



World Scientific News

An International Scientific Journal

WSN 178 (2023) 1-11

EISSN 2392-2192

VUV Radiation and Protons cannot produce the Shroud Body Image

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ABSTRACT

In this paper we investigate the radiative hypothesis, already proposed by other scientists, as being the mechanism that may have produced the Shroud Body Image. We are critics of the above process, because it is incomprehensible to both Physics and Theology. Moreover, due to the presence of air in addition to linen, it is impossible to penetrate to the same depth all the points of the region where the Body Image should lie. In fact, considering the no-contact regions of the body-sheet, radiation would have to pass through two types of matter, first air and then linen. The layer of air has a variable thickness, and radiation, on reaching the linen, will experience a change in its physical state due to a drop in energy. In the contact regions this does not occur, due to the absence of air. Consequently, the linen penetration depth would be variable, with a constant value only in the contact region. However, for the Shroud of Turin this is not so. Moreover, the radiation might not reach the linen. In this case, there would be no colouration, no Image formation, no correlation between Image intensity and body-sheet distance. In short, the radiative hypothesis is not adequate in explaining image production.

Keywords: Shroud of Turin, Body Image formation, subatomic particles, electromagnetic radiation, linen and air, Radiations-Linen and Radiations-Air Interactions

1. INTRODUCTION

Talking about the Shroud of Turin means taking into consideration the archaeological find that has interested scientists, scholars and people from all over the world for over a hundred years. The level of curiosity is naturally due to the fact that this linen cloth might be: (i) the burial sheet of Jesus Christ, the Nazarene; (ii) a medieval forgery made by an artist/forger.

This is a religious problem that is divisive for scientists. Hypothesis (i) is based on the matching of wounds present in the body imprinted on the Shroud and the descriptions that appear in the New Testament (in the four Gospels) about the Passion of Jesus Christ. Hypothesis (ii) is based on the fact that the Shroud of Turin appeared in Europe around the middle of the 14th Century when the Old Continent was flooded with false relics, some of which produced locally, some coming from Asia Minor.

The sheet has been studied for over a century (starting from May 1898, when Secondo Pia, an amateur photographer, took the first photographs), with the production of many (often conflicting) results, leading to arguments and squabbling among scientists. This behaviour has grown over time. This situation is naturally the result of religious issues, with the Shroud causing a mix-up over the Immanent and the Transcendent, with little or no respect for their respective spheres of action. Often, Transcendent phenomena are treated as if they obey natural laws.

All this generates even greater confusion in a situation where the confusion reigns supreme. Sometimes, it seems the Tower of Babel has come back to life.

Although several characteristics of the Turin Shroud are questionable and a cause for debate, which has been going on for decades, the goal of Shroud research is to understand the mechanism of the Body Image formation. Many, or perhaps it is better to say almost all researchers, have tried to solve this puzzle, but without success. A definitive result is very difficult to obtain, because the Image is over-characterized, and all hypotheses put forward as well as laboratory tests have not been successful.

Currently, it is not possible to reproduce the whole set of characteristics. Thus, scientists and researchers are gradually moving away from an unnatural explanation that does not respect the laws of physics. In other words, various scientists have abandoned the Immanent for the Transcendent where, among other things, physics is ineffective.

The great leap in knowledge about the fabric came in 1978, when a team of scientists from various American universities and Research centres created “The Shroud of Turin Research Project” (STURP) and investigated the linen sheet for 5 days and 5 nights, without interruption.

The results obtained were extraordinary. We report some of these articles [1-14] to highlight their claims. Honestly, for the STURP team it was easier: they entered a field that was almost all flowery. And they collected. For all of us, there are few flowers that are difficult to find. Among these, the formation mechanism of the Shroud Body Image.

In Figure 1, we show two frontal images of the Shroud of Turin, the archaeological find of our concern.

On the left, we see the front part of the Shroud Body Image; on the right is his photographic negative, with light and dark interchanged like right with left. In other words, the image on the right is the reversed colour Shroud Body Image. It is evident that this is an important feature of the Body Image, so as much to direct many scholars and scientists to study and understanding of its formation mechanism.

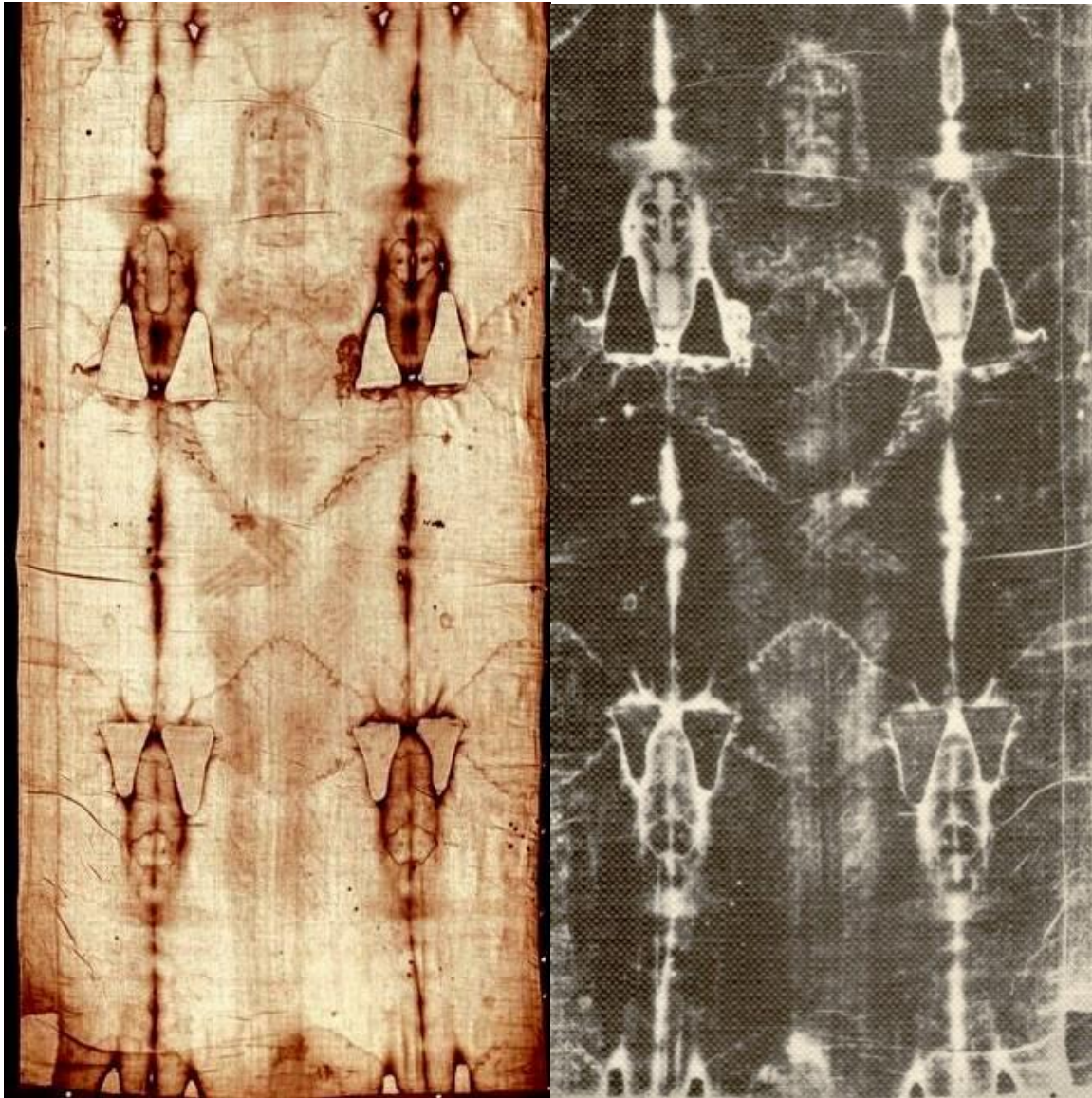


Figure 1. The frontal image of the Shroud of Turin. (left) the image as appear on the burial linen, (right) the same image in reversed colour. This last shows the first very important characteristic, of the Shroud Body Image, discovered in the May 1898 by Secondo Pia.

2. PROTONS AND ELECTROMAGNETIC RADIATION

Nowadays, numerous scientists are certain that the Shroud Body Image was formed by the action of some sort of radiation, as described in Refs. [15-27]. These articles describe the emission of particles or electromagnetic radiation by the corpse wrapped in the burial linen, and its action on the burial cloth. The authors of these articles have considered subatomic particles as protons and electromagnetic radiation in the far UV region. ^2H , ^3He and α -particles might also have been used. In these cases, it would be necessary to evaluate the correct kinetic energy for each of the above-considered particles.

For electromagnetic radiation, only one λ value is the right one. This value must furnish sufficient energy $E_{\text{rad}} = h c/\lambda$ (where $h = 4.135 \times 10^{-15}$ eV s is the Plank constant and $c \approx 3 \times 10^8$ m/s, about the speed of light) to penetrate the linen to a depth of 200 nm. This is the thickness of the Body Image that coincides with that of the primary cell wall, while the inner part remains colourless [28].

The interactions of the charged particle with matter are due to Coulomb forces, which mainly produce ionization, excitation, scattering, radiative losses, and trigger other processes [29, 30]. The various types of interaction, in this paper briefly described, are inelastic and elastic interactions:

- *Inelastic Collision with Atomic Electrons.* These collisions with bound atomic electrons are the predominant mechanism through which a charged particle loses kinetic energy in matter. The result of this interaction leads one or more atomic electrons to suffer a transition to an excited state (excitation) or to an unbound state (ionization).
- *Inelastic Collision with a Nucleus.* The incident-charged particle has a deflection. In some, but not all, such deflections a quantum of radiation is emitted (bremsstrahlung emission), while a corresponding amount of kinetic energy is lost by the colliding particles. This is a radiative type of inelastic nuclear collision.
- *Elastic Collision with Atomic Electrons.* The incident-charged particle may be elastically deflected in the field of atomic electrons of a struck atom. Energy and Momentum are conserved. The energy transfer is generally less than the lowest excitation potential of the electrons, so that the interaction is really with the atom as a whole.
- *Elastic Collision with a Nucleus.* In elastic nuclear scattering the incident-charged particle will be deflected, but does not radiate, nor does it excite the nucleus. The incident particle loses the kinetic energy necessary for the conservation of momentum between the two particles but the bremsstrahlung emission is absent.

Now, as already stated, electromagnetic radiation must have one, and only one, correct wavelength that guarantees, with its energy, a penetration depth in all the points of the linen equal to that of the Body Image on the Shroud. For a $\lambda = 193$ nm value, the photons have an energy $E_{\text{rad}} = 6.4$ eV.

Photons of this energy are quickly absorbed by molecular oxygen (binding energy of about 5.16 eV). However, we stress that the ENEA team of Frascati showed experimentally that the obtained Shroud-like colouration was latent, superficial and possessed various characteristics of the Shroud Body Image.

The latency time could be, artificially, reduced. The Frascati team achieved these results using a wavelength ($\lambda = 0.193 \mu\text{m}$) in the vacuum ultraviolet, a region of the electromagnetic spectrum with λ values of between 100 nm and 400 nm. Their experimental arrangement consisted of an excimer laser (ArF) focused, using lens, on a piece of linen.

The ArF laser was used in a narrow interval of irradiation parameters (e. g. the duration of a single laser pulse must be shorter than 50 ns). Moreover, in the ENEA experiment, the radiation of the above wavelength penetrated 200 nm of linen, as on the Shroud Body Image.

However, for more detailed information on such a complex experiment, we believe it is necessary to read the Refs. [31-34].

However, both protons and radiation can be directed against a piece of linen cloth to cause an interaction with the above type of matter. The objective would be to investigate the possibility of obtaining a body image like that on the Shroud of Turin due to the above-described interaction effects. In this way, the results obtained would test whether the radiative hypothesis may be the right one to obtain the result we are looking for. However, as already stated, studies of the above interactions, coming under the subject of nuclear physics, are very complex and difficult to investigate. In these interactions, indeed, the results depend on the type of radiation, its energy and the properties of the matter it has to pass through.

3. ANALYSIS

Scientific literature on the Shroud of Turin and all its characteristics consists of an abundance of articles. These includes articles that investigate the Holy Shroud using the radiative process to obtain the Shroud Body Image formation. Regarding this hypothesis, we can state that it is impossible for a corpse, or indeed for a living person, to emit subatomic particles or electromagnetic radiation. To support the radiative hypothesis, it is necessary to accept the Miracle, and a Physicist would not be the right type of investigator. Consequently, we need to turn to Theology, which due to its nature rejects such a hypothesis. When a scientific path has been outlined to obtain a final result, an initial mistake (e.g. accepting a supernatural event) inevitably amplifies the error in the following steps. However, for the above interaction to occur, protons or radiation need to be emitted from a dead body.

For our investigation, we are convinced that the protons or radiation in question are unable to distinguish, among the fibrils, those that must be yellowed to obtain a body image from those that must maintain the background optical density. The rays emitted see all linen fibrils in the same way. Protons or VUV Radiation are unable to make a choice. They obey the laws of physics. This is a very important limitation for the radiative hypothesis. In fact, the correct distribution of the yellowed fibrils guarantees a correlation between the yellowed fibril density and body-sheet distance. Fundamental confirmation that information on the above distances is encoded in the structure of the Shroud Body Image [35, 36].

In fact, their existence makes it possible to build, successfully and with some slight imperfections, a 3D model of the man of the Shroud. In Figure 2, we show such a reconstruction obtained with a VP-8 Image Analyzer. This last is an analog computer that makes a brightness map of whatever data processes; white appears to be higher in elevation, black appears lower and mid-range is between the two extremes [37].

We observe that the Body Image is present with a depth of penetration that is the same in each point of the Shroud Body Image. This is independent from both the density of yellowed fibrils values that changes, point per point, and predictions provided by the correlation between said density and corpse-sheet distances.

This characteristic is the one that prevents the result desired by scientists who believe in the radiative hypothesis. To understand this, we should note that, in the case of the Shroud Body Image formation, there are two types of matter, linen and air, that must be crossed.

Therefore, protons or radiation must penetrate the linen to the right depth. So, in the body-sheet contact regions, radiation or particles must disperse, with their own characteristic mechanisms, their energies to a thickness of 200 nm. Otherwise, in no-contact areas, radiation

or particles must first pass through a variable layer of air, whose thickness is equal to the corpse-sheet distance (variable from point to point), before reaching the linen.

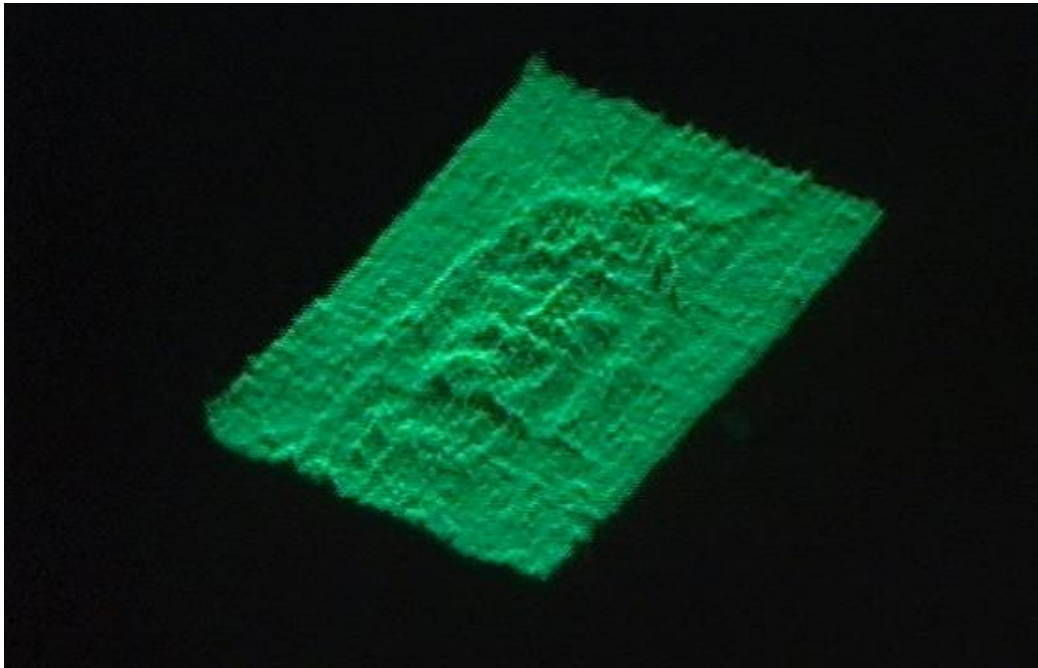


Figure 2. The face of the Body Image on the Shroud of Turin as it appears on the screen of a VP-8 Image Analyzer. This result exhibits another important characteristic of the Shroud Body Image discovered, in 1976, by John P. Jackson.
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In other words, radiation or protons emitted in the no-contact region will reach the linen in a different physical state with respect to the direct passage from the corpse to the linen. With direct interaction, the physical state cannot change, because air is absent and the radiation when penetrating the linen maintains the same physical state as when released from the corpse. Otherwise, in no-contact area, their physical state is no longer the same, and they will produce different effects, when and if they reach the linen. In this way, the same penetration depth at every point of the produced image cannot be guaranteed.

Moreover, radiation or particles might not be able to overcome the first matter form (air) encountered, because all their energies might be expended before reaching the other matter form (linen). In this case, we would not have a colouration and, consequently, a correlation between yellowed fibril density and cloth-body distance. Nevertheless, the energy of the protons might be increased, or the wavelength of the radiation reduced, to penetrate deeper into the air. Consequently, the thickness of the penetrated linen would have increased without respecting an important characteristic of the Shroud Body Image.

So, even if the situation described above might seem a borderline case, the presence of two matter forms will always produce a difference in the physical state (of both radiation and particles) between the direct impact and that which occurs after air is crossed. However, we are practically in a borderline case, with radiation and protons able to penetrate the linen to a depth

of 200 nm, travel in the air for a few microns [38] and a few hundred microns [39] respectively. Hence, it would be impossible to colour the no-contact areas. Consequently, it is necessary to reject the radiative hypothesis. The result reported in Ref. [38] is from L. Torrasi, Professor at the University of Messina and Associate Editor of *Radiation Effects and Defects in Solids: Incorporating Plasma Science and Plasma Technology*.

Literature also proposes another way of verifying whether vacuum UV radiation is able to explain the formation of the Shroud Body Image. In this hypothesis, the corpse, covered with the burial linen, became mechanically transparent, with the consequent collapse of the linen cloth into and through the body, while VUV radiation was emitted [40-43]. It is evident that in this process of Body Image formation, in addition to a radiative hypothesis, there is another unnatural (Transcendent) event that happens when the body becomes mechanically transparent.

One of the problems of this radiative model of image formation, apart from the rejection of the science of Physics, is that of having an immense amount of wattage available. Here, we are talking about miraculous events that are, obviously, impossible to understand, even with the help of Physics. There can be no explanation, and there never will be. Events of this type are not part of the Immanent. They are in the domain of the Transcendent. A Miracle is a supernatural event that happens instantly, because the Author is Almighty God, the Eternal, the timeless.

The instantaneous nature of the event implies that the Miracle happens with infinite speed. A result that, today and forever, will be incomprehensible to the Natural Sciences [44, 45]. Consequently, it is impossible to describe a phenomenon (or various phenomena) that occurs in a time equal to zero. As already stated, Theology denies the possibility for a corpse, or a living human being, to emit subatomic particles or vacuum ultraviolet radiation because this event would be a Miracle that is an effect, and only God is the cause. The human body can only emit thermal energy. This energy, emitted by matter that is at nonzero absolute temperature, is transferred in the form of electromagnetic waves.

4. CONCLUSIONS

In conclusion, the radiative processes discussed here are incompatible with both Physics and Theology. Thus, the above formation mechanisms taken into consideration cannot produce the Shroud Body Image in any way. Furthermore, we add the role played by the presence of air in the regions where the body is not in contact with the sheet. It must be crossed by protons or ultraviolet radiation, causing a change in their physical state.

Now, in scientific literature, in addition to the articles that support the above hypothesis, other mechanisms are proposed by various scientists, including our stochastic process. We are unable to provide a depth of penetration of the expected image without experimentation. Unfortunately, due to the nature of the stochastic process, we might come up with an answer after years or decades [46-50]. However, this probabilistic hypothesis has been investigated by us for two reasons: (a) the necessary thermal energy is the only energy present in a 1st century AD sepulchre; (b) the distribution of yellowed linen fibrils coincides with the distribution of bodies that had been hit by a weak radiation years or decades before [51,53]. Here, (b) is a classic result of the stochastic action.

We also took an interest in Rogers' hypothesis, which was then developed with Arnoldi. The two scientists believed that the colour may be the result of a Maillard Reaction between

reducing sugar, left on the burial cloth by manufacturing procedure, and amines coming from the decomposition of the corpse [54,56]. Other proposed formation mechanisms, already present in scientific literature, have various problems that need to be solved.

All these processes fail when they must explain the formation of the Shroud Body Image and all its characteristics. In other words, almost all investigated processes are able to reproduce some features of the Shroud Body image, but not all of them. Currently, we can state there is no known formation process that gives the certainty of reproducing all the properties possessed by the above Image.

The religious problem, always present in the minds of scientists and researchers, has conditioned their behaviour as regards the exchange of thoughts, ideas and new projects for future experiments. Today, dialogue among scientists is not as open in this sphere as it is in other scientific areas. We all move randomly. So, it will be very difficult to find an answer to the question that many have been asking since May 1898: what was the process that formed the Shroud Body Image? Which would help us to better understand the Shroud of Turin.

Acknowledgements

The author wishes to thank Barrie M. Schwartz, Editor of STERA Inc. for the Shroud of Turin Website (www.shroud.com), which provides information to all scholars and scientists on the Linen of Turin. In this work, the above Editor has allowed us to use, without charge, an image from his collection. Thanks also to Prof. Rosanna Callipari (High School of Humanities and Linguistics, I-89044, Italy), for improving the quality of English. This research received no funding from either public Institutions or private Agencies and the author of this article declares no conflict of interest.

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