission)

The ultraweak biophoton emission (UPE) is a common phenomenon of life, and comes from the transition of biological molecules from a high energy state to a low energy state, and the wavelength range of it is ultraviolet and visible light. Biologists have discovered that the bases of DNA molecules can form substances only existing in an excited state due to the heaps interaction, which may be one of the material bases of UPE (10). The UPEs radiated from the lives carry the original information about the lives, and this information is able to affect the human body mainly through the weak magnetic field, so as to correct the chaotic state of the magnetic field in the human body, and recover the life order of the atoms, molecules and cell. So the UPE, which can be used as a macro performance of a micro life activity, must be inevitably associated with various detailed life processes (11). Actually, many studies have found that UPE is closely related with a great deal of fundamental life processes, such as, growth regulation,

oxidative metabolism, information transfer, cell division, cancer, death and so on. Also, any influence of internal change and external environment will cause changes at the microscopic energy level, which lead to changes of biophoton emission. Therefore, the biophoton, which carries a wealth of internal information about the human body, can act as the "Qi" information to synthetically reflect the health state of the host on the whole, and this is consistent with the diagnostic view of the TCM. Besides, during cell division of the organism, the double strands of DNA molecules are completely separated, and each separate strand synthesizes new double strands again using the surrounding material. In this process, it's easy to radiate an electromagnetic wave, but also easy to receive foreign electromagnetic waves. Hence, the intensity of UPE from the body also enables reflection of the active state of human cells, namely the division rate, and from this we can diagnose the human health state.

However, how can we get and analyze the UPE? Biophoton analytical technology (BPAT) is just the way. It can quantitatively detect, analyze and record the UPE which carries abundant inside information of the human body using the biophoton detector in order to get the health state of the body and achieve the early diagnosis of disease. The biophoton detector usually uses a photon counting system, and Figure 1 shows the biophoton detector in our laboratory and its schematic diagram. The core component of it is the photomultiplier tube (Hamamatsu Photonics K.K., Iwata City, Japan). During the measuring process, the photons radiated from a part of the body, arrive at the photocathode, and generate electrical pulses. Subsequently, the electric pulses are fed

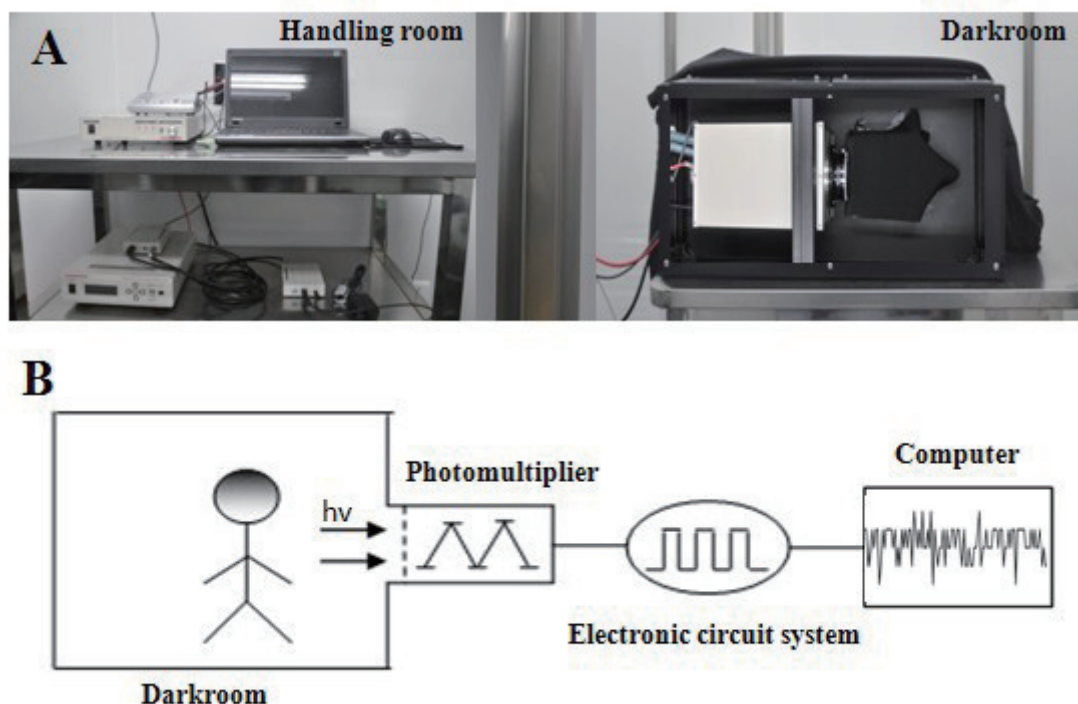


Figure 1. The biophoton detector (A) and the schematic diagram (B) used in the author's laboratory.

into the electronic circuit system, in which the electric pulses are amplified, screened, counted and so on. In the end, the measuring signals are displayed and stored by computer. Through the comparative analysis of the received signal, we can obtain the health state of the body.

At present, many research groups have obtained significant results: such as using the BPAT and uniting with the balance of the yin-yang theory in TCM theory, Joon-Mo Yang *et al.* found that the intensity of biophoton emission from the left hand was balanced with the right hand in the normal people, while in stroke patients the intensity of biophoton emission from the left hand was imbalanced with the right hand (12); Wen-Ying Yang *et al.* found that in bronchial asthma and chronic gastritis patients, there were significant differences in the intensity of biophoton emission from the corresponding acupoints on both sides of the body during the period of disease exacerbation, and displayed an imbalanced state, while there were no obvious differences in healthy control groups (13). Rong-Rong Zheng *et al.* detected the UPE of the index finger (large intestinal meridian passing from this finger) of simple constipation patients, and found that the luminescent value of left-right was obviously asymmetric, while the luminescent values of the healthy control groups showed symmetry (14). Also, some interesting phenomena has been found in the author's lab: the intensity of UPEs from the first finger (lung channel passing this finger) of the patient with Qi deficiency were obviously lower than that of healthy patients; and the same phenomena were also found in the middle finger (pericardium meridian passing this finger) and little finger (the heart channel of Hand-Shaoyin passing this finger) of the patient with insufficiency of the heart-Qi. However, further research is needed here.

These results directly or indirectly indicate that it is feasible to realize quantification of the diagnosis of Quantum TCM by using BPAT. BPAT not only is able to give holistic information of the internal state of the human body, but also has the ability to make information of life activity from microscopic to macroscopic in order to quantitatively analyze the holistic state of life which is called a symptom in TCM, and this is consistent with the diagnostic characteristics of TCM and can be used as a detection index system of Quantum TCM. In addition, the function of BPAT is collecting and analyzing the surface information of the human body so as to observe the inner healthy state, which is also in accord with the diagnostic ideas of TCM: analyze internal change through external appearance. Therefore, it is sufficient to use BPAT to establish the experimental technique system for diagnosis with TCM, which is suited for the thought model of TCM, and this technology has many merits for diagnosis, such as being rapid, sensitive, reliable, noninvasive and easy to be accepted by patients.

In addition to the application in TCM, BPAT has also been widely used in many other fields including

food inspection, water quality analysis, environmental monitoring, drug development, gene technology, agricultural science and medical diagnosis *etc.*

However, BPAT also has some shortcomings. First, there are factors affecting the biophoton emission, such as change of the external environment or emotional fluctuations. Therefore, we must strictly control the experimental conditions and stabilize the emotion of volunteers when we detect the biophoton emission. Additionally, we must explain the results prudently considering all factors. Furthermore, before we apply this technique practically, we need to have a large number of systematic and standard detection techniques in the laboratory, to create a multi-level database corresponding to the various symptoms, to supply as well as perfect the base according to actual needs, and to set up a feasible "standard" finally, which requires considerable investment. Once a standard is setup, the advantages of BPAT can be sufficiently explored.

### 3.2. Infrared region

As we all know from physics, all objects above absolute zero can produce infrared radiation (thermal radiation), and this radiation energy depends on the temperature and the emissivity of the object's surface. The temperature distribution of normal humans is stable and symmetrical to some degree. However, change of subcutaneous blood circulation, local metabolism organization, or thermal conductivity of the skin *etc.* can result in a change of temperature distribution. When the human body gets ill or function is changed, blood flow and metabolism of the corresponding parts will be changed, which causes a local temperature change, which results in a change of infrared radiation.

From the perspective of molecular biology (16), the major source of infrared radiation is electromagnetic waves, generated by the transition of molecular vibration energy levels in proteins. The infrared energy or biological energy is transmitted along the protein molecular chain through dipole-dipole coupling interactions of the amide bond between adjacent protein molecules, which causes change of structure, configuration, and configuration of protein molecules, so as to promote growth and development of organisms. In this process, the bio-energy released by ATP hydrolysis has a similar effect. Once the ATP molecules or ATP enzymes or proteins conformational change goes wrong because of the effect of the internal or external environment, the bio-energy provided by the ATP hydrolysis will be insufficient or delivered abnormally. As a result, the biological tissues won't grow normally, which will lead to a change of infrared radiation on a large scale, and finally will cause diseases.

Therefore, both from a macro and micro perspective, infrared radiation plays a role to deliver information and energy, so it is closely related to the activities of the

human body, and can be used as the "Qi" information of the body. Through measuring and analyzing slight changes of infrared radiation in different parts, we can obtain the relevant internal state of the human body (the information of health or disease), so as to find the changes of thermal infrared radiation corresponding to the variety of symptoms in TCM.

Thermal measurement technology, such as infrared thermography, was mainly used in clinical trials to measure the infrared radiation of the body surface. Figure 2 shows infrared thermography (Figure 2A) and the schematic diagram (Figure 2B) of it. It can filter, aggregate, and modulate the far infrared light waves radiated by humans through an optical electronic system and convert this wave into an electrical signal, which can be further converted into a digital signal. The temperature field of the human body will show up as an image through multimedia image processing. At the same time, special software was applied to analyze the difference in temperature quantitatively for judgment of lesion positions and nature for further diagnosis of disease.

From the general processes of occurrence and development of disease, the changes of human infrared radiation usually precedes variation of its structure, and shape, so that the medical infrared thermal imager can observe the early diagnosis of (17) disease in the human body, such as early prediction of cancer, differential diagnosis and screening of tumors (18,19), and early diagnosis of cardiovascular and cerebrovascular disease and various inflammation (17). Another study found that the degree of deficiency of Yin was proportional

to the temperature of the tongue (20); and the surface temperature was positively associated with the Yang (21). Some researchers also found that the infrared radiation of the body's surface corresponding with the line of meridian circulation may change in the state of viscera lesions (22,23); etc.

The core of TCM theory is an overall concept, and TCM theory pays attention to the overall dialectics and dynamic balance, while the measurement technology of the infrared thermal imager can obtain continuous and dynamic information of the human body. Therefore, using thermal measurement techniques to study the dialectical theory of TCM is consistent with the methodology.

The thermal measurement technique is a new medical technology, which is different from traditional structure imaging. It reflects the functional state of the human body, and directly reflects the phenomenon of life, and is able to guide us to understand the pathogenesis of TCM. Additionally, it has the characteristics of no damage, no pain, no radiation and safety to the patients. With it, lesions can be found in advance of inspection results. The results are fast and easy to be accepted by volunteers. However, the infrared thermal imager diagnoses disease in the human body mainly through infrared thermography of surface temperature and the location and size of lesions within the human body are not clear and are unable to be located (17) accurately. Moreover, the disease reflected on the body surface is not only from the body, but the dysfunction of the surface itself. Thus, the infrared thermal imager has a limitation for diagnosis currently.

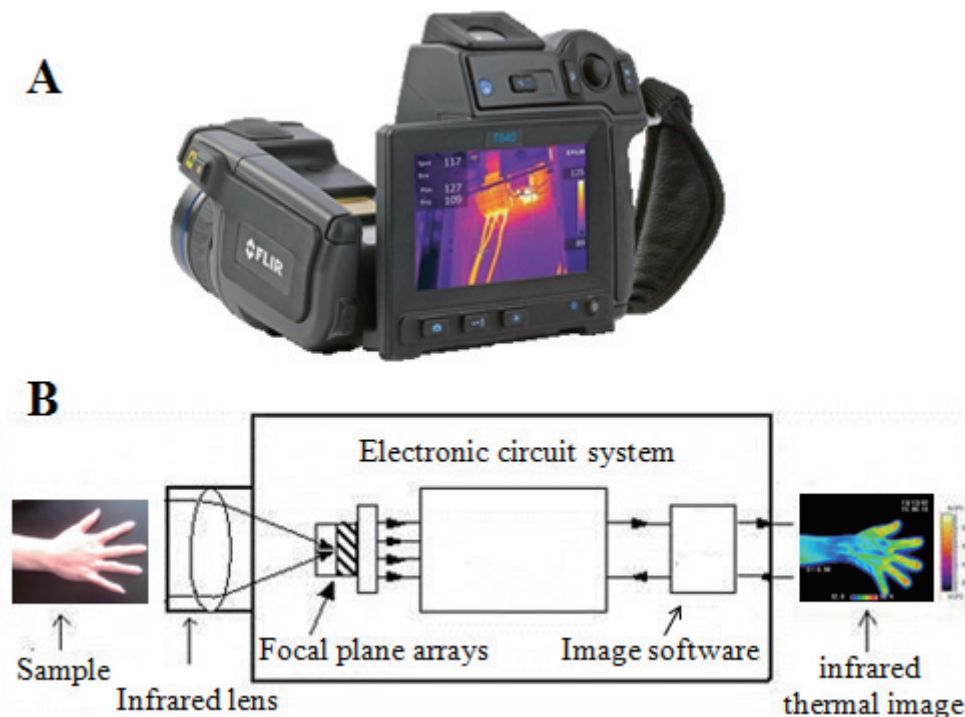


Figure 2. The infrared thermography (A) and the schematic diagram (B) of it.

### 3.3. Other electromagnetic fields of the human body

The same with UPE, which is an inherent attribute of biology, all substances (including lives) in nature have magnetisms which are either strong or weak. Each molecule, cell, tissue, organ, *etc.* in life have magnetic phenomena. There are two types of field sources in the human body concerning the biological magnetic field (24). One is the intrinsic magnetic field, which is formed by tissue *in vivo*. The physiological activities of the human body are accompanied by ion currents (Ion movement inside and outside the cell membrane), such as the bioelectricity in heart, brain, *etc.*, those currents have the ability to produce magnetic fields. In addition, paramagnetic materials (such as the Fe in hemoglobin, the Co in vitamin B12) in some biological materials within the human body are also important parts of the intrinsic magnetic field. The other type of magnetic field is formed by exogenous ferromagnetic substances. That is to say, the ferromagnetic substances, which are inhaled or eaten by the human body from nature, will be magnetized under the external magnetic field, and will form substances which are similar to magnets, so as to generate a magnetic field *in vitro*, such as the magnetic field generated by the stomach, liver and lungs.

It follows that the generation of the magnetic fields in the body are most associated with physiological activity. When the body is abnormal or diseased somewhere, the physiological activity will change inevitably, so as to lead to a variation of the magnetic field. Therefore, we can obtain information on the internal state of the human body by measuring and analyzing the slight changes of the magnetic field in the body, in order to find changes in the biological magnetic field corresponding to the various symptoms in TCM. So the measurement of the biological

magnetic field can also serve as a means of quantification of Quantum TCM for diagnosis.

But it is very difficult to detect the biological magnetic field in an environment full of earth's magnetic field and magnetic field noise, because the biological magnetic field (generally 10<sup>-6</sup> times in the magnetic field of the earth) of the human body is very weak. However, the superconducting quantum interferometer device (SQUID) with ultra-high sensitivity, successfully developed by the Massachusetts Institute of technology of the United States has solved the core issue of this problem (the schematic diagram of SQUID is shown in Figure 3). Although the research on SQUID is still in some dispute, this does not affect the enthusiasm of researchers studying it. At present, clinical medicine mainly uses the detection systems of the superconducting biomagnetometer, whose core component is the SQUID. This system consists of three basic parts: detection coil, SQUID and a low temperature container. The detection coils connecting with the input coils of SQUID can form a superconducting circuit, which enables the changes of magnetic flux to be transformed into changes of power consumption, so as to detect and quantify the weak magnetic signal of the human body. The cryogenic vessel filled with helium is a vacuum insulated container, in order to ensure the equipment working in the superconducting state (25). Coupled with the technologies of magnetic shielding and space identification, which are able to suppress the interference of the external magnetic field more efficiently, the detection system can get a more accurate determination of the biological magnetic field of the human body.

Presently, the measurement system of the superconducting biomagnetometer has achieved remarkable results for the diagnosis of disease. Typical

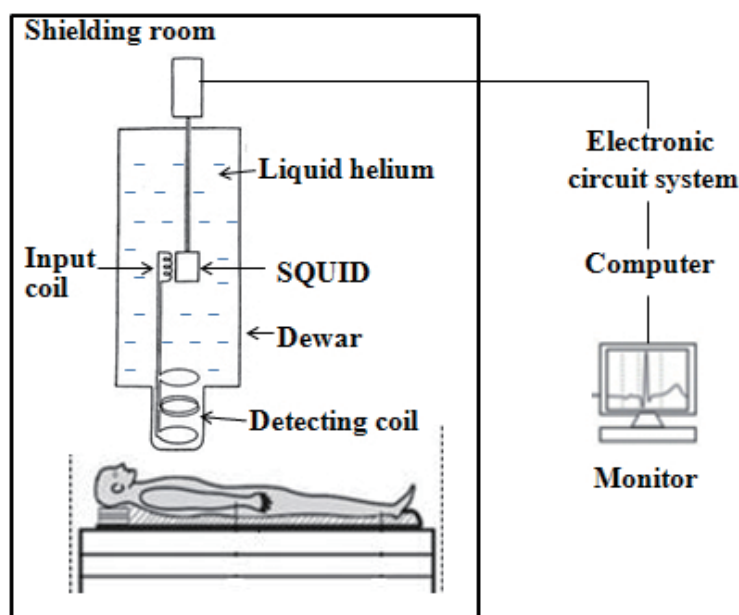


Figure 3. The schematic diagram of the superconducting quantum interferometer device (SQUID).

applications include magnetoencephalography (MEG), magnetocardiography (MCG), magnetopneumographic (MPG) and mechanomyography (MMG). MEG is mainly used for early diagnosis and lesion locations of brain disease, for example, the accurate localization and diagnosis of epilepsy (26). MCG is used for early diagnosis of heart disease, such as early diagnosis of arrhythmia (27). MPG is a method of measuring the dust content in lungs by detecting the residual magnetic field of the ferromagnetic dust, and is mainly used for diagnosing pneumoconiosis and defects of lung function (28). While the generation of MMG comes from the appearance of muscle current, which is generated during movement of skeletal muscle, and it is mainly used for diagnosing injuries of human muscle *et al.* (29). Also, the magnetic field in nerves, eye, retina, liver, abdomen, limbs and scalp are also detected. In spite of these fields, few studies have been examined on the diagnosis of TCM using the detection system of the superconducting biomagnetometer.

As seen above, further research is needed for the diagnosis of TCM using the detection system of the superconducting biomagnetometer. We are able to get a basic understanding of the internal state of a human body through detecting and analyzing the biological magnetic field of all parts of the human body, so as to obtain valuable information for the quantification of symptoms. Additionally, the measurement of the human biological magnetic field is entirely noninvasive, with no contact, and has the characteristic of high sensitivity and accuracy. Consequently, it is more convenient to people than the measurement of human biological electricity. Furthermore, for some underlying diseases, biological electricity may not appear abnormal yet, as the electromagnetic map has shown. Therefore, the biological magnetic field of the human body can be used to study the "preventive treatment of disease" in TCM. However, the measurement of the biological magnetic field needs a large magnetic shielding room to eliminate the interference of the electromagnetic environment, and also needs a SQUID with high sensitivity at the temperature of liquid helium and a signal processing device. Thus, clinical application is less. In addition, in the detection of lungs, this method can only be used for the detection of dust containing ferromagnetic dust, and is invalid for the non-ferromagnetic dust.

#### 4. Conclusion

From what we have been discussed above, the electromagnetic waves in three kinds of bands are significantly associated with the activities of the human body, so they can be used as the body's "Qi" information to reflect the overall state to some extent, and detection results of them are able to provide valuable information for the quantification of syndromes. However, compared with the detection technology of infrared light and

other electromagnetic fields of the human body, the detection technology for the ultraviolet-visible range is more suitable as an experimental techniques system of Quantum TCM for diagnosis. The reasons are as follows: (i) The mechanism: The information contained in the ultraviolet-visible area partly comes from the accumulation of bases in the DNA molecules. It not only carries the information of the origin of life, but also controls the order of the human body's activities, so it is closely relative to the detailed process of life. Thus, when the state of the body is abnormal, the abnormal information must be reflected in this band first. While the electromagnetic waves in the infrared band mainly come from the thermal radiation produced in the energy level transition of various protein molecules, it is the lowest energy information, and is influenced by the external environment significantly. The electromagnetic waves from other electromagnetic fields mainly come from the ion current and magnetic substance within the body, so they can't reflect the body's state fundamentally. (ii) The detection technique: **a.** Although the detection technology of infrared thermal imaging can show the body's functional state, which can reflect the body's health status directly, it can't find the exact location and size of the lesions mainly through the infrared thermal imaging of the body's surface to diagnose disease within the human body. Besides, the disorders reflected by this mechanism may not come from the inside of the body entirely; they may also derive from the surface dysfunction of the body or the influence of the external environment, so the infrared thermography has certain limitations for diagnosis. **b.** Although the detection of SQUID on human bio-magnetism is much more convenient than the detection of human bio-electricity, the bio-magnetic fields are very weak, and may be influenced by the magnetic field in the environment. Thus, a large magnetic shielding room is needed to eliminate the environmental magnetic interference. Another drawback is that this device only be used to detect magnetic material. Therefore, it also has some limitations for diagnosis. **c.** Biophoton analytical technology (BPAT) is used to detect the intensity of photons from the non-localized coherent electromagnetic field in the human body, and the results can reflect the body's state directly. Additionally, biophotons are easier to detect than infrared and other electromagnetic waves, owing to the reason that most of the biophotons are in the visible spectra, and that the biophoton detector has the advantage of simple structure, so BPAT is more suitable for further study as an experimental techniques system for Quantum TCM for diagnosis.

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