

Religions, Christianity and Shroud

by *Giuseppe Baldacchini*

giuseppe.baldacchini@gmail.com

Physicist, formerly director at the Research Center ENEA in Frascati (Rome)

Collegamento pro Sindone Internet – February 2013

© *Giuseppe Baldacchini – All rights reserved*

Abstract. Religion has always existed in the history of human civilization which, on the basis of the latest archaeological discoveries, appears to have been fostered by it. There have been many Religions, and some of them and new ones still thrive today, and often they had and still have the presumption of being right a priori, with consequences for humanity not always painless. But, at a careful investigation it remains difficult to answer at the basic question of which one or which ones of them are true, or have been devised on purpose, consciously or unconsciously, by a group of individuals, or some great personage, as it is the case especially for the revealed Religions. All of them possess complex mythologies and/or stories with more or less credible witnesses, but within Christianity there is a unique relic that may answer the previous question. In fact, in the light of what is known to date, the Shroud of Turin is very likely the burial cloth of Jesus Christ as told in the canonical Gospels. Careful studies by using the scientific method have proved beyond any reasonable doubt that it is not a fake, and also that the most credited hypothesis for its image formation call into question a process of radiant energy compatible with the Resurrection. The traces of this phenomenon are still being observed on the Shroud, which was and still is a mute eye-witness of the most important event in human history.

1. Introduction

Many people may wonder why we should believe in a Religion, and atheists have already asked themselves the question and have answered negatively. Instead, from agnostics and doubters there have been many answers more or less known. But everybody agree on the fact that Religion was born with man from time immemorial, very likely a consequence of its codification in our genetic helix.

In fact, since the onset of consciousness (awareness of his own existence in the world), man has always sought to address religious and/or philosophical subjects that would give a sense and a guide to his life from birth to death. The first funeral rites, some 30,000 years ago, clearly demonstrate the human quest for forms of deities, Religions, and/or ways of life, i.e. Philosophies. But, until a few years ago it was thought that Religions were born after the birth of agriculture, ca. in 9,000 B.C., when men changed their nomadic lifestyle to a more sedentary, and therefore a more socially organized one. Instead, it has been found recently that Religions appeared before this developmental stage, and that in practice it was the cornerstone of human civilization, and not vice versa. Indeed, since a few decades it has been discovered on a low hill in the south-east of modern Turkey an architectural complex of monumental temples built circa 11,600 years ago, well 7,000 years before the rising of the great pyramid of Giza.

The place is called Göbekli Tepe (potbelly hill), there are not remains of houses and pottery, which did not exist yet, but it was clearly a sanctuary where men, nomadic hunters and gatherers, were going to pray and worship in their own way some deity, before the birth of civilization (Mann 2011).

Although many archaeological relics remain of these primitive beliefs, only with the advent of the writing systems later on it was possible to have a more detailed knowledge of Religions and/or Philosophies, which for brevity will be called Religions from now on.

We will meet some of these in the following, but there remains the central question posed at the beginning, especially now that we are living in an age of secularization as never before. To give a reasoned answer, in Chapter 2 the most important Religions ever are briefly described, while Chapter 3 is devoted to why common people choose a Religion and to a general criticism of all Religions. Christianity is introduced in Chapter 4, while the Shroud of Turin, which is the main subject of this work, is discussed in Chapter 5. The hypotheses on the origin of the Body Image left on the Shroud are talked in detail in Chapters 6 and 7. Then, all the above topics are critically discussed in a systematic and constructive way in Chapter 8. Finally, the conclusions are drawn in Chapter 9, and many friends of mine will jump off the chair while reading them, so unorthodox and politically incorrect they are.

2. The World Religions

For what we know today, there are thousands of Religions that developed in the course of human history, some of them long extinct and other ones relatively young. Without considering them all, because some of them are simple variants of older ones or just sects having limited impact on societies at large, an approximate chronological list of the most important ones in the past and present history is given in the following. Of course, the responsibility of their choice is only mine, and I sincerely apologize for unwanted oversights and/or errors, which could also be the result of my ignorance in such vast and intrigued matter. In any case, besides the denomination of the single Religion, some brief information, when known, are also given such as, the place of origin, the founder/s, the age, the nature, and a motto that might connote it in the public imagination.

- **Polytheism** (World), the oldest form of Religion of humanity, but now virtually disappeared, except for Hinduism to be treated separately because of its notable peculiarities. *Many gods are worshiped, each of them having his own faculty, with a rich mythology that has characterized the cultures that developed in different historical realities of all times in all continents (Sumerians, Babylonians, Assyrians, Egyptians, Hittites, Chinese, Indians, Greeks, Romans, Celts, Scythians, Toltec, Maya, Inca, Aztec, Native American, Aborigines, etc.).*
- **Judaism** (Middle East), Moses, circa 1200 B.C., monotheistic. *Hear O Israel, the Lord our God, the Lord is one. Blessed be the name of His glorious kingdom for ever and ever. And thou shalt love the Lord your God with all thy heart and with all thy soul and with all thy might.*
- **Hinduism** (India), The Upanishads, circa 1000 B.C., monotheistic and pantheistic. *He (Brahma) desired, "May I have a family myself!" He performed an ascetic practice. Having*

lived accordingly, He created everything, everything that exists. Having created it, indeed, He entered in it. (Taittiriya).

- **Zoroastrianism** (Persia), Zarathustra, circa 1000 B.C., monotheistic imperfect. *In the Zoroastrian doctrine, revealed directly to Zoroaster by the supreme God Ormazd, the good wins over evil, and its morality is based on the triad of "good thoughts, good words, good deeds".*

- **Mazdaism** (Persia), 600 B.C., monotheistic (?). *The great God was Ahuramazdah, creator of everything, but there are other gods: Mithra (sun), Mah (moon), Zam (earth), Atar (fire), Apam Napat (water), Vayu (wind). The priests, Magi, held a very strong power at the court, believed in good and evil, and many practices of the Magi are similar to those of the Celtic people, for the common origin of this Religion among the Scythian people.*

- **Jainism** (India), Mahavira, 599-527 B.C., atheist. *The doctrine is based on ascetic rules to obtain the liberation of the soul from matter, and the main rule is respect for every living creature.*

- **Buddhism** (India), Sakyamuni Gautama, 560-480 B.C., atheist (?). *Salvation (enlightenment) is obtained through eight steps that are "right understanding, right thought, right speech, right action, right livelihood, right effort, right mindfulness, right concentration."*

- **Taoism** (China), Lao-tzu, VI century B.C. (?), atheist. *The wise man reaches the perfection of Tao (the force which pervades the entire universe) stripping of his passions, and refrains from acting in the world for fear of interfering negatively.*

- **Confucianism** (China), Confucius, 551-479 B.C., atheist (?). *The wise man knows the decrees of Heaven and the rites, develops the Way (the cosmic will of an impersonal heaven) with religion, morality, charity, and statecraft, which he uses as a tool to act positively in the world.*

- **Gnosticism** (Iraq?), III century (?), pantheistic-idealistic. *The term Gnostic was coined by Irenaeus of Lyons, 140-200 A.D., but the ideas of this philosophical and religious movement are antecedents of at least five centuries, and can be summarized in the teaching of the ultimate goal, for which every being should overcome the vileness of matter and return to the spirit Parent.*

- **Hermeticism** (Hellenic world), Hermes Trismegistus, III century B.C. (?), monotheistic (?). *The man can grasp the essence of divine transcendence through the gnosis (conoscenza), a super-rational process of enlightenment from God which leads man to ecstasy and returns the soul to its creator.*

- **Epicureanism** (Greece), Epicurus, 341-270 B.C., quiet atheist. *The Epicurean doctrine ensures the attainment of happiness, and says that there is nothing to fear from the gods and death, and pain can be endured.*

- **Stoicism** (Greece), Zeno of Citium, 333-263 B.C., atheist (?). *It is a philosophical and spiritual doctrine with a strong ethical orientation. It supports the virtue of the detachment from earthly things, Atarassia, in order to achieve moral and intellectual integrity, and dominion over the passions, Apathy, which allows the spirit to achieve wisdom.*

- **Mithraism** (eastern Mediterranean), 200-100 B.C., mystery. *The cult of Mithras is based on mysteriosophic (from Greek mysterion, mystery, and sophy, knowledge or wisdom) concepts, which revolve around the idea of the existence of the soul and its ability to reach eternity through the seven planetary spheres.* A possible derivation from the Zoroastrian and/or Persian culture is widely debated, while it spread primarily in the West: as a matter of facts it was the official Religion of the Roman legions.
- **Animism** (Africa), centuries B.C, monotheistic (?). *It is a Religion that gives a soul to all natural phenomena, an energy that permeates everything visible and invisible. The Shaman is the interpreter of all that because it travels in a state of trance in the spiritual world and uses its powers.*
- **Christianity** (Middle East), Jesus Christ, 6 B.C.-30 A.D., monotheistic and trinitarian. Jesus says: *I am the resurrection and the life. Whoever believes in me, even if he died, shall live: and whosoever liveth and believeth in me shall never die.*
- **Manichaeism** (Persia), Mani, 215-277, atheist-dualistic (?). *It is based on two principles, Light and Darkness, coeval, independent and opposing, influencing every aspect of the human existence and behavior. The revelation of Mani is seen as the conclusion of the prophecies of redemption, from Adam to Noah and above all Zoroaster, Buddha and Jesus.*
- **Islam** (Arabia), Mohammed, 570-632, monotheistic. The key teaching is: *Allah is great and Mohammed is his prophet. Allah is one, Allah is the Lord, he did not generate and was not generated, there is no co-equal to Him. Allah is the Creator of all that exists.*
- **Shinto** (Japan), Kojiki (Records of Ancient Matters), 712, polytheistic-animist-shamanist. *Sincerity leads to truth. Sincerity is wisdom that unites man and the divine in one. Be charitable to all beings: love is the first characteristic of the divine.*
- **Sikhism** (India), Nanak, 1469-1538, monotheistic. *He is the Creator, Pervasive, fearless, without malice. His Being is not touched by time. He is unborn, and he exists in himself. He can be understood through the Grace of the Guru.*
- **Candomblé** (Brazil), African slaves, 1549-1888, polytheistic imperfect. *A blend of indigenous rituals, African beliefs, and Christianity, which worships the Orixas, divinities of totemic and family origin, each one associated with a natural element, and believes in the soul of nature itself.*
- **Positivism** (France), August Comte, 1798-1857, atheist. *Love for principle, order for the foundation, progress for the purpose.* It is a political and philosophical movement which closely follows the Illuminism, anticipates and partly inspires Liberalism, Nationalism, Socialism, Communism, Futurism, Fascism, Nazism, Modernism, Globalism, and perhaps more of such ones.
- **Mormonism** (USA), Joseph Smith Jr., 1805-1844, monotheistic. *Jesus Christ is the Savior of the world, and Joseph Smith is his prophet. The Church of Jesus Christ of Latter-day Saints is the restored Kingdom of God on earth to prepare the second coming of the Messiah.*
- **Baha'is** (Iran), Baha'u'llah, 1817-1892, monotheistic. *There is one God unknowable, which is gradually revealed to humanity through his word by means of divine messengers, like Abraham, Krishna, Moses, Zoroaster, Buddha, Christ, Mohammed and Bab.*

- **Jehovah's Witnesses** (USA), Charles Taze Russell, 1852-1916, monotheistic. *This doctrine believes that the end of the world is near. On that day the earth will become a place of happiness for the survivors and the dead resurrected, and that Christ will separate the bad from the elect ones, who will form the new world of the Kingdom of God, Jehovah, a world as the paradise of Eden.*
- **Scientology** (USA), Lafayette Ron Rubbard, 1911-1986, science-fiction. *This doctrine teaches that humans are immortal spiritual beings who have forgotten their true nature, and that the souls, Thetans, are reincarnated on Earth after having lived in different planets.*
- **Esoteric** (World), from time immemorial, complex esoteric (from the Greek "entering") doctrines, which are configured by cultural phenomena such as Magic, Alchemy, Astrology, Mystery, Gnosticism. In most non-esoteric Religions there is some heretic form of Esotericism, as in Brahmanism, Buddhism, Sufism, Manichaeism, and Christianity. Esotericism is often associated with Freemasonry, which dates back to the spirit of solidarity of medieval craft guilds, and that in a ritual says *"Be tolerant because nothing can define the Great Architect of the Universe. Seek the Truth, Justice and love your neighbor as yourself, such is the way of Duty, the only way to Salvation."*

All these Religions have attempted to answer the ultimate questions of man (Who are we? Where we come from? Where do we go?) in different ways but with precepts sometimes surprisingly similar as it is evident in the "golden rule" of many of them as below:

- What is hateful to you, do not do to your fellowman. This is the entire Law, all the rest is commentary. (**Judaism**, Talmud, Shabbat 31a),
- This is the sum of duty; do naught onto others what you would not have them do unto you. (**Hinduism**, Mahabharata 5,1517),
- That nature alone is good which refrains from doing another whatsoever is not good for itself. (**Zoroastrianism**, Dadisten-I-dinik, 94,5),
- Try your best to treat others as you would wish to be treated yourself. (**Jainism**, Sutakritanga 1.11.33),
- Hurt not others in ways that you yourself would find hurtful. (**Buddhism**, Udana-Varga 5,1),
- Regard your neighbor's gain as your gain, and your neighbor's loss as your own loss. (**Taoism**, Tai Shang Kan Yin P'ien),
- Do not do to others what you would not like yourself. (**Confucianism**, The Dialogues No. 280, Analects 12:2),
- Thou shalt love thy neighbor as thyself (**Christianity**, Mark 12:31),
- No one of you is a believer until he desires for his brother that which he desires for himself. (**Islam**, Sunnah),

and the previous Religions are often widely separated in time, place and culture. In any case, men of all ages have put their trust in them, sometimes to the point of sacrificing life and possessions for their defense and affirmation.

3. The True Religion

Recently, during a School on Atomic and Molecular Spectroscopy, Erice, Sicily, the Director of the same, Baldassare Di Bartolo (Rino for friends), told me point blank that "if you were born in the Middle East today, you would have been a Muslim". At the moment, I did not catch the full meaning of his statement, but then I realized that, with few exceptions throughout history, the inhabitants of a place really became and still become members of the dominant Religion in the same place. Lately, this human condition has partially changed due to the phenomenon of globalization, but if you are born in Arabia, China, India, Italy, and Thailand, respectively, it is rare not to be affected by Islam, Confucianism, Hinduism, Christianity, and Buddhism, not counting that in the first example only Islam can be professed in public by law.

Then, neglecting Atheism which can ultimately be represented by Epicureanism (Onfray 2006) or Agnosticism (Russell 1927), one may wonder if, beyond the geographical and cultural factors, all Religions are equally valid with respect to the ultimate questions, as argued by some modern syncretist, or just one Religion is actually "true", as claimed by the majority of believers, especially when the Religion is a revealed one. Of this latter opinion was also the well-known philosopher and mathematician Bertrand A.W. Russell (vixit 1872-1970), for whom "*not more than one of them can be true*", even though he also adds "*I think all the great religions of the world – Buddhism, Hinduism, Christianity, Islam, and Communism – both untrue and harmful*" (Russell 1927a). Apart from his personal opinions which also led him to say "*I do not believe in God and in immortality, and I do not think that Christ was the best and wisest of men, although I grant him a very high degree of moral goodness*" (Russell 1927b), the history of Religions does not help us out of the above dilemma. In fact, with the exception of some Religions strongly imbued with philosophical principles, which can coexist with many different religious beliefs, in most cases Religions claim to be the only and true ones and, apart long periods of dialogue and peaceful coexistence, there were also cruel repressions and violent conflicts in order to assert the superiority of one Religion over another, and still today there are outbreaks of religious fanaticism. Leaving aside the never ending debate on whether Religions have a tendency to promote violence (Wellman 2007) or rather religious motivations are used by the States for their own purposes (Cavanaugh 2009), the fact remains that Religions strongly disagree each other. For instance, it is known that the Jews claim Jesus Christ (JC) was an impostor, for Christians JC is the Son of God, Muslims argue that JC was a prophet but Muhammad is the last and final one, while the Mormons say that Joseph Smith is really the last one, and today there are many other minor Religions who say that there have been and/or still are other prophets. So, you cannot expect a possible convergence of the existing Religions on the ultimate questions, although in recent times we are witnessing an ecumenical dialogue between the major religious denominations that at least is reducing the level of confrontation to a peaceful coexistence.

Anyway, in the world there are thousands of Religions with many Gods, none or just one God, from the very abstract to anthropomorphic God, which were followed and worshiped by humans over the past millennia. In all the historic times no single Religion was practiced by the majority of world population, and also some Religions contradict each other, which further diminish their credibility. In fact, the existence of many Religions and many different deities would seem the logical demonstration

that none of them has ever provided irrefutable evidences to be true, giving further good motivations to atheists/agnostics who are currently, and probably have always been, the majority of world population. That being so, I wondered whether it would be possible a scientific approach to the religious question. As it is well known, modern Science arose in Europe soon after the Renaissance when the scientific method became an indispensable tool, namely the pursuit of experimental evidence to validate a scientific theory, and Galileo Galilei (vixit 1564-1642), who first applied systematically this method, is commonly considered the father of modern Science.

The desire to prove scientifically the validity of a Religion would seem at first a complete nonsense (Ratzinger 2007), as usually a Religion is accepted by an act of faith, or a Philosophy is embraced by conviction, but if we analyze this new possibility with a spirit free from any preconception we may arrive at surprising conclusions.

First of all, let me clear away all those Religions/Philosophies basically indicating a way of life that could be accepted without great difficulty by a large number of people. For example, Epicureanism and also Confucianism are among these, while the Buddhism was so at its beginning until it co-opted the cycle of metempsychosis, a common belief in various Religions, including Hinduism. The latter one is indeed a Religion in which the supernatural realm is closely connected with the natural sphere, as in the Yoga which was designed to bring the follower more near to Shiva, the main God of the Hindu pantheon, but ended up being an exercise beneficial to health.

All Religions containing the supernatural sphere have their origin described in sacred books that tell stories that would be hard pressed to obtain the approval of a scientific analysis, where only repetitive events are analyzed in detail, or of a judicial tribunal, where only evidences certain and documented are taken into account, or of ordinary people who use a little common sense and logic. The previous considerations hold for all the episodes in the Gospel where many disciples turned away from JC because his words were "hard". Only twelve of them remained with him, and when JC asked them why they have not gone away too, Peter answered, "*Lord, to whom shall we go? You have the words of eternal life*" (John 6:68). Clearly, Peter and the others were fascinated by the supernatural realm that emanated from JC. But, when it was arrested later on, all of them abandoned him, which is the evidence that against the fear of reprisals the certainties about JC and his words were not very solid, like in the case of the disciples who walked away at first. As far as I know, a similar situation with large variations of minor parameters is valid for all Religions, and when we go to look for evidences we end up finding that we have to believe the testimony of one person or more than one directly involved in the events, or because of faith, which is not the same as the scientific method, the judiciary or common sense, as mentioned above (Hopper 2010).

To give an example of an extreme exegesis, the very existence of JC is questioned in the first place. In fact, in a modern chronology of ancient philosophical schools (Onfray 2006), we read as follows:

- 40 B.C., death of the Philodemus of Gradara
- 0, birth of an hypothetical Jesus
- 2 A.D., birth of Seneca

yes "hypothetical Jesus" referring to JC, so uncertain are considered by some scholars the origins of Christianity from the historical point of view in relation to other contemporary events.

This sharp conclusion has a taste of irony if we think that Christianity is at the basis of the birth of Western civilization and of the scientific method (Baldacchini 2001), but it is a fact that especially since the Renaissance it was subjected to a thorough exegesis that in some cases came to affirm that it is the result of pure imagination and/or calculated desire for power. The same cannot be said of the other Religions in general, for which a critical exegesis is lacking almost completely. Someone might argue that the exegesis was a fruit of Western civilization and that it was logical to expect its application to Christianity and not to other Religions born in other development contexts. But, the previous way of reasoning could have been accepted until a few generations ago, and certainly not now in a full era of globalization. I venture to say that this critical exegesis with respect to Christianity has developed largely as a result of the expansion of Western civilization since the discovery of America by Europeans in 1492 (with warning signs since the Crusades in 1096), and subsequent phase of expansion and colonization in all continents. And since Christianity has been at the very heart of this historical process, this same Religion has been studied and criticized and still is (Cox 2009), with the aim of the enemies, internal and external, to prove its groundlessness and falsity in order to undermine Western civilization itself, which is regarded aggressive and expansive (Saraswati 1999). Although this last argument is a very interesting one, it is also very marginal for this work, so it will not be developed further, with the exception of the important mention that it was just the extreme exegesis of Christianity that has inadvertently produced a scientific proof in favor of the same Christianity.

4. Christianity and the Shroud of Turin

The Resurrection of JC is the cornerstone of Christianity, as it is testified by the same Paul who says in a letter to the inhabitants of Corinth "*And if Christ be not raised, your faith is vain; ye are yet in your sins.*"(1 Corinthians 15:17). Paul believed in the Resurrection of JC because of the light and the voice that made him fall from his horse on the road to Damascus, but his companions did not see anything even if they heard the voice. The only evidence of the Resurrection soon after the fact is the one of the young John who "*Then went in also that other disciple, which came first to the sepulchre, and he saw, and believed.*" (John 20:8). Then, the risen JC appeared to the pious women, to all the apostles and many others, but still a small number of people who could have had many reasons for giving false evidence, as claimed by the enemies of Christianity at that time and still today, although the theory of a concerted conspiracy on the side of a few simple and illiterate persons seems scarcely credible. However, the fact remains that there were no direct witnesses, and today there is an empty and silent tomb, over which was built the church of the Holy Sepulcher. But, this tomb contained a corpse wrapped in bandages and spices (John 20:7). Today there are not remains of the corpse, but there are two bands known as the "Sudarium of Oviedo" and "Shroud of Turin", and in the following the latter one will be at the center of our attentions because of singular features that make it a relic unique in the world (Wilson 2010).

Of course, even in this case people who know the Shroud, not including the many faithful who a priori consider it a relic of JC for a religious or devotional choice, can be divided broadly into two categories thinking it to be:

- a medieval fake useful to the Catholic Church for devotional practices and/or religious propaganda, like many other relics,
- the real cloth that wrapped the corpse of JC, and has witnessed his Resurrection.

Two decades ago, the first view has been supported by the results of dating with ^{14}C (the isotope of atomic mass 14 of the element carbon) which provided the years 1325 ± 75 (Damon et al. 1989), a confirmation of the medieval date of 1353 corresponding to the time when the Shroud appeared for the first time in France at Lirey, a city 150 km South-East of Paris. The second view, based on a long series of previous and more recent evidences, remained practically unshaken by the new finding. Moreover, several experts have questioned the validity of the dating with ^{14}C because the samples taken for the measurement were considered not representative of the Shroud and/or contaminated. As a matter of facts, at moment we are back in a situation of intense debate, and a common truth accepted at least by the majority of the two previous group of persons seems as far as ever has been.

So, at this point I too would like to participate in this debate, contributing with a new methodological approach that is actually using the old but still valid proof by contradiction (*reductio ad absurdum*).

5. The Shroud of Turin is not a Fake

The Shroud is a linen (cloth of flax) apparently very old and approximately 4.40 m long and 1,10 m large, upon which there are many marks including a weak front and back Body Image (BI) and patches of organic and inorganic liquids. It has been found that the BI is not a drawing or a painting made by known techniques, and some red stains were caused by human blood (Antonacci 2000), (Wilson 2010), but somebody still consider it a hoax. So, let us suppose that the Shroud is a medieval fake produced by the most ingenious forger ever appeared on Earth and still unknown (Baldacchini 2011). It follows that the hypothetical author, or authors, knew some of the technologies or information prior to their invention and disclosure at large. For instance:

- The BI is a photographic negative (this technology was discovered and used in photography since 1850, although the phenomenon of the dark room was already known to Aristotle (vixit 384-322 B.C.) and much later on recorded by Leonardo Da Vinci (vixit 1452-1519). But, apart from the technical difficulties of painting a negative picture, it is not clear why such a choice should have been made, in the first place, by the hypothetical forger, a more than rare occurrence in the history of art),
- The iron nails are driven through the wrists of the man of the Shroud (practically all ancient representations of the crucifixion show the nails hammered into the hands, but today we know that the body could not be hung on the cross in this manner, but the medieval forger did not know this important detail and it was rather odd his decision to act contrary to the well-established tradition of a sacred representation),
- In the crossed hands the images of the thumbs are missing (which is a consequence of the unique way of nailing the wrists to the cross and of a particular anatomical space, which is called Destot Space from the radiologist and French anatomist Étienne Destot (vixit 1864-1918)),

- The image of the left leg is shorter than the right one (which is a consequence of the method of nailing the feet in the crucifixion and the sudden rigor mortis, two aspects unknown in the Middle Ages and discovered only recently),
- On the right side of the chest there is a large stain of blood and serum (no medieval forger could have known that this is a consequence of sudden death by rupture of the heart wall, a recent discovery of medicine. Moreover, the same circulation of blood and the function of the heart has been discovered only in the 17th century by William Harvey (vixit 1578-1637)),
- The supposed stains of blood contain information on the properties of human blood (some of them are known only by a couple of centuries and others only from decades, such as venous and arterial circulation system, the different components, the phenomena of de-clotting and coagulation, etc...),
- The bloodstains are sharp and under them there is not trace of BI (these features are incompatible with an artistic work, and only recently the connection with the mode of formation of the BI has been explained),
- There are several spots of blood on the forehead and on the skull (the traditional representation of JC has always been with a crown of thorns, but the wounds on the Shroud require a helmet of thorns, a fact unknown even in the Gospels),
- The BI is absent in places such as the right side of the face and forehead and other parts of the body (only recently these features have been explained with the formalities and rituals of the burial and with the physical nature of the formation of the BI),
- The BI contains three-dimensional information (paintings and photos are generally flat on this regards and, apart from the technical difficulties of reproducing 3-D effects, it is not clear the motivation behind the decision on the side of the forger to create such effect, useless and unknown in the whole history of art. Moreover, it is related with the physical nature of the formation of the BI),
- The BI is extremely shallow and consists of fibrils colored yellow-sepia and which are oxidized and dehydrated (the chemical and physical techniques known in the antiquity could not have done that, while there is a modern optoelectronic technique which is compatible with these features).

The above characteristics and other ones not reported here for sake of brevity, have been studied in great detail by experts from various cultural and religious extractions since the first photographs taken in 1898 that brought to light the negativity of the BI. The procedures used have always been inspired by the principles of the scientific method, and therefore the published results are recognized by all the scholars. In particular, the above characteristics reveal that it was not possible for a medieval artist to produce a false Shroud, because he did not know circumstances and phenomena which were discovered only later on or in modern times, and the techniques available to the said artist did not allow to perform such work from the macroscopic and microscopic point of view. For instance, the BI is not well visible at less than 2 m so that no artist could paint it manually unless using a brush 2 meters long, and the microscope was invented only in the 17th century. So, it follows that the Shroud is not a fake, much less medieval, and actually it contained the dead body of a man crucified in ancient times.

As before by using again the proof by contradiction, let us suppose now that the dead body wrapped in the Shroud was not that of JC, but belonging to an unknown man tortured and crucified in the same period of time or later on. Then, we must explain in a satisfactory way the following contradictions:

- The linen used to wrap the corpse was precious and expensive (similar linens were used in Israel only for persons of royal rank and/or high social position, and in the present occurrence some traces would have been found in historical records, which is not the case until now),
- The man of the Shroud was flogged methodically over the whole surface of the body (there are signs of Roman scourge in such large numbers that, apart from the Gospels, no historical document has ever reported a similar cruelty for any other convicted man),
- The man of the Shroud was capped with a crown/helmet of thorns (no other crucifixion has ever been reported historically with a crown, and none ever with a helmet. Even the writers of the Gospels ignored this singular event, known perhaps only to the closer actors, (John19:2) *“The soldiers twisted together a crown of thorns and put it on his head”*, who very likely did not inform the above writers.
- The side of the man of the Shroud was pierced by a lance (there is a conspicuous spot of blood and serum into the right side of the man of the Shroud caused by a wound from a particular kind of lance, a rather uncommon procedure ever),
- The legs of the man of the Shroud are intact (the legs of the crucified persons were usually broken to hasten death, which otherwise would have occurred much later by suffocation),
- The Shroud does not contain trace amounts of putrescent liquids and/or gases (these signs are produced after about 40 hours from the death of a man, and so the dead body was gone before then but not too much before, because of the blood stains that had the time to form from the liquefaction of the blood already clotted, a process called hemolysis and discovered in recent times),
- The dead body was not removed manually (there are no traces of dragging at the bloodstains).

If the Shroud is of the same period of JC, it is much more than surprising how the previous characteristics could have been described later on with so many details in the Gospels, especially since the consequences of these details were totally unknown to the same authors of the Gospels. So, we must assume that they reported what they had personally seen or what was told them by eyewitnesses, who for instance could not know about the helmet versus the crown of thorns. On the contrary, if the Shroud is subsequent to the writing of the Gospels, from the medieval era according to the hypothesis of a forgery, we must assume that another person has been subjected to the same tortures of the JC described in the Gospels, taking into account, however, that no one also at that age knew the consequences of such actions, and that it would have been practically impossible to reenact the same temporal and spatial conditions, as required by the features of the Shroud. As a consequence of not being able to give a logical explanation to the previous contradictions, we arrive to the only conclusion that the Shroud was actually the linen used to cover the corpse of JC about 2,000 years ago, after being scourged and crucified in a town of Galilee called Jerusalem, as described in the Gospels.

It remains to establish how the BI has been generated on the Shroud, and how did the body of JC disappear from the tomb and in particular from inside the Shroud itself, which on the morning after the Easter Sabbath was simply lying (collapsed) on the stone of the tomb. If someone had removed the

body, the linen enveloping it would have been tampered with and positioned differently. Someone might say that the Apostles or/and disciples did remove the body, and stealthily made sure that everything would have looked exactly as it was later on described by the Gospels, that is a Resurrection (Matthew 27:62-66). But this hypothesis is contradicted by everything that has been said in the above first and second series of proofs by contradiction. In fact, the Apostles could not know, as also the hypothetical clever medieval forger, the consequences of their actions. Moreover, if the Apostles or/and disciples took the trouble to steal the dead body, I do not understand why they missed the opportunity of taking also the linen enveloping the corpse, which would have facilitated very much the transportation, and avoided at the same time to contaminate the soil, a ritual must for the Jews. Someone might say that the linen had to prove that the Resurrection really took place, but then why this linen is not mentioned anymore in the Gospels, or in the Acts of the Apostles, which would have been a good piece of evidence to exhibit to hard believers? Moreover, is it possible to think that simple and uneducated men as the Apostles and/or disciples gave their lives to maintain such fiction, and never talked even under close and brutal questionings? And still, if it was a preordered fiction, how did it happen that no leaks at all came out from a small, but not negligible, number of persons, who were aware of the facts? The answer to all these questions is a nope strong and clear, and therefore it is logical and proper to think that, until proven the contrary, the facts under scrutiny here happened exactly as described in the Gospels.

Then, let us go back to the BI and the Resurrection, which I shall describe within the general laws of Physics, leaving to the imponderable realm the ultimate answer.

6. Hypothesis of an Energy Burst and More

Over the past 100 years, various chemical and physical hypotheses for the formation of the BI on the Shroud have been advanced by eminent scholars with mixed results (Fanti 2011, Supplemental Bibliography). But lately the hypothesis of a Radiative Energy Burst (REB) has been taken in consideration more seriously than other ones by many of them (IWSAI 2010), because it explains in a satisfactory and punctual way the properties of the Shroud listed in the previous chapter, and many others not reported here but well known in the literature.

But, the fact remains that the body of Jesus Christ, who then appeared to many witnesses in his human and divine attributes, somehow came out of the Shroud without damaging it and without leaving traces of dragging, for example on the blood stains. In order to explain this further feature, the new hypothesis of the Mechanically Transparent Body (MTB) has been also introduced (Jackson 1990). Briefly, this new idea states that while the body emitted radiant energy, it also became transparent with respect to the Shroud, with the consequence that the upper part of the Shroud fell under the force of gravity until lying above the lower part of the Shroud already on the burial stone, a plain collapsing event following the abrupt lacking of any support. So, this scenario appeared to the first rushing witness, John the Apostle, in the early morning of the first day of the Jewish week, i.e. the first Sunday of the Christian Easter from then on.

The hypothesis REB has been thoroughly discussed with evidences contra (Rogers 2004) and pro (Jackson and Propp 2004) and, although the majority of scholars is prone to accept it, it is also true that up to now we do not know of any natural process which leads the matter to become transparent against other matter, unless we utilize nuclear reactions of fission and/or fusion, in which a fraction of the matter is transformed into energy and then literally disappears from the view. If this is the case, there are at least three technical difficulties to overcome when we compare it with the known story of JC. A nuclear reaction requires the presence of fissile material in an appropriate conformation, and it is pretty weird to think that part of the body of JC could have contained uranium or other fissile elements, and in case of fusion light elements, at high concentration. Furthermore, the energy produced during these reactions is so big that the Shroud, the tomb and a large part of Jerusalem would have been destroyed in the explosion, a fact that has not occurred historically. Finally, in case the enormous destructive energy of the explosion could have been harnessed otherwise, most of the body, the non-fissile part of JC, would have remained still wrapped inside the Shroud, which is not what really occurred as we know the story from the Gospels.

As a consequence, another step forward was devised with the Historically Consistent Method (HCM) (Antonacci 2000), which cleverly combines one of the assumptions in REB, where the radiation consists of protons and other elementary particles, and the hypothesis MTB. While this new hypothesis was able to explain many features of the Shroud and to make some interesting predictions, it aroused a prompt and sharp criticism, especially for some scientific aspects (Rogers 2001). In particular, the hypothesis HCM assumes that the body disappeared or de-materialized emitting radiations, elementary particles and electromagnetic waves, which generated the BI on the Shroud. But, only a small fraction of the body is required to disintegrate in order to obtain the radiations for producing the BI, and then remains the problem of how to dispose of the rest of the body. One possible solution has been found in the theory of general relativity for which, according to the same proposer, wormholes are possible and allow a generic mass to move freely in different points of the fabric of space-time.

Now, since the past century wormholes (Einstein-Rosen bridges) are mentioned in Science, but so far there has not been any evidence that these objects really exist, while they are commonly utilized in science fiction to overcome galactic distances and long time travels. Moreover, the hypothesis HCM clashes with another unsolved problem, namely the disposal of the energy contained in much of the mass of the body, which as we have already seen is huge and, when fully developed, would have devastating effects. However, it is also reasonable the fact that if we accept the reality of the Resurrection, then we can also believe in phenomena unexplained by Science, but it is equally true that the divine manifestations in Judaism and Christianity have always happened discretely through natural laws, even if likely stimulated by a supernatural intervention (believers) or simply a random event (non-believers).

In conclusion, if the Resurrection really happened, then in my opinion it should have been like the creation of the universe. Indeed, the beginning of the Big Bang can be considered the result of a supernatural intervention (Religions) or a random event (Science), but its subsequent developments certainly followed the laws of Physics, which most likely were born as we know them today in the very initial moment of the Big Bang. So, also for the Resurrection it is possible to apply the same model of a supernatural intervention or a random event at first, followed by phenomena within the laws of Physics,

but the HCM model is clearly out of this scheme, because it requires first a partial nuclear reaction and second a space-time displacement of the body, which is a bit too much to accept, even outside a comprehensive scientific context.

7. Annihilation Hypothesis

The only phenomenon known in Physics that leads to the complete disappearance of any mass with the generation of the equivalent energy is the Matter-Antimatter Annihilation process (AMA), which today can only be reproduced in laboratories at the subatomic level of elementary particles, but was dominant immediately after the Big Bang, i.e. in the initial instants of existence of our universe. However, for this process to occur, the mass should collide with an identical quantity of antimatter freeing the energy of the mass at rest, i.e.:

$$(1) \quad E = m \cdot c^2$$

the famous equation devised by Albert Einstein (vixit 1879-1955) at the beginning of the 20th century, where E is the energy, m the mass in consideration and c the speed of light. In simple words, this equation tells us that mass and energy are equivalent and, because of the enormous speed of light, also the energy of the mass is so. Assuming that this enormous energy may be channeled to somewhere non-destructively, the problem remains of where to find the antimatter which does not exist in our universe, or at least has never been discovered or produced in great abundance.

To this end, it comes to our help a physical entity known as *virtual state*. For example, many nonlinear optical phenomena, such as the Raman Effect and multi-photon transitions, (Baldacchini 2013a) take place through virtual states which do not really exist in nature, hence the name virtual, but they act as intermediate states which appear when needed and disappear soon after. Meanwhile, the real physical phenomenon that is mediated by them actually happens, and this is true for both electromagnetic waves and matter, being a consequence of quantum mechanics that replaces classical mechanics to explain the microscopic phenomena which, however, contribute also to the macroscopic properties of the universe. In the present case, it is assumed that a virtual mass of antimatter has come into contact with a similar mass of matter with the result of the production of gamma rays which decay immediately after producing again matter and virtual antimatter. So, this partially virtual process might seem at first sight to bring the system back to the same initial state, but this is not the case because the process of creating matter-antimatter (particle-antiparticle pairs) does not preserve the symmetry CP (Charge-Parity), for which more matter is created than antimatter. This is the reason why our universe of matter, space and time began to exist after the Big Bang when, after 100 seconds, electrons, protons and neutrons emerged as stable particles from the primordial fireball and then, after 1 billion years, they formed the stars, and then the matter which we know today and which makes up our bodies, in particular. Then, for the energy equivalent to an initial mass M , and keeping only the essential terms of the process in question, we can write the following equation:

$$(2) \quad \mathcal{M} \cdot c^2 + \mathcal{M} \cdot c^2 \rightarrow \mathcal{E}(\gamma) \rightarrow \mathcal{M} \cdot c^2 + M \cdot (1 + \eta) \cdot c^2$$

where \mathcal{M} is the virtual mass, $\mathcal{E}(\gamma)$ the virtual energy of the γ rays, and $\eta = 10^{-9}$ is the "asymmetric parameter", very likely a basic constant of Physics deriving from the symmetry breaking. By eliminating the virtual terms mediating the process and balancing the energy, Eq. 2 becomes:

$$(3) \quad M \cdot c^2 \rightarrow M(1 - \eta) \cdot c^2 + M \cdot \eta \cdot c^2$$

where the energy is conserved, but the mass M has turned into a slightly minor mass $M(1 - \eta)$ releasing an energy equal to $M \cdot \eta \cdot c^2$. In practice, there has been a process of total annihilation, but the energy released is limited to only a factor η of the initial mass.

Equations 2 and 3 obey the known laws of Physics for elementary particles, and in particular the total energy is conserved while the CP symmetry is broken, but we have also made an extrapolation from the subatomic to the macroscopic world, and today we do not know how these processes can be started in the latter context. However, similarly, we do not know why and how the Big Bang happened at all, but we do know that it happened for some reason, be it supernatural or accidental, and that it evolved as a consequence of the laws of Physics up to arrive at the actual universe.

At this point, let us set $M = M_{JC}$, where the mass in Eqs. 1-3 is replaced by that of JC, and the Resurrection can be reduced, at least from the physical point of view, to a process of annihilation of matter. This process, which has been called AMA, allows overcoming the two unresolved problems of the hypothesis HCM. In fact, only a small part of the rest mass energy is released, which avoids an enormous explosion, while the body is annihilated, that is, it becomes transparent and is re-composed, other than a hair (the fraction ηM_{JC}), as it was before the annihilation in any place inside or outside the Shroud. Indeed, Eqs. 2 and 3 impose to the annihilation process only a time evolution as in the arrow verse, but not restriction at all as far as space is concerned.

Then, the body of JC becomes transparent for the Shroud as required by the hypothesis MTB, while emitting a limited amount of radiant energy as for the hypothesis REB, without the problems of the hypothesis HCM. Now, let us examine the consequences of these interesting results and, in particular, the energy released on the known features of the Shroud.

JC was about 180 cm tall (Ricci 1967, Fanti et al. 2010, Baldacchini et al. 2010), which corresponds to an estimated weight of 78 kg, by taking into account that 2000 years ago an overweight individual was a rather rare event. Then, the energy contained in this mass according to Eq. 1 is given by:

$$(4) \quad E_{JC} = M_{JC} \cdot c^2 = 78 \cdot (3 \cdot 10^8)^2 = 7 \cdot 10^{18} \text{ J}$$

where J stands for Joule, which is the unit of measurement for energy (it takes 4.18 J to heat by 1 degree centigrade 1 gram of water). To get an idea of how big this energy is, let us compare it to the energy produced in 1945 by the explosion of the atomic bomb on Hiroshima, $E_{HB} = 20 \text{ kt}$ (kilotons of TNT, trinitrotoluene) = $7.7 \cdot 10^{13} \text{ J}$, and so:

$$(5) \quad E_{JC} / E_{HB} = 7 \cdot 10^{18} / 7.7 \cdot 10^{13} = 0.92 \cdot 10^5 = 92,000$$

that is about 100,000 times greater than the Hiroshima bomb. This explosion is equivalent to a giant H-bomb of 1800 Mt (Megatons of TNT), which can destroy the whole Palestine and beyond.

Fortunately, the asymmetric parameter η lowers the energy released during the Resurrection, E_R , to a much more reasonable figure, that is:

$$(6) \quad E_R = E_{JC} \cdot \eta = 7 \cdot 10^{18} \cdot 10^{-9} = 7 \cdot 10^9 \text{ J}$$

an energy about 10,000 times smaller than the one released by the Hiroshima bomb, but still equivalent to 1.82 t (tons of TNT), and so capable of destroying completely the tomb and the surrounding area within a radius of 50 m. Let me remind that when a 1 t unexploded bomb from World War II is found in a European city, an entire neighborhood within a radius of 500 m is evacuated as a precaution.

Since this explosive event has not happened, the energy delivered in Eq. 6 has been used otherwise, for example in the production of elementary particles, which is allowed by the laws of Physics. In this respect, let us calculate how much energy is required to produce $2 \cdot 10^{18}$ neutrons (we will see later on why this specific numeric value). A neutron weighs $1.67 \cdot 10^{-27}$ kg, equivalent to an energy E_n equal to:

$$(7) \quad E_n = 1.67 \cdot 10^{-27} \cdot (3 \cdot 10^8)^2 = 1.5 \cdot 10^{-10} \text{ J/neutrone}$$

So, in order to create a number of neutrons as above, an energy equal to $2 \cdot 10^{18} \cdot 1.5 \cdot 10^{-10} = 3 \cdot 10^8 \text{ J}$ is required in total. This value is largely contained in the energy of the Resurrection of Eq. 6, and plenty of energy remains for the production of other subatomic matter such as protons, α particles, electrons, and neutrinos. Assuming the number of these particles to be equal to that of the neutrons, and taking into account that α particles are four times heavier and electrons are 2000 times lighter than neutrons, respectively, an energy equal to $3 \cdot 10^9 \text{ J}$ is more than enough for the generation of all such elementary particles. Therefore, an energy of $4 \cdot 10^9 \text{ J}$ remains at disposal, still a significant amount. But, it is also possible to utilize this energy to charge electrically the death body wrapped in the Shroud and, in this case, 10^9 J are needed to reach 100 MV (millions of Volt). Finally, the residual energy could have heated the same body, it takes 10^7 J to increase by 30 °C the temperature of a mass such as that of JC, and have caused a modest explosion in the tomb with a consequential displacement of air.

In conclusion, the hypothesis AMA, in addition to meeting the basic requirements of an event that develops within the laws of physics, also manages to dispose of the energy produced by the Resurrection in various options which are functional to the characteristics of the Shroud, and prevents an explosion which, although being much smaller than a nuclear one, would still be disastrous for the tomb and its surroundings.

8. Discussion

The hypothesis AMA has all the requirements necessary to describe a posteriori what could have been happened on the night before Sunday April 9, 30 A.D., in a tomb in Jerusalem, where on the previous

Friday well before 6 pm a small group of hasty and frightened people deposited the corpse of JC enveloped in the Shroud and put the Sudarium “...that was about his head ...wrapped together in a place by itself.” (John 20:7). The body left the Shroud without messing up it, and this is evidenced by the lack of clues in the same Shroud, and later on the same JC appeared alive to many witnesses, and this is told by the Gospels. The hypothesis AMA tells us nothing about the latter event, but it indicates that the body dematerialized into the Shroud and instantly materialized again in another place, which is not in contradiction with the Gospels. Moreover, the hypothesis AMA makes no difference between a dead or alive body, while the Gospels tell that the resurrected body was alive, which is not in contradiction with the laws of Physics. So, there is a singular reciprocity between the Gospels and the hypothesis AMA, which do not exclude but rather are complementary each other.

During the dematerialization, the body of JC released in its surroundings a substantial amount of energy which, in accordance with the basic laws of Physics, produced **elementary particles** and/or **electromagnetic waves** and/or **electricity** and/or **heat** and/or **a small explosion**, and all five of these energetic events may have played an important role in the unique event of the Resurrection (Venturini, 2011).

Almost all the interdisciplinary studies carried out on the Shroud until now show that it is a linen fabric compatible with the time of JC (Antonacci 2000, Wilson 2010), with the only exception of the relatively recent dating with ^{14}C , which assigns a date between 1260 and 1390 (Damon et al. 1989). The discrepancy between the latter dating and the former ones has started a lively discussion that continues still today between those who believe the ^{14}C dating as the ultimate test and those who think it is plain wrong. Some ones, however, do not criticize this test, although they noted some coarse statistical inconsistencies (Fanti et al 2010a), but rather they say that the sample used for the measurements was not representative of the Shroud and/or has been contaminated by an unknown cause. These last conjectures considered substantially correct from a technical standpoint the measurements with ^{14}C , but not the consequent age of the Shroud. To make a long story short, among the many existing hypotheses there is one which attributes to a neutron flux the rejuvenation of the Shroud of about 1300 years, thus putting an end to the controversy about the ^{14}C dating.

This radioactive isotope of C (carbon) exists in trace amounts in the atmosphere because it is produced continuously by **neutrons** (a byproduct of the cosmic rays which strike the upper atmosphere) hitting the atoms of ^{14}N (nitrogen), and is located in the same proportion in all kind of vegetation. When a plant is harvested, the ^{14}C atoms are no longer renewed and, because of its half-life of 5,730 years, their number decreases exponentially. Then, by simply counting the number of isotopes still present at a certain moment, it is possible to determine the date when the plant has been harvested, and this is exactly what was done in 1988 to establish the age of the Shroud which is woven with flax fibers. But the flax naturally contains a small amount of atoms of ^{14}N , about 600 ppm (parts per million), which when irradiated with neutrons are transformed into isotopes of ^{14}C that add to those already existing naturally, thus distorting the dating. In short, it has been found that if a linen fabric similar to that of the Shroud is irradiated with a flow of 10^{14} neutrons/cm², the tissue rejuvenates of about 1300 years (Linde et al. 2010). By supposing a 1:1 ratio between the surfaces of the body of JC and the Shroud, and assuming a surface area of 2 m², corresponding to a man like JC, his body should have emitted $10^{14} \cdot 2$

$10^4 = 2 \cdot 10^{18}$ neutrons to rejuvenate the Shroud, as measured by the method of ^{14}C . At this point, it is clear the origin of this number of neutrons utilized in the calculations of the previous chapter.

Having credited the neutrons with solving the not negligible problem of the ^{14}C dating, let us see how to use properly the rest of the energy produced in the annihilation events, as in Eq. 6.

In the hypothesis HCM (Antonacci 2000), the BI is attributed to the effect of **protons** that are absorbed by the Shroud cloth in a very thin layer, which is one of the main features of the BI. **Alpha particles** behave similarly to protons, with the difference of their greater mass which requires an increased kinetic energy to obtain the same results (Rinaudo 1993). Also **electron** beams have been used but with unsatisfactory results, since the irradiated fibrils are scorched rather than simply colored on the surface (Ferrero et al. 2002).

Among all the sources of electromagnetic waves, only **ultraviolet light** (UV) is able to produce a coloration Shroud-like (Baldacchini et al. 2008, Di Lazzaro et al. 2010, Di Lazzaro et al. 2012). In fact, it has been observed that the depth of coloration decreases with decreasing wavelength, and also the color changes from brown to yellow sepia, a coloration closer to that of the Shroud. The experimental measurements have shown that the right wavelength to obtain a coloration similar to the BI should be in the range from vacuum ultraviolet light (VUV), 200 nm, and soft x-rays, 10 nm, very likely closer to the former value. It was also noticed that only very short pulses, less than 100 ns, and high powers, greater than 10 MW, are able to color linen fabrics. This is a further experimental evidence in favor of a burst of radiant energy, REB, as the most likely cause of the Resurrection. Finally, it is useful to remind that only a laser source is able to produce beams of light with the characteristics listed above, and in fact **excimer laser** of high power were used for the previous experiments. Among other things, the laser light is directional and coherent, two properties which are required to produce the BI. The directionality is necessary to explain the resolution of about 0.5 cm and the three-dimensionality of the IC, while the coherence is able to explain the discontinuity of coloration between adjacent fibrils and the same fibrils, which most likely is the result of diffraction phenomena and/or laser power instabilities. But, how the body of JC could have delivered coherent and directional light without the presence of an optical cavity, one of the essential elements for the classical laser emission? The only possible response in the context of the modern scientific knowledge is **superfluorescence**, which consists of an intense and short pulse of light emitted by a material previously excited energetically that releases all of its energy in a synchronized way (Bonifacio and Lugiato 1975). In addition, the light emission takes place mainly in a directional mode as a result of the symmetries of the excited material. The body of JC in the tomb possessed all the energy and geometrical criteria required for the emission of a burst of coherent and directional VUV light. Indeed, the corpse was deposited on a flat surface of the stone tomb, which so indicated a privileged vertical direction (Baldacchini 2012), as the force of gravity in the MTB hypothesis.

We have seen in the previous chapter that the burst of energy is capable of producing **electrical charges** on the body enveloped by the Shroud up to 100 MV, which of course are not stable but tend to cancel each other, for example by means of electric discharges that in particular situations can also become **corona discharges**. The latter phenomenon is known in laboratories dealing with high voltage differences, which nearby the electrodes ionize the surrounding fluid, in this instance humid air, with the result of producing plasma. Ultimately a corona discharge generates a current of electrons and ions,

and an intense light with a strong UV component. Laboratory experiments have shown that corona discharges can produce a coloration similar to the BI (Fanti 2010), and can also explain the double superficiality of the Shroud (Fanti 2003, Fanti and Maggiolo 2004) which, moreover, is not yet considered a fact ascertained (Balossino 2003). It is unclear which component of the discharge, electrons, ions, or UV light, is responsible for the final coloration, although the known effects of excimer lasers do tilt the choice in favor of the UV light. Of course, it is conceivable that all components contribute to the final result with different degrees of involvement. Shroud-like stains were obtained on small samples, but it was calculated that an experiment in scale would require a voltage of 100 MV (100 million of Volt), clearly impossible in a laboratory but not within the AMA hypothesis, as we have already shown.

It is a fairly common experience that **heat** tends to color the fabrics from a light straw yellow to a real blackish scorch, if applied for long times and at temperatures above 100 °C. Let us just think of a careless use of irons on white fabrics like shirts. A detailed study of the effects of heat on the degradation of cellulose, which is the major constituent of flax, was carried out using a CO₂ laser, and colorations similar to those of the BI have been obtained (Jackson and al. 1988). Furthermore, heat accelerates the degradation, i.e., it induces coloration on cellulose which has been previously irradiated by UV light without coloring it, a phenomenon known as **latent coloration**, and that many experts think it also happened to the BI of the Shroud. In fact, it is considered possible that the Shroud irradiated did not present any BI at the beginning, but only later on with natural aging the BI emerged as we know it today. Moreover, the heat may be administered in other ways, as it has been suggested recently (Baldacchini and Baldacchini 2012). In fact, many experts are of the opinion that the Shroud that enveloped the body of JC was partially waterlogged for both the natural moisture in the tomb and the addition of liquid solutions of various preservatives and/or flowers. In this case, the BI could have been produced by the **water vapor** generated by a flash of infrared light. Indeed, this kind of radiation is strongly absorbed by water that would be transformed into steam at high temperature capable of coloring superficially the fabric because only a small layer of water is vaporized in this process. Some major effects of steam on the coloration of tissues irradiated with CO₂ lasers have already been observed (Moroni 1986), but not yet perfected for the purpose of the present contest.

Leaving aside a modest residual explosion, which could explain the movement of the tombstone (Matthew 28: 2- 8) but without any effect on the BI, it is my opinion that, of all the previous radiative agents, only the VUV light emitted by means of superfluorescence possesses all the criteria required to generate the BI of the Shroud, that is, power, duration, wavelength, directionality and coherence. Of course, I do not exclude that other agents could have contributed to generate it, but certainly not exclusively. In fact, the elementary particles, that is, protons, alpha particles and electrons, are emitted isotropically in space, and cannot produce discontinuous coloration on the fibers of fabrics. Even the heat cannot do that, and in addition cannot be confined on the surface of the fabric, with the exception of the heat transmitted by a steam in particular experimental condition. The corona discharge is a phenomenon that develops in an unpredictable way in space and time, and usually generates burns at the points of contact but, if the double superficiality is confirmed experimentally, it still remains an interesting hypothesis because of its variety and complexity, although difficult to explore experimentally.

9. Conclusions

After a modest examination, but sufficient for the present purpose, of some of the most representative Religions appeared on our planet since the dawn of history, I came to the conclusion that none of them is able to prove beyond any reasonable doubt the veracity of their professions of faith. Indeed, especially for the revealed Religions, at the end of any serious discussion about the above argument, the ultimate proof is based on the testimony of an individual or a certain number of individuals who often tells in detail what happened, but at the same time do not bring any concrete evidence that can confirm their testimony. Almost always with time these testimonies were written down, and so Holy Books appeared and had to be accepted as they were without the possibility of any criticism. These rigid system of organization led inevitably to discussions and clashes among believers in the same Religion and in different ones, up to arrive to horrible Wars of Religion, which were almost always also utilized by secular political interests. Today, this religious bellicosity seems to be impaired, and more and more often dialogue and cooperation stand out among Religions, which try to solve in harmony the many social problems of the world. This new attitude is certainly commendable, but does not resolve the question whether the initial revelations are true or not, and then the individuals choose a Religion for territorial belonging, choice of faith, personal convenience, or does not choose anything. In the latter case, some can become very critical at their own Religion, as it is the case of Ayaan Hirsi Ali, a young Somali woman who left the war thorn Somalia as a refugee (Ali 2007), and other become agnostics, as it happened at some point in his life to William Hopper, who in his youth had successfully begun the Catholic priesthood (Hopper 2010).

In any case, Religions were important to humans in the past, and the basic reasons why it was so then are still valid today, because they are dealing with the ultimate quests about life and death. So, one may wonder whether there is in the first place a true Religion, and whether it is among the many ones that have existed and still exist. With different degrees of implications, single Religions are not able to answer to this question in a credible way from a logical point of view to the modern man, who is now globalized geographically and culturally. On the contrary, the Shroud of Turin may give an answer to this question, and it is remarkable that the evidences which support this answer are coming from Science (Baldacchini 2013b) that is often opposed to Religion, while in my opinion there is no conflict between these two different mental categories of mankind.

Logical reasoning and scientific arguments have proved by contradiction (*reductio ad absurdum*) that the Shroud is not a fake, and that it has really enveloped the body of JC after his excruciating death on the cross, and on it there are still signs of its Passion and Resurrection.

Up to now, nobody has been able to reproduce a copy of the Shroud with all the known characteristics of this famous relic, although some copies may seem very similar at a first glance. Moreover, none of the traditional assumptions based on known technologies has withstood the comparison with the peculiar characteristics of the Shroud.

This state of affairs has led one of the leading experts on the Shroud, a physicist, to say that *"Therefore, perhaps the time has come to ask if we ought to start thinking about the Shroud image in categories*

quite different from those that have been considered in the past. In particular, perhaps we need to be more flexible in our scientific approach and consider hypotheses that may not be found readily in conventional modern science; for it is conceivable that the Shroud image represents, if you will, some type of "new physics" that ultimately requires an extension or even revision of current concepts." (Jackson 1990). These new scientific approaches have been named by some experts "miraculous", because they are located at the edge of current scientific knowledge. But, I want to remind everybody that even the hypothesis of the Big Bang was called miraculous, and therefore was not taken seriously by scientists when Georges E. Lemaître (vixit 1894-1966) proposed it for the first time in 1931. It was considered by many to be a contrivance of religious propaganda, being Lemaître a scientist and a catholic priest, and there were still scientists against its acceptance, as Hannes O.G. Alfvén (vixit 1908-1995), 1970 Nobel Prize for Physics, who used to call "*Big Bang believers*" the scientists working on this hypothesis (Alfvén 1984), even when it had already been accepted by the majority of the scientific community. In fact, since 1965 it is practically the official theory of the origin of the universe, because its predictions were verified experimentally using the technologies as they were being gradually developed. It is singular then the mere fact that a burst of light was the first event in both processes, and even more remarkable that this light has left traces which can be measured using the scientific method, the BI on the Shroud and the cosmic black body radiation in the Universe. Light seems to have played a key role both in the Resurrection of JC (Venturini 2011) and in the origin of the Universe (Gamow 1956).

So, also the hypotheses that seem miraculous should be taken into account when they are based on the fundamental laws of Physics and their predictions are testable with the scientific method. Among the hypotheses concerning the Shroud, the burst of radiative explosion (REB) is currently the most credible one, and its variant AMA (matter-antimatter annihilation) resolves some difficulties otherwise overwhelming.

This last hypothesis is in agreement with the characteristics of the Shroud, explains in a simple way the discordance with the ^{14}C dating, and its predictions have been or may be verified through the normal instruments available in the scientific laboratories. As a result, and until new opposite evidences, the only way to explain the Shroud as a whole is that the man described by the Gospels as JC has undergone a process of annihilation when his corpse was enveloped in the Shroud.

Since JC has then been seen alive after this event, and we can no longer have doubts about the witnesses who having not lied before the Resurrection should not have lied after for the same reason, we arrive at the conclusion that on the night between Saturday 8 and Sunday 9 April, 30 A.D., in a tomb in Jerusalem a singular event took place, and since then it has always been remembered in the diverse realities of Christianity as the Resurrection. This incredible event is proved by a cloth of linen still existing and known as the Shroud of Turin.

In conclusion, the Shroud of Turin is a silent witness of the Resurrection of JC, who then is really the son of God, as he himself has repeatedly asserted. But then also what he said, which in part has come down to us through the Gospels and the Church's tradition, about life and death is of paramount importance to us. It is true that there have been and still are many discussions about the authenticity of the Gospels with respect to the real teachings of Jesus Christ, that may have been misunderstood in good or bad faith (Baldacchini 2013c), but this uncertainty should make us more responsible and

concerned that our very life is at stake, not the present life limited in time and space but the eternal one promised by Jesus Christ himself.

Acknowledgements

Many thanks are due to Francesco Baldacchini e Luigi Picardi for a critical reading of the work, discussions and useful suggestions to improve its form and substance.

The author is also particularly grateful to Halina Bilokon, who has provided precious religious information and did not hesitate to criticize my extrapolation of the laws of Physics from the subatomic world to the macroscopic one without experimental verifications, a criticism already advanced by Giuseppe Dattoli following a preliminary discussion. But here I want to point out that my proposal of scientific scenarios at the very limits of current knowledge is part of a normal scientific dialectics, especially when there are observable consequences of the initial hypotheses.

References and Notes

(Alfvén 1984) Hannes Alfvén, *Cosmology: Myth or Science?* J. Astrophys. Astr. (1984) 5, 79-98.

(Ali 2007) Ayaan Hirsi Ali. *Infidel*, Free Press, New York, 2007.

(Antonacci 2000) Mark Antonacci, *The Resurrection of the Shroud*, M. Evans and Co., Inc., New York, 2000. And references cited therein.

(Baldacchini 2001) Giuseppe Baldacchini, *The Origins and Modern Developments of Science*, Proceedings of the International Congress on Science and Education on the Threshold of the 3rd Millennium, Minsk, Belarus, 3-6 October 2000, Belarus Academy of Science, Editor, 2001, pp. 251-272.

(Baldacchini et al. 2008) G. Baldacchini, P. Di Lazzaro, D. Murra, and G. Fanti, *Coloring Linens by Excimer Laser to Simulate the Body Image of the Turin Shroud*, Appl. Opt. **47**, 1278 (2008).

(Baldacchini et al. 2010) G. Baldacchini, F. Baldacchini, L. Casarosa, and G. Falcone, *Crux Mensuralis of Grottaferrata and the Shroud of Turin*, (IWSAI, 2010), pp.161-168.

(Baldacchini 2011) Many people think that the Shroud is a fake and the work of a genial forger, but I have a different opinion about him, if he ever existed. Indeed, this forger was certainly very good at producing a burial cloth like the Shroud, but he certainly was not a genius at least for two reasons. First, he remained completely unknown to the history, not an easy task for any genius at that time. Second, he committed the unpardonable error of using a medieval cloth, while he should have used a cloth of the period of JC to achieve perfection in falsehood. The content of this note reflects the author's thought formed also on various information reported by other authors.

(Baldacchini 2012) In the hypothesis MTB (Jackson 1990), the vertical direction of the imprinting of the BI is assured by the gravity, which forces the same upper part of the Shroud to fall down while the radiation is emitted isotropically from all points of the disappearing body. However, the time required by the Shroud to collapse on the flat stone is of the order of 1 s, a value not compatible with the hypothesis REB where the radiation is emitted in much shorter times, very likely less than 100 ns (Baldacchini et al. 2008).

(Baldacchini 2013a) In general, when the light excites a material, the effects which are observed are proportional to the intensity of light itself, linear optics, but if the intensity exceeds a certain critical threshold then the effects are proportional to the square, the cube, and so forth of the intensity, non-linear optics. In the latter case, many new effects have been discovered in the last 50 years, and many of them have found many practical applications. For example, the intensity of the light can be amplified

using the Raman effect, which enables the light signals in optical fibers to reach intercontinental distances, and so the telephone communications traveling with the light.

(Baldacchini 2013b) Until 1898, the Shroud of Turin was considered a relic among many other ones existing in the Christianity and worshipped accordingly to the rules of the Catholic Church. But, in that year, an Italian amateur photographer, Secondo Pia, was allowed to take the first official photos of the relic, and to the surprise of everybody the negative effects of the Shroud was discovered. From that time on, besides still being considered a relic, the Shroud started to be also a subject of studies from the point of view of Science. However, the common approach of many scholars was skeptical at the beginning, an attitude very often reversed during and after the studies. As an example, let us take the STURP (Shroud of TURin Project), the first and more comprehensive scientific examination every attempted. In 1978 a team of international experts conveyed in Turin mainly to demonstrate the falsity of the Shroud after the first examinations. On the contrary, they found out that Shroud was hardly a fake, and the BI was a mystery (<http://www.shroud.com/78conclu.htm>). So, it was Science which provided the information that the Shroud was very likely the most extraordinary and important relic existing in the world.

(Baldacchini 2013c) St. Thomas Aquinas (vixit 1225-1274) pointed out that the truth of faith is contained in the Holy Scriptures in a lengthy, varied and sometimes obscure ways. From these considerations, since the first century of Christianity the necessity arose to extract from them the essential truths of faith to be proposed to everybody, and which are contained in the Apostolic (2nd century A.D.), Nicene (325 A.D.), and Nicene-Constantinopolitan (13th century A.D.) Symbols.

(Baldacchini and Baldacchini 2012) G. Baldacchini and F. Baldacchini, *Image Formation of the Turin Shroud: Hypothesis Based on Water Vapor Effects of Light Absorption*, Scientific Research and Essays Vol. 7(29), pp. 2591-2602, 30 July, 2012. Available on line at: <http://www.academicjournals.org/SRE>.

(Balossino 2003) Nello Balossino, *Sul Retro della Sindone Non Vi E' Impronta: Osservazione Diretta ed Elaborazioni Informatiche* (On the Back of the Shroud There Is N an Image: Direct Observation and Computer Processings), Sindon, Nuova Serie, Quaderno n. 19-20, dicembre 2003, pp. 57-69 (in Italian).

(Bonifacio and Lugiato 1975) R. Bonifacio and L.A. Lugiato, *Cooperative Radiation Processes in Two-Level Systems: Superfluorescence*, [Phys. Rev. A11\(5\), 1507 \(1975\)](#), [Phys. Rev. A12\(2\), 587 \(1975\)](#).

(Cavanaugh 2009) William T. Cavanaugh, *The Myth of Religious Violence. Secular Ideology and the Roots of Modern Conflicts*, Oxford University Press, 2009.

(Cox 2009) Harvey Cox, *The Future of Faith*, HarperOne, New York, 2009.

(Damon et al. 1989) E.P. Damon et al., *Radiocarbon Dating of the Shroud of Turin*, Nature 337(6208):611-5.

(Di Lazzaro et al. 2010) P. Di Lazzaro, D. Murra, A. Santoni, G. Fanti, E. Nicolatti, and G. Baldacchini, *Deep Ultraviolet Radiation Simulates the Turin Shroud Image*, Journal of Imaging Science and Technology, 54 (4): 040302-040302-6, 2010.

(Di Lazzaro et al. 2012) P. Di Lazzaro, D. Murra, E. Nichelatti, A. Santoni, and G. Baldacchini, *Superficial and Shroud-like Coloration of Linen by Short Laser Pulses in the Vacuum Ultraviolet*, Appl. Opt. **51**, 8567-8578 (2012).

(Fanti 2003) Giulio Fanti, *Commenti sulla Doppia Superficialità dell'Immagine Frontale dell'Uomo della Sindone di Torino* (Comments on the Double Superficiality of the Front Image of the Man of the Shroud of Turin), Sindon, Nuova Serie, Quaderno n. 19-20, dicembre 2003, pp. 83-88 (in Italian).

(Fanti and Maggiolo 2004) G. Fanti and R. Maggiolo, *The Double Superficiality of the Frontal Image of the Turin Shroud*, J. Opt. A: Pure Appl. Opt. 6 (2004) 491-503.

(Fanti 2010) Giulio Fanti, *Can a Corona Discharge Explain the Body Image of the Turin Shroud?* J. of Imaging Science and Technology, 54 (2): 020508-020508-11, 2010.

(Fanti et al. 2010) G. Fanti, R. Basso, and G. Bianchini, *Turin Shroud: Compatibility between a Digitized Body Image and a Computerized Anthropomorphic Manikin*, J. Imaging Science and Technology, 54 (5): 050503-050503-8, 2010.

(Fanti et al. 2010a) G. Fanti, F. Crosilla, M. Riani, and A.C. Atkinson, *A Robust Statistical Analysis of the 1988 Turin Shroud Radiocarbon Dating Results* (IWSAI, 2010), pp. 249-253.

(Fanti 2011) G. Fanti, *Hypotheses Regarding the Formation of the Body Image on the Turin Shroud. A Critical Compendium*, J. Imaging Science and Technology, 55 (6): 060507-1-060507-14, 2010.

(Ferrero et al. 2002) F. Ferrero, F. Testore, C. Tonin, and R. Innocenti, *Surface Degradation of Linen Textiles Induced by Laser Treatment: Comparison with Electron Beam and Heath Sources*, Autex Research Journal, 2, No.3, September 2002, pp.109-114.

(Gamow 1956) George Gamow, *The Creation of the Universe*, Published by the Viking Press, New York, 1952.

(Hopper 2010) William Hopper, *The Heathen's Guide to World Religions*, New World Order, Toronto, Canada, 2006.

(IWSAI 2010) *International Workshop on the Scientific Approach to the Acheiropoietos Images*, ENEA Research Centre of Frascati, Rome, Italy, 4-6 May 2010. Click the link "Proceedings" of the home page IWSAI www.acheiropoietos.info to read the papers.

(Jackson et al. 1988) J.P. Jackson, E. Arthurs, L.A. Schwalbe, R.M. Sega, D.E. Windisch, W.H. Long, and E.A. Stappaerts, *Infrared Laser Heating for Studies of Cellulose Degradation*, *Appl. Opt.* **27**, 3937-3943 (1988).

(Jackson 1990) John P. Jackson, *Is the Image on the Shroud Due to a Process heretofore Unknown to Modern Science?* *Shroud Spectrum International*, No. 34, pp. 3-29, March 1990.

(Jackson and Propp 2004) J.P. Jackson and K.E. Propp, *Comments on Rogers' "Testing the Jackson Theory" of Image Formation*", <http://www.shroud.com/pdfs/jacksonpropp.pdf>, 2004.

(Linde et al. 2010) A.C. Lind, M. Antonacci, G. Fanti, D. Elmore, and J.M. Guthrie, *Production of Radiocarbon by Neutron Radiation on Linen*, (IWSAI, 2010), pp. 255-362.

(Mann 2011) Charles C. Mann, *Birth of Religion*, *National Geographic*, 219 (No. 6), June 2011, pp. 34-59.

(Moroni 1986) Mario Moroni (CISE, Milano), personal communication by Giulio Fanti in 2010.

(Onfray 2006) Michel Onfray, *The Antiques Sagesses. Contre-Histoire de la Philosophie I*, Editions Grasset & Fasquelle, 2006.

(Ratzinger 2007). Joseph Ratzinger (265^o pope of the Catholic Church as Benedict XVI, 19 April 2005-28 February 2013), *Jesus of Nazareth: From the Baptism in the Jordan to the Transfiguration*, Doubleday, New York, 2007.

(Ricci 1967) Giulio Ricci, *Statura dell'Uomo della Sindone* (Height of the Man of the Shroud), Edizioni Portiuncola, Assisi, 1967. (in Italian).

(Rinaudo 1993) Jean-Baptiste Rinaudo, *Nouveau Mecanisme de Formation de l'Image sur le Linceul de Turin, Ayant Pu Entrainer une Fausse Radiodation Medievale* (New Mechanism of Image Formation on the Shroud of Turin, Having Been Able to Induce a False Medieval Radiodation), *Proceedings Int. Sci. Symposium*, Rome, 1993, pp. 293-299. (in French).

(Rogers 2001) Raymond N. Rogers, *Comments on the Book "The Resurrection of the Shroud" by Mark Antonacci*, <http://www.shroud.com/pdfs/rogers.pdf>, 2001.

(Rogers 2004) Raymond N. Rogers, *Testing the Jackson "Theory" of Image Formation*, <http://www.shroud.com/pdfs/rogers6.pdf>, 2004.

(Russell 1927) Bertrand Russell, *Why I Am not a Christian*, Paul Edwards, Ed., A Touchstone Book, published by Simon and Shuster, New York, 1957.

(Russell 1927a) Idem, preface, p. V.

(Russell 1927b) Idem, p. 5.

(Saraswati 1999) H.D. Swami Prakashanand Saraswati, *Formation of the New Testament and the History of Christianity*, APH Publishing Corporation, New Delhi, 1999.

(Venturini 2011) Simone Venturini, *Il Libro Segreto di Gesù: I Codici Nascosti della Resurrezione, i Tre Giorni che Hanno Cambiato il Mondo* (The Secret Book of Jesus: The Hidden Codes of the Resurrection, The Three Days that Changed the World), Newton Compton editori, Roma, 2011. (in Italian).

(Wellman 2007) *Belief and Bloodshed, Religion and Violence across Time and Tradition*, James K. Wellman, Jr., Editor, Rowman & Littlefield Publishers, Inc., Lanham, 2007.

(Wilson 2010) Ian Wilson, *The Shroud: The 2000-Year-Old Mystery Solved*, Bantam Press, London, 2010. And references cited therein

Supplemental Bibliography

Christopher Dawson, *Religion and Culture*, Sheed & Ward, London, 1948.

History of Eastern and Western Philosophy, Vol I, Sarvepalli Radhakrishnan, editor, George Allen and Unwin Ltd, London, 1959.

Arnold Toynbee, *A Study of History, Part VII, Universal Churches*, Oxford University Press and Thames and Hudson Ltd, London, 1972.

Joe Nickell, *Inquest on the Shroud of Turin*, Prometheus Books, Buffalo, New York, 1983; new updated version, 1997.

Michael Minor, *A Lawyer Argues for the Authenticity of the Shroud of Turin*, Terrell, Texas, 1990.

Kenneth E. Stevenson and Gary R. Habermas, *The Shroud and the Controversy*, Nelson, Nashville (USA) 1990.

Ian Wilson, *Holy Faces, Secret Places*, Doubleday, New York, 1991.

Walter C. McCrone, *Judgment Day for the Turin Shroud*, Microscope Publications, Chicago 1997.

Mark Antonacci, *The Resurrection of the Shroud*, M. Evans and Co., Inc., New York, 2000, Chapter 10: and references cited therein.

Frederick Zugibe, *The Crucifixion of Jesus, a Forensic Inquiry*, M. Evans & Co., New York, 2005.

G. Fanti and R. Basso, *The Turin Shroud: Optical Research in the Past, Present and Future*, Nova Science Publisher, Inc., New York, 2008.

Raymond R. Rogers, *A Chemist's Perspective on the Shroud of Turin*, Barrie M. Shwartz, editor, Florissant, CO (USA), 2008.

Avinoam Danin, *The Botany of the Shroud*, DANIN publishing, Jerusalem, 2010.

Ian Wilson, *The Shroud: The 2000-Year-Old Mystery Solved*, Bantam Press, London, 2010.