

# How the Image Was Formed on the Shroud

Robert A. Rucker, July 31, 2020

## **Abstract**

To explain the characteristics of the image on the Shroud of Turin, along with the 1988 carbon dating and the characteristics of the blood on the Shroud, it is hypothesized that an extremely brief intense burst of vertically collimated radiation was emitted within the body of the crucified man that was wrapped within the Shroud. This radiation, probably consisting primarily of charged particles, caused a static discharge from the top fibers facing the body, which caused heating in a very thin surface layer on the fibers, which caused molecular damage to the cellulose in this thin layer. With the passage of time and possibly ultraviolet exposure, this thin damaged cellulose layer on the fibers gradually became discolored to form the image of a man that was crucified exactly as Jesus was crucified. By this process, the radiation controlled the location of the discoloration, thus encoding into the image the information that defines the appearance of a crucified man, so that the image could have this appearance. The evidence for this hypothesis is its ability to explain the characteristics of the image, carbon date, and blood on the Shroud.

## **1. Introduction**

The hypothesis of an extremely rapid intense burst of radiation from the body has been proposed<sup>1</sup> to explain the mysteries of the Shroud related to the image, the carbon dating, and the blood on the Shroud. This paper provides a deeper understanding, according to this hypothesis, of how the image of a crucified man could have been formed on the Shroud. Background information and further information on how the image was formed is available<sup>2</sup> on the research page of [www.shroudresearch.net](http://www.shroudresearch.net).

Based on the hypothesis in “Holistic Solution to the Mysteries of the Shroud of Turin”, the image on the Shroud was not formed by an artist, a forger, or as the natural product of crucifixion, but was formed by the body that was wrapped in the Shroud. We can see the image of a crucified man on the Shroud because the information that defines the appearance of a crucified man has been encoded into the pattern of discolored fibers that form the image.<sup>3</sup> Discussed below is a proposed explanation for how this encoding process took place. The information that defines the appearance of a crucified man had to be communicated from the body to the cloth to control the discoloration mechanism that formed the image. The only option to transport this information that is required to form a good resolution image is radiation.<sup>4</sup> This radiation was absorbed onto the cloth in the process of controlling the discoloration mechanism, and thus encoded the information into the pattern of the discolored fibers.

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1. Robert A. Rucker, “Holistic Solution to the Mysteries of the Shroud of Turin”, Rev. 0, December 18, 2019
  2. Robert A. Rucker, “Summary of Scientific Research on the Shroud of Turin”, Nov. 14, 2018, “Explaining the Mysteries of the Shroud”, Nov. 14, 2018, “Status of Research on the Shroud of Turin”, June 21, 2019, “Information Content on the Shroud of Turin”, Oct. 11, 2016, “Role of Radiation in Image Formation on the Shroud of Turin”, Oct. 11, 2016, and “Image Formation on the Shroud of Turin”, June 20, 2019
  3. Robert A. Rucker, “Why we Can See the Image on the Shroud”, December 20, 2019
  4. Robert A. Rucker, “Role of Radiation in Image Formation on the Shroud of Turin”, Oct. 11, 2016

Hands-on testing of the Shroud performed by the Shroud of Turin Research Project (STURP) in 1978 and following years led to the conclusion that the image could not be due to paint, dye, stain, liquid, scorch, photography, or normal body decay. The unique characteristics of the image indicate that it could not have been formed by a human agent. These unique characteristics include:

1. The Shroud contains full size images of the front and back of a man that was crucified exactly as Jesus was crucified.
2. The images have good resolution and are negatives, with light and dark areas reversed.
3. The images contain 3D information related to the vertical distance of the cloth from the body. No painting or photograph contains 3D information.
4. The images are extremely superficial with only the top one or two layers of fibers discolored in a thread and a discoloration thickness less than 0.4 microns around the circumference of the discolored fibers, which have a diameter of about 15 microns.
5. The discoloration in this extremely thin layer is caused by the carbon atoms that were in the cellulose having some of their single electron bonds changed into double electron bonds.

## **2. Reasons for Radiation**

There are many reasons to believe that the front and back images were formed by radiation.

1. These characteristics of the image could not have been formed by someone using pigment, a liquid, a scorching process using a hot object, or a photographic process. This means that the image could not be the result of an artist or a forger.
2. It could not be the natural result of crucifixion and the Jewish burial practices, as STURP found no decay products on the Shroud. Thus, the best explanation is that the body that was wrapped in the Shroud produced the image by a unique process, as this is the only image created on a piece of fabric by a dead body.
3. There are six ways to transfer information from one location to another, but five of them can be rejected for the Shroud. The only remaining option is radiation<sup>4</sup>. Thus, the focused information required to form the image could only be transferred from the body to the cloth by radiation.
4. The images are on the side of the cloth that faced the body as it was wrapped in the cloth. This can be determined from the blood that is on the cloth. This indicates that the source of the radiation was the body.
5. The color of the discolored fibers is a straw-yellow or sepia color. This is the color that is produced by a scorch, but the image is not a hot scorch because it does not fluoresce under ultraviolet light. But an alternative is a cold scorch caused by radiation without heat.
6. Upper threads and fibers that are discolored shield lower ones from being discolored, as though something is flowing from the body to the cloth.
7. A dead body has never created an image of itself on fabric. The only exception is the Shroud of Turin. The image is thus totally unique, which implies a unique cause.
8. The front and back images have a similar intensity of discoloration, even though where the front image is located on the cloth would have only had the weight of the cloth on it

whereas where the back image is located would have had the weight of the body on it. This is consistent with vertically oriented radiation causing the image.

9. When the Shroud only has lighting from the rear, no image can be seen. This was interpreted by STURP to mean that the discoloration process included only energy but no substance, i.e. no atoms. Energy without atoms is a good definition of radiation.
10. Experimentation with infrared and ultraviolet light, and with protons, indicate that linen can be discolored by these forms of radiation.
11. If the radiation were vertically collimated, vertically up and vertically down from the horizontal body as it lay in the tomb, it would explain the good resolution of the image. It has been shown that collimated radiation controlled by information can produce a good image of the face.<sup>5</sup> Some loss of resolution in the image would occur due to scattering and absorption of the radiation by the air in the gap between the body and the cloth, due to the finite size of the threads, and due to effects of electrical discharge, to be discussed shortly.
12. Radiation from the body causing the image would explain why the image is a negative. The high points of the body that would be in contact with the cloth would receive radiation that was not diminished by passing through the air gap and would thus be darkened the most. This is contrary to normal lightning which reflects more from the high or exposed points of the body, such as the tip of the nose.
13. It also explains why the image contains 3D information regarding the vertical distance between the body and the cloth, as the radiation diminishes due to scattering and absorption as it passes through the air in the gap between the body and the cloth. Some forms of radiation could also diminish due to decay.
14. Only the top one or two layers of fibers being discolored can be explained by the radiation causing a static discharge from the top fibers, as will be discussed shortly.
15. This can also explain why less than the outer 0.4 microns on a fiber are discolored.
16. Radiation leading to a static discharge is also a possible explanation for how the single electron bonds in the carbon atoms in the cellulose were changed to double electron bonds.
17. A “lightning rod” effect resulting from such a static discharge may explain why there is a mottling of the discoloration on the fibers. This is discussed below.
18. If neutrons were included in the burst of radiation that caused the image, then a small fraction of them would have been absorbed in the trace amount of  $N^{14}$  in the cloth, which would have produced new  $C^{14}$  in the threads. This new  $C^{14}$  would shift the carbon date forward by thousands of years, depending on the location on the Shroud<sup>6</sup>, as first suggested by Dr. Tom Phillips.<sup>7</sup> This would explain the 1988 carbon dating of the Shroud.<sup>8</sup>
19. The image of the face shows no effects of the cloth wrapping around the head. It is as if the cloth were flat above the face when the image was encoded onto the fabric. The effects of static charge and radiation pressure may explain this.

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5. C. Donnet, J. Granier, G. Verge, Y. Bleu, S. Reynaud, and F. Vocanson, “2D Reproduction of the Face on the Turin Shroud by Infrared Femtosecond Pulse Laser Processing”, *Applied Optics*, March 20, 2019

6. Robert A. Rucker, “The Carbon Dating Problem for the Shroud of Turin, Part 3: The Neutron Absorption Hypothesis”, July 7, 2018

7. Thomas J. Phillips, “Shroud Irradiated with Neutrons?”, *Nature*, Vol. 337, No. 6208, page 594, February 16, 1989, published in the same edition of *Nature* as Damon, et al.

8. P.E. Damon, et al., “Radiocarbon Dating of the Shroud of Turin”, *Nature*, February 16, 1989.

20. The blood on the Shroud still has a reddish color whereas blood turns dark brown to black in hours to days. If neutrons were included in the burst of radiation that caused the image, then some of the neutrons would have been absorbed by the blood. Previous experiments<sup>9</sup> indicated that blood would retain a reddish color if exposed to neutrons followed by ultraviolet light, which is in sunlight.
21. Dried blood is not absorbed into cloth. So why is the blood that ran down and dried on his arms, without underlying wounds, now on the Shroud? It is as if there were some force that lifted the blood off the body and thrust it onto and into the cloth. Radiation, if it is sufficiently intense, could provide this force by a transfer of momentum to the blood. This is called radiation pressure.

### 3. Characteristics of the Radiation

Some of the characteristics of this radiation can be determined by following the evidence where it leads:

1. The radiation that formed the image is probably low energy radiation, since higher energy radiation would have produced ion trails in the linen fibers, as natural background radiation does. It is believed that this low energy radiation consisted primarily of charged particles such as protons and electrons because of their potential for causing static discharge from the top fibers. The radiation might also have included neutrons and infrared, visible, and ultraviolet light.
2. Highly penetrating radiation such as neutrons, X-rays, and gamma rays were not a significant contributor to the image because if they were, then the image would have a similar intensity on both sides of the cloth, which is not the case.
3. Laser experiments<sup>10</sup> have shown that the duration of the energy pulse must be extremely brief to not discolor more than one or two layers of fibers in a thread.
4. The appearance of bones can be seen on the image, such as teeth, bones in the hands, etc. For these bones to be included in the image, the information regarding the presence of these bones must be communicated from the body to the cloth. For this to happen, the radiation had to be emitted within the body so that it could be altered by the bones as it went through the body. Thus, the radiation was emitted within the body, not just emitted from the surface of the body.

The front and back images on the Shroud have good resolution. Such good resolution could not be formed if the radiation, when it was emitted in the body, was emitted randomly in all directions. This is because there were no lenses between the body and the cloth to focus the radiation onto the cloth. The only way to produce this good resolution is for the radiation to be

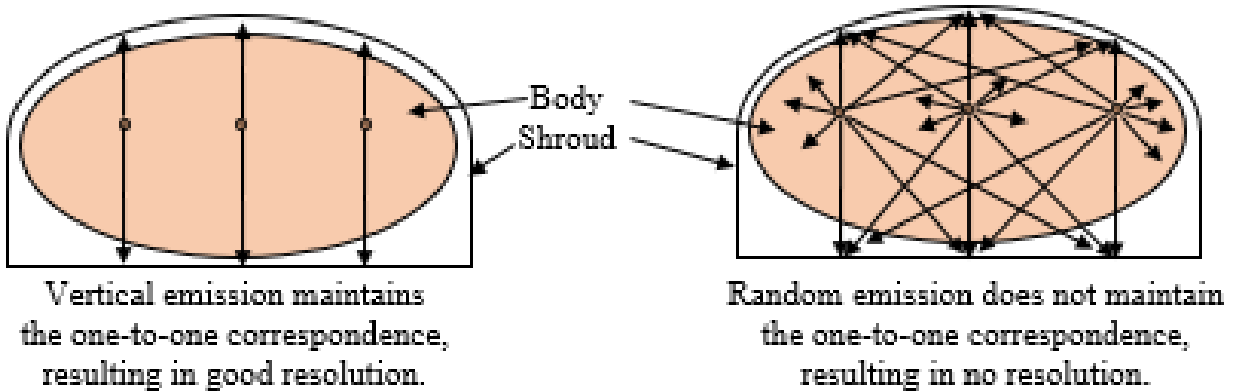
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9. Carlo Goldoni, "The Shroud of Turin and the bilirubin blood stains", International Conference on The Shroud of Turin: Perspectives on a Multifaceted Enigma", Columbus, Ohio, August 14-17, 2008

10. Paolo Di Lazzaro, et al., "Deep Ultraviolet Radiation Simulates the Turin Shroud Image" *Journal of Imaging Science and Technology* 54(4): 040302–040302-6, 2010, "Colouring Fabrics with Excimer Lasers to Simulate Encoded Images: the Case of the Shroud of Turin", 2008, "Shroud-like Coloration of Linen by Nanosecond Laser Pulses in the Vacuum Ultraviolet", 2012, "Superficial and Shroud-like Coloration of Linen by Short Laser Pulses in the Vacuum Ultraviolet", January 2013, "A Ray of Light on the Shroud of Turin" published in the Proceedings of the Conference "FIAT LUX – Let there be light" held in Rome, Italy, on 3-5 June 2015. The summary on page 8 is particularly helpful.

vertically collimated when it is emitted, assuming the body is laying horizontally in the tomb. This means that the radiation must be emitted exactly vertically up and exactly vertically down. This also explains why there are no side images or an image of the top of the head. With vertical collimation of the radiation, there will be a one-to-one correspondence between each point on the body and each point on the cloth. This means that each point on the body will affect only one point on the cloth, and each point on the cloth will be affected by only one point on the body. This is shown on the left side in Figure 1. If the radiation were randomly emitted in any direction then each point on the cloth would be affected by many points on the body, leading to confusion of the information and thus no image. This is shown on the right side in Figure 1.

Figure 1. The Radiation Must be Vertically Collimated to Form a Good Resolution Image



The proposed explanation for the image is an extremely brief energetic burst of radiation emitted homogeneously in the body. The radiation that caused the image had to be vertically collimated to produce the good resolution of the image. The primary radiation that caused the image was probably charged particles such as protons and electrons. The electrical charge of these particles would be deposited on the Shroud where the radiation was absorbed. If this burst of charged particle radiation was sufficiently brief and intense, it could cause a static discharge from the high points of the fibers facing the body. Such a static discharge would involve an extremely high electrical current in the fibers. Due to electrical-magnetic effects, a high electrical current in any conductor will flow in a very thin layer near the circumference of the conductor. Thus, the electrical flow in the fibers would occur in a very thin layer near the circumference of the fibers, which would produce extreme heating in this very thin layer. If strong enough, this heating might damage the molecular structure of the cellulose to produce the extremely thin (less than 0.4 microns) discolored layer on the fibers. Another possibility is that ozone produced by the static discharge, when absorbed into a fiber, might chemically alter the cellulose resulting in the discoloration of the fibers. The mottling of the discoloration on the threads might be caused by a static discharge in one location causing a discharge of the surrounding area. This might be called a "lightning rod" effect because it is similar to a thunder cloud passing over many lightning rods. When lightning strikes the first lightning rod, it is not likely to strike again in the immediately area because the electrical charge in the surrounding area tends to be discharged by the first lightning strike.

When the cellulose is altered in this thin layer near the circumference of the fibers, it may not have displayed the image immediately. Additional time may have been required for the atoms to move into the lowest energy arrangement of atoms in the new molecule. This new arrangement of atoms would result in some of the single electron bonds of the carbon atoms in the cellulose to be changed into double electron bonds, which would cause the appearance of color on the fibers. This is a gradual process and is the same as the oxidation-dehydration process that takes place over time in aging of the linen, only it is more rapid. Thus, formation of the discoloration that produces the image of a crucified man on the Shroud is hypothesized to be due to the combination of the damage to the cellulose from the extremely brief intense burst of radiation from the body followed by the gradual oxidation-dehydration process that produces the color on the fibers.

#### 4. Conclusion

This hypothesis is attractive because of its explanatory power. It explains the mysteries of the Shroud regarding the image, the carbon dating, and the blood:

1. It explains why the image is on the side of the cloth that was facing the body,
2. Why the image has a good resolution, without images of the sides of the body or the top of the head.
3. Why there is an image where the cloth would not have been touching the body,
4. Why the front and back images are of similar intensity,
5. Why the image is a negative image,
6. Why the image contains 3D information related to the vertical distance of the cloth from the body,
7. Why only the top one or two layers of fibers are discolored in a thread,
8. Why only the very thin outer layer less than 0.4 microns thick of a fiber is discolored,
9. Why the electron bonding was changed from single to double electron bonds for carbon atoms that were already in the cellulose molecules, which causes the discoloration,
10. Why upper threads and fibers shield lower ones, and
11. Why the discoloration is mottled on the threads.
12. If neutrons were included in the burst of radiation from the body, it would explain the 1988 carbon dating of the Shroud to 1260-1390 by neutron absorption in the trace amount of  $N^{14}$  in the cloth to produce new  $C^{14}$  on the Shroud by the  $[N^{14} + \text{neutron} \rightarrow C^{14} + \text{proton}]$  reaction which would shift the carbon date forward by up to thousands of years depending on the location on the Shroud.
13. Neutron absorption in the blood might explain why the blood that is on the Shroud retains a reddish color whereas blood will normally turn dark brown to black in hours to days.
14. A sufficiently brief intense burst of radiation from the body could explain how the blood that would have been dried on the body, without underlying wounds such as the blood on the arms, is now on the Shroud. This is an issue since dried blood does not soak into fabric. A sufficiently brief intense burst of radiation from the body, by radiation pressure, would thrust the dried blood off the body and onto and into the cloth.

15. This might explain why there is no image under the blood, since the radiation may have transferred much of its energy and momentum to the blood to move it, thus leaving insufficient energy to cause the change from single to double electron bonds.
16. The electrostatic forces in such an event might explain why the image of the face does not show the effects of distortion from the cloth wrapping around the head. The image of the face appears as though the radiation that exited the body hit the cloth as the cloth was flat above the face.

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