



Scientific Working Group on Digital Evidence

SWGDE Guideline for the use of Reflected Ultraviolet Radiation (UV) in Forensic Photography

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- g) Change to (provide suggested text where appropriate; comments not including suggested text will not be considered)
 - h) Basis for change

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1. Purpose

The purpose of this document is to provide an understanding of how reflected ultraviolet radiation (UV) photography can be used to document and examine evidence.

2. Scope

This document will provide a basic understanding of the principles of reflected UV photography, the equipment needed, its use when documenting and examining evidence, and procedures for capturing images. This covers an advanced photography technique and does not address basic principles of photography.

3. Limitations

- CCD and CMOS sensors detection limit and potential sensor damage over time
- Exposure to UV may denature DNA
- Glass lenses may limit UV transmission
- Not all substrates and surface materials are conducive to reflected UV

4. Equipment

Please reference *SWGDE Photographic Equipment and Infrastructure Recommendations* prior to implementation of new equipment or procedures.

A. A full spectrum camera or a camera that has been professionally modified to allow for the capture of images in the UV spectrum.

- Full spectrum cameras are sensitive to wavelengths of energy from UV, visible, and infrared (IR).
- Lenses that transmit UV radiation.
- UV focuses at a different point than visible light and each lens may have a different focus shift. It is important to test the camera with the lens prior to use. This is especially true when a camera has been professionally modified.
- For comparative analysis photography, a fixed focal length macro lens is recommended.
- For documentation photography, a variable focal length lens may be utilized; however, this may cause or create distortion of the image.

B. Filters

- UV transmission filters
- IR blocking filter
- Visible band pass filter (if using a full spectrum camera)



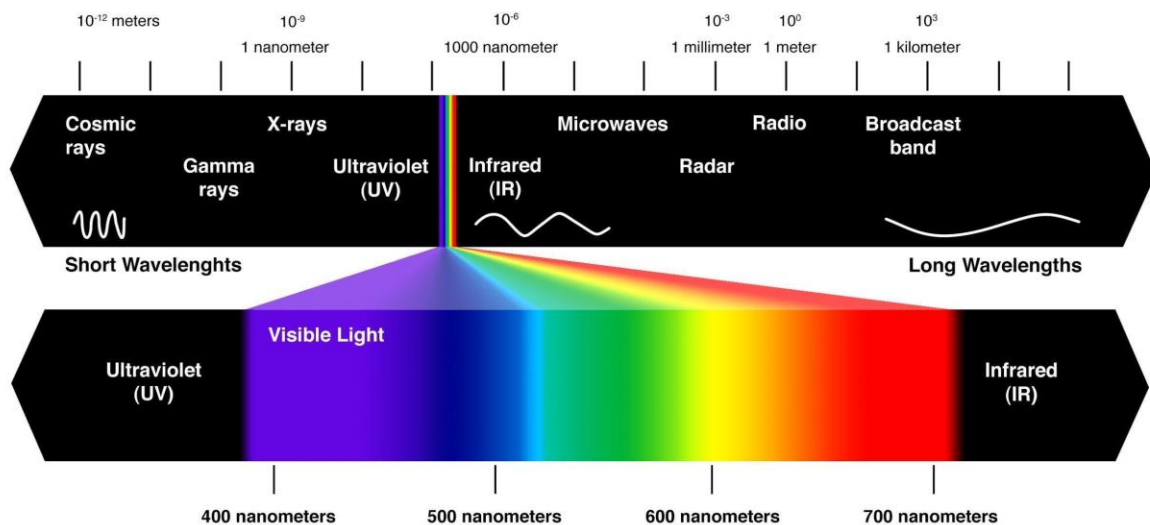
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- C. Light source which emits energy in the UV-A spectrum (315-400nm)
 - Typically, UV light sources come in 254nm and 365nm
 - Research indicates UV wavelengths <280nm will denature DNA rapidly during exposure.
- D. Remote shutter release
- E. Sturdy tripod or copy stand capable of various angles and positions
- F. Digital storage media
- G. Standardized scales of various sizes
- H. Appropriate Personal Protective Equipment (PPE)

5. Basic Principles Behind UV Photography

The visible portion of the electromagnetic spectrum (Figure 1) includes wavelengths of approximately 400-700 nm. UV is outside the visible spectrum of light, approximately 10-400 nm.

Figure 1. Electromagnetic Spectrum



UV photography takes advantage of a camera sensor's ability to capture wavelengths that are outside the visible spectrum. UV reflectance photography is a technique to capture UV energy. Subjects that reflect UV energy will appear lighter in appearance.

This technique is beneficial for visualizing details which are not observable under visible light but react differently to UV energy. Documentation of evidence such as healing injuries and diminished bruising, concealed evidence, latent impressions, surface disturbances and questioned documents may benefit from UV photography.

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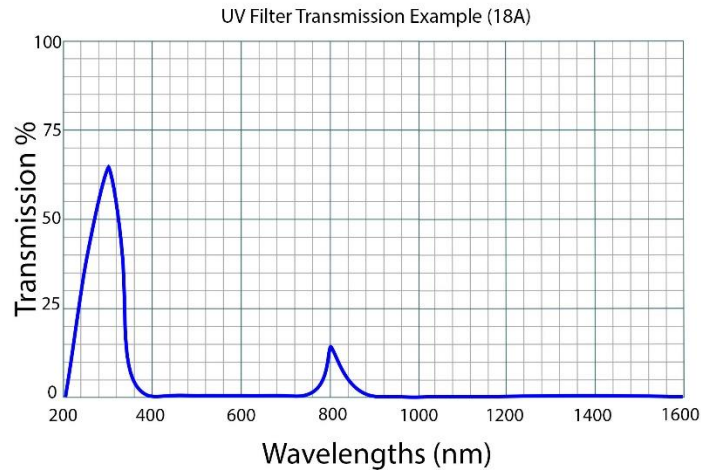
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UV transmission filters are designed to allow UV wavelengths to pass through the camera lens to the sensor while blocking visible light wavelengths; some UV filter also transmit IR; therefore, an additional IR blocking filter may be needed.

Figure 2. Example of UV transmission filter curve



Note: Figure 2 demonstrates the transmitted wavelengths of UV radiation and the percentage of IR transmission (IR leakage). To eliminate any interference from IR leakage, an IR blocking filter should be used.

Figure 3. Examples of UV Filters

Filter	Transmitted wavelengths (nm)	IR leakage
Kodak 18A	300-400	14% at 746 nm
B&W 403	300-400	17% at 746 nm
PECA 900	250-400	28% at 710 nm
Hoya U330	150-400	50% at 715 nm
Baader U-Venus	300-400	0.15% at 737 nm 0.3% at 813 nm 0.1% at 872 nm
Kolari Vision UV	320-400	0.025% (unknown)
Schott UG-1	300-400	9% at 746 nm

Note: This is not a comprehensive list and the manufacturers listed in the chart should not be construed as an endorsement.



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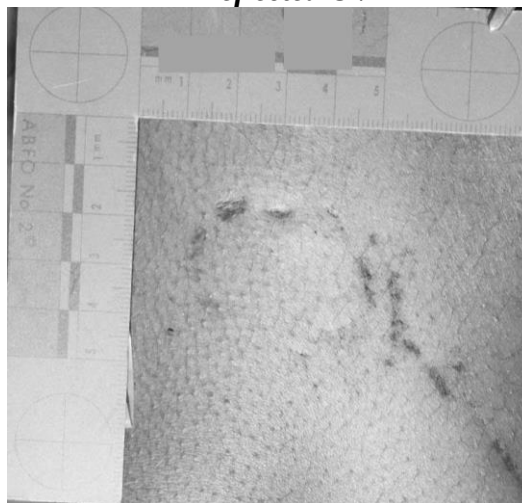
6. Examples of Reflected UV Photography Using a Baader U Filter and 365 nm Light Source

6.1 Bite mark on skin

Visible light

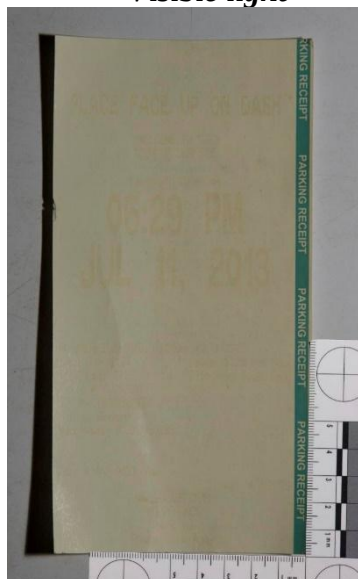


Reflected UV

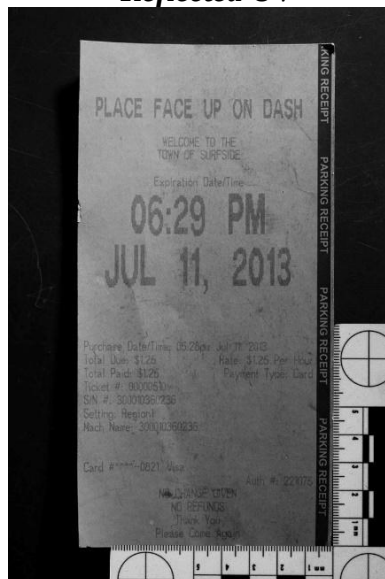


6.2 Thermal receipt

Visible light



Reflected UV





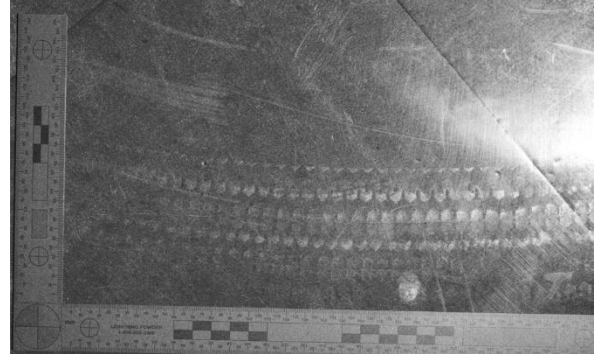
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6.3 Impression on a waxed floor

Visible light



Reflected UV



7. Procedures for Reflected UV Photography

These procedures are written for a full spectrum camera; however, if you are using a UV converted camera, then skip steps 6 - 8. It is suggested that the subject also be documented using visible light photography. If utilizing a preconfigured system, refer to the appropriate user manuals.

1. Mount the camera to a tripod, copy stand or another sturdy device
2. Set camera to the lowest ISO for the lighting conditions
3. Set the camera to manual mode
4. Set the camera to the appropriate file format
5. Compose the subject so that it is perpendicular to the camera - place a scale and label on the same plane as the subject
6. Apply even and direct lighting (do not diffuse) to the subject
7. Place a visible bandpass filter on the camera and focus
8. Capture image with visible light; review and adjust as necessary
9. Place an appropriate UV filter on the camera
10. Apply even and direct UV lighting
11. Bracket for proper exposure, capture images, review and adjust as necessary



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History

Revision	Issue Date	Section	History
1.0 DRAFT	2019-09-19	All	Initial draft created and voted by SWGDE for release as a Draft for Public Comment.
1.0 DRAFT	2019-09-29	--	Formatting and technical edit performed for release as a Draft for Public Comment.
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