# DOWNLOAD PDF INFRARED ULTRAVIOLET PHOTOGRAPHY.

## Chapter 1 : Ultraviolet photography - Wikipedia

*Infrared and ultraviolet photography Infrared and ultraviolet photography IR image taken by calendrierdelascience.comgen with a Fujifilm S2 Pro DSLR equipped with a Nikkor AF-S mm f/ lens and a Kodak Wratten 89B filter ( nm).*

Introduction to Infrared and Ultraviolet Photography Please check our " Available Training " page for the most current status of the course. Please consider signing up for it. Law enforcement officers and investigators who are responsible for investigating and photographing child trauma. Enhance the ability of investigators to document trauma sometimes observed on the bodies of maltreated children. Students will learn to capture images with the more sensitive infrared and ultraviolet photography equipment provided by the Academy. Define infrared energy and list three sources of infrared energy which are readily available to investigators. Define ultraviolet energy and list two sources of available near-UV energy. Explain why infrared and ultraviolet energy may be useful during the investigation of child maltreatment. Complete all instructor directed assignments while capturing color images which are correctly exposed and focused. Explain the exposure triangle and list the parts of the triangle. Distinguish the manual mode of camera operation from the program and shutter priority modes. Using the electronic flash, capture properly exposed color images. State the essential criteria for any photograph to be admissible in court. Using the medical training doll as a subject, capture images which depict the proper composition, perspective and focus. Utilizing the Fuji IS Pro Camera, capture and assemble properly focused and exposed infrared images utilizing human subjects and other forensic evidence. Utilizing the Fuji IS Pro Camera, capture and assemble properly focused and exposed ultraviolet images utilizing a medical training doll prepared by the instructor. Using images captured during class, demonstrate correct preservation and documentation of digital photographs by presenting 4 images from each assignment in class. Explain how commercially available photography equipment may be modified to accomplish full spectrum imaging. This course employs lecture, demonstration and practical exercises. Attendance is required at all class sessions. In order to satisfactorily complete this course, the student must demonstrate proper photographic technique by assembling a portfolio containing ultraviolet and infrared images using the equipment provided by the academy. Students may wish to bring laptop computers and flash drives if available for the purpose of transferring, presenting or viewing images. After signing in to the portal, you can view ALL available classes.

## Chapter 2 : ULTRAVIOLET and INFRARED Photography Summarized

*Infrared Conversions, IR Modifications & Photography Tutorials | Life Pixel IR The world leader in infrared conversions, modifications & DIY IR conversion tutorials. Scratched sensor replacement, UV & Full spectrum conversions.*

Imaging and Photographic Technology Department Rochester Institute of Technology A large part of the spectrum and its relationship to the world around us is invisible because we are limited to seeing electromagnetic wavelengths which extend only from those characteristic of violet-blues to those of the deep reds. Photographic materials can extend our vision, especially when aided by special light sources and various filters. The proper use of film, lights, filters, exposure techniques and specific applications of the four basic methods of photographing the invisible spectrum are discussed below. Here is one example where I used infrared photography to yield useful information to art historians about the "pentimenti" or underpaintings and underdrawings in a painting by Velazquez called "The Forge of Vulcan" which is located in the Prado Museum in Madrid, Spain. The hope is that the subject may appear differently by these rays than it does by "white" light or than it would appear if seen through colored filters. This, of course, is accomplished by placing a yellow or red complementary colors to blue and cyan, the color of the sky filter over the camera lens. The filter does not allow the sky color wavelengths to pass on to the film and thus the sky is rendered clear on the negative and dark on the print. The point is that we can distinguish between two subjects of similar tone, the sky and the clouds in this instance, but different color by filtering out one of the colors with a filter of complementary color placed over the camera lens. This principle applies also to the invisible areas of the spectrum but we need films which can "see" in these areas in order for our own eyes to see the differences if they exist. It is also about the only IR emulsion readily available! Since the film has no antihalation backing allowing light and IR to pipe into the cassette it should be loaded into the camera in total darkness or under subdued fluorescent illumination. Fluorescent tubes usually are very weak in IR output diminishing the chance for fogging the film by IR rays passing into the cassette. Associated with the lack of antihalation layer in Kodak High Speed Infrared film, the fact that IR can pass through the film base largely unimpeded, this sometimes causes artifacts to appear on the negatives. Pressure plates that have a dimpled pattern embossed on them will cause a similar pattern of dots to appear on the film and cutout areas in an otherwise smooth pressure plate may also leave a matching impression but of lower density than the surrounding area. Both of these can be prevented by covering the pressure plate with a thin, smooth, IR absorbing material. Kodalith or other litho film, exposed and processed to maximum density should work well for this purpose. It should be attached with the emulsion side facing away from the pressure plate. When attempting either UV or IR photography the subject must be lit with lights which emit the wavelengths by which we wish to photograph. Electronic flash is a good source of both UV and IR wavelengths. Some flashes have a UV absorbing filter incorporated in the flash head and this may need to be removed if possible for best results. However, even if not removed, there is usually enough UV that "leaks" through so that at close range they still serve as useful UV sources. Then, placing a UV transmitting filter Wratten 18A or IR transmitting filter Wratten 87 or 87C over the camera lens will effectively expose the film only to the wavelenghths of interest. Under certain conditions it is possible to previsualize the approximate appearance of a UV scene by installing into the camera a groundglass covered with a fluorescing substance. The UV energy passing through the lens causes this substance to fluoresce and the UV scene becomes visible in the finder! This is also possible for IR but to a much less satisfactory extent by using screens that exhibit a "reverse" fluorsescence effect Stokes effect whereby a material illuminated with IR fluoreseces in the visible regin. There are also evaporation based systems where the IR-formed image may be examined visually or photographed. In some cameras with behind the mirror metering systems the filter may need to be positioned just in front of the film between the film plane guide rails. Metering off the film may be impossible. While exposure is most appropriately determined in either case by making a set of test exposures or by bracketing it may be possible to establish a UV or IR "personalized speed index" by using one of the new ultrasensitive light meters but metering through the UV or the IR filter and correlating the exposures that seem to deliver negatives which you judge acceptable by your

own standards with those suggested by the meter. You should generally only attempt to establish this personalized speed index metering in the reflected mode. Finally this does not preclude bracketing but you may more consistently arrive at the proper exposure with less waste. The focal length of a given lens "changes" with wavelength and for this reason its focus should be adjusted slightly when attempting to use it for other than light wavelengths. There is a common misconception about the direction in which this adjustment needs to be made. In the case of IR the lens must almost invariably be moved somewhat further from the film than visual focus demands. While simple lenses need to be moved somewhat closer to the film in the case of UV rays, standard camera lenses need most often to be moved also further from the film just as is the case with IR. This is because most camera lenses are of achromatic color correction unless otherwise stated to be simple, very unlikely, or apochromatic in correction and bring two visible except in some cases with lenses intended specifically for UV photography wavelengths to a common focal point. Since they "curve" the chromatic focal plane about these two wavelengths the result is that both IR and UV come to a focus farther from the lens than the visible rays. The use of small apertures will in most cases diminish or eliminate the need to make a focus adjustment. When using a fluorescing screen in UV photography the UV rays are properly focused when the image on the screen is sharp. When some subjects are illuminated by certain wavelengths they reflect back not only the same wavelenghts that they are illuminated by but they may transform some of these incident wavelengths into usually longer ones. In a sense they change the color of the light falling on them. Some subjects change short, ultraviolet energy into longer, visible, wavelengths or colors. Others may change visible rays into yet longer, infrared wavelengths. The former effect is, of course, visible while the latter is not. Usually over this source is placed an EXCITER filter the function of which is to allow only those wavelenghts through which will cause fluorescence. In UV work this is most commonly the Wratten 18A filter and in the visible region of the spectrum the Corning filter can be used. To photograph fluorescence excited by UV, which usually results in a visible effect, color film can be used to good advantage with Kodachrome 64 being paricularly suitable. Since not only the "new", visible, wavelenghts are reflected from the subject but also some of the UV transmitted by the exciter filter, a UV blocking filter, called a UV barrier filter, is placed over the camera lens to allow the film to record only the fluorescence. For UV work this barrier filter is the 2E or similar, pale yellow, filter. Exposure may possibly be metered in the camera especially with the newer more sensitive in-camera meters. No focus compensation is necessary. Sometimes startling results can be obtained by using Infrared Fluorescence or as H. Lou Gibson calls it: IR luminescence and one such example is illustrated above where several documents were prepared by the parents of a family and intended for their children to be read in the future. These were then placed in a home-made time box and buried in the family lawn for 25 years. The father wrote with a typewriter on one side and the mother with pen and ink on the other. The typewritten message survived the intrusion of water into the box, but the ink the mother used was hopelessly washed away so that her message "into the future" was visually quite indiscernible. IR fluorescence made her message reappear to the delight of the children grown up by then. To photograph IR fluorescence or as H. The exciter filter placed over the light source must not allow any infrared rays through to the subject. The Corning is just such a filter and it can be obtained from the Corning Corporation. It is a glass filter and since it will be used over the light source it can be of low optical quality. Even so, it is almost twice expensive as the 18A filter which should be of optical quality although for a much larger size. Six inches square vs. The barrier filter should be a deep red or infrared filter such as the 87 or 87C. Camera focus should be adjusted as per previous discussion. Metering is not possible because the effect ocurrs in the IR and most meters are designed to meter light, not infrared. Even meters with IR metering capability would probably fail to detect the presence of IR fluorescence because of the very low amounts of IR produced in this fashion. The four techniques briefly summarized above have widespread application in document investigations and forensic photography, in surveilance and in environmental studies. Also in medicine, mineralogy, philately, art history, entomology, etc. Generally one sets out on a voyage of discovery when faced with a new subject. One tries each method in turn, hoping that one of them will yield better information about the subject than that which the unaided eye can perceive. Each new subject becomes a most exciting photographic adventure. If the subject does not fluoresce then you can place the filter over the light but you

need to work in a dark room. This technique is useful for the photographic enhancement of rashes and other skin disorders and also for detecting alterations in documents, etc. Electronic Flash best if flash does not have UV absorbing coating Filter on camera: Should be able to transmit UV. Most camera lenses are suitable for long wave UV associated with use of 18A filter over lens. Under special conditions, such as when a short wave UV source is available, photography is done in the dark and the 18A filter is not used. Subjects that fluoresce will be recorded as a mixture between reflected UV and visible fluorescence. When photographing with short wave UV around nm or less energy, typically provided by special sources, many standard camera lenses are unsuitable because the glasses they are made of absorb such wavelengths. Quartz or mirror lenses may need to be used although pinholes and some plastic lenses are an alternative. Under very short wave UV conditions the gelatin of the emulsion itself may absorb the incident rediation. In this case special emulsions with silver halides deposited on the surface are used. Generally determined by trial. Camera focus must be adjusted for critical use. The sample will appear in various colors as a result of the effect the sample has on the incident energy. Because samples also reflect some UV as well as fluorescing, the unwanted UV is removed with a "barrier" filter opaque to UV. The filter which limits the incident energy to a desired spectral region is known as the "exciter" filter. This technique is particularly useful for the identification of minerals and for "fingerprinting" documents such as stamps and currency. It is also used in forensic work with fluorescing powders in fingerprint visualization. Electronic Flash or UV emitting lamps operating in a darkened environment. Wratten 2A or 2E Appropriate film: Color reversal daylight film seems best. Can often be determined with built in meter but light level is much lower than it might appear visually. Visual focusing on groundglass possible. In a darkened room the filter may be placed over the light source. Sometimes a filter is not required. For example, a flatiron may be used as a source of IR radiation and if operating in a dark room no filters are needed.

## Chapter 3 : MCI Imaging Studio | Museum Conservation Institute | Smithsonian

*Technical information on ultraviolet, infrared and fluorescence photography; including rarely encountered luminescence phenomena. Includes a unique application of reflected-ultraviolet, equipment modifications, and spectral properties.*

Infrared and ultraviolet photography IR image taken by O. Colors have been corrected. The reason is simple. Lenses are specially designed from glasses offering a high and low dispersion to transmit a maximum of light in the visible spectrum and focus all wavelengths at the same focal point. Astronomers particulary well know that issue when using achromatic refractors. Sensi tivity to infrared In fact all photosensitive sensors based on silicium are "naturally" sensitive to a much wider radiation spectrum that extents between about nm and nm as explains this document from Olympus. If cameras recorded all the spectrum to which their sensor is sensitive, not only colors would be false, but although the quality of optics images would be somewhat blurry and in some conditions would display uneasthetic reflections. To limit the sensitivity of cameras to sole visible spectrum, all manufacturers placed in front of their sensor a low-pass filter, also named IR blocking, hot mirror or IR Cut Filter, aka ICF see that video from Canon on YouTube. This filter is a dielectric mirror, in fact a dichroic filter transparent to the light but blocking the transmission of any radiation over or nm depending on manufacturers. It is also an easy way to reduce at low cost the chromatic aberration at the ends of the visible spectrum. In addition, this filtering system includes an anti-aliasing and anti-dust system. For the ease of writing, in this document, except other mention, when we will deal of "IR" understand the "near IR" window. The sensor of a camera is sensitive from to about nm. Note the glass absorption in UV. About the examination of masterpieces The near-infrared radiation can also be used to examine the deepest painting layers thanks to a technique named IR reflectography. This technique uses the IR part of the spectrum between and nm, thus practically outside the spectrum available to IR DSLR and compact cameras, most manufacturers selling dedicated cameras to that usage. Engineers found the trick in placing the IR blocking filter in front of the reflex mirror. As shows this picture , it is only needed to push on the base of the ring supporting the filter to extract it and shooting in IR. In this case, the sole solution is to apply the procedure described by Jim Chen on LifePixel website. It consists in opening the body with a small cruxiform screwdrive to remove this IR blocking filter. It represents a very delicate work that practically requests to dismantle the body. Once the camera is dismanteled, one recognizes easily the IR blocking filter: Being given that the IR blocking filter interdependent with the anti-aliasing filter shows some thickness 1. Otherwise a recalibration is needed. We will come back on this subject. On some models, it is free and simply hold under a screwed frame, on others it is sticked on the frame and requires several manipulations. A right, sizes of the anti-aliasing 43x33x0. Documents Life Pixel corrected by the author and T. Specifications of the replacement glass depend on the applications. Usually it is one of the next models: In this case we can easily isolate the IR radiation in adding an infrared filter in front of the camera lens. All are transparent up to , nm or even nm depending on models. In this case, the camera is dedicated to IR imaging and can no more be used for conventional photography in white light without a new modification. It is not recommended for the astrophotography because the IR peak increases the sky brightness. It is not really suited to IR imaging either because its transmission in the near IR is too low. It is without saying that this replacement glass or filter must be adapted to your camera. If the glass is too thick, you could not close the frame, and too thin, the element will no stay in place. So, if you order an internal Schott filter, it is better that it is delivered at the exact size of the IR blocking filter. Otherwise the technician will have to cut or polish it to the right size with a diamond saw or will have to install some hold to maintain it, a job that requests accuracy and not at the level of all photo workshops. Once the modification performed, one reassembles the camera, one closes it, and nobody knows. Only difference, your camera is now sensitive to the near IR and from now on see the world under a totaly different lighting. What company can perform this IR modification? But in the field, most shopkeepers have never dismantled a camera and even professionals hesitate to make this modification. You can request to the support team of your camera manufacturer to perform this modification at your expenses but some have already refused. If you cannot find a specialist and do not want to perform that delicate modification yourself, here is a non-exhaustive list of

european and american companies ensuring that service. He works with various manufacturers including Schott. The larger part fixed to the IR blocking filter is the anti-aliasing filter. Documents Atelier Jacques Guyon. They also ensure various maintenance works. Their prices are competitive. At last name the two larger US companies specialised in this field. These cameras having been modified, they are no more covered by the manufacturer warranty. Here also, these cameras are not more covered by the manufacturer warranty. Note that to LifePixel and MaxMax the unfiltering is performed in a clean white room Class or ISO 5 using ionized air and antistatic work surfaces. The recalibration Any photographer has probably noted that in focusing on the eyes of a person, on the image the focusing was sharp on the nooze or on the ears. This problem called "front or back focus" is related to a miscalibration of the autofocus for that specific lens. The autofocus calibration is essential because of the right refraction of the beam depends on the accuracy of the focusing; if the refraction index of the glass is not correct par ex. The adjustment must be accurate to a fraction of millimeter and is not identical in visible ligh and in IR and from a lens to another. LensCal calibration chart from Datacolor. Watch the presentation on YouTube. Even is the glass is clear or the internal IR filter replacing the low-pass filter shows the same refraction index or the same tickness and the former filter, the camera must be calibrated again according to the working wavelength and the lens used. Knowing that some photographers use also their unfiltered camera for white light photography, technicians calibrate the autofocus for a wavelength of nm. However, this wavelength is not suited to infrared photography. If your camera is dedicated to IR photography, you must request that the calibration be performed at the wavelength of your most used filter e. Theoretically, the adjustement to perform to get a correct focusing is calculated according to the refraction index of the glass used n and the thickness difference dT between the original filter and the replacement one according to the relation: But it is not enough. Then one one needs to adjust either automatically the autofocus via the DSLR menus or manually in adjusting physically a screw using a japanese screwdriver located inside the darkroom of the DSLR. This recalibration is always needed to get sharp images at the focusing distance and all the more if you dedicate your camera to IR photography. By lack of calibration, your images will be sharp in the visible spectrum but risk to be slightly fuzzy in IR, without speaking about the microfocusing issue. If you camera needs a manual recalibration, if your shopkeeper does not want to perform it, you can ask to the support service of your brand to perform this job. When the adjustment is important, this servicing will be performed under cover of the warranty. But they can refuse it if they consider that the adjustement is not needed In this case, knowing that most unfiltered cameras are no more protected by the warranty, remains to perform the calibration yourself.

## Chapter 4 : Ultraviolet Photography

*Ultraviolet impacts the environment a totally different way than infrared. we can use UV photography for artistic photography (macro, portrait, landscape) as well as for analytic photography (dermatologic and forensic analysis).*

History[ edit ] Until the early 20th century, infrared photography was not possible because silver halide emulsions are not sensitive to longer wavelengths than that of blue light and to a lesser extent, green light without the addition of a dye to act as a color sensitizer. Wood , who discovered the unusual effects that now bear his name. Mees also took a few infrared photographs in Portugal in , which are now in the Kodak archives. Infrared-sensitive photographic plates were developed in the United States during World War I for spectroscopic analysis, and infrared sensitizing dyes were investigated for improved haze penetration in aerial photography. The Times regularly published landscape and aerial photographs taken by their staff photographers using Ilford infrared film. By 33 kinds of infrared film were available from five manufacturers including Agfa , Kodak and Ilford. The first version of this, known as Kodacolor Aero-Reversal-Film, was developed by Clark and others at the Kodak for camouflage detection in the s. Infrared photography became popular with a number of s recording artists, because of the unusual results; Jimi Hendrix , Donovan , Frank Zappa and the Grateful Dead all issued albums with infrared cover photos. The unexpected colors and effects that infrared film can produce fit well with the psychedelic aesthetic that emerged in the late s. Infrared light has a range of wavelengths, just like visible light has wavelengths that range from red light to violet. The longer, far infrared wavelengths are about the size of a pin head and the shorter, near infrared ones are the size of cells, or are microscopic. When a single-lens reflex SLR camera is fitted with a filter that is opaque to visible light, the reflex system becomes useless for both framing and focusing, one must compose the picture without the filter and then attach the filter. This requires the use of a tripod to prevent the composition from changing. However, it should be noted that diffraction effects inside a camera are greater at infrared wavelengths so that stopping down the lens too far may actually reduce sharpness. Catadioptric lenses do not often require this adjustment because their mirror containing elements do not suffer from chromatic aberration and so the overall aberration is comparably less. Catadioptric lenses do, of course, still contain lenses, and these lenses do still have a dispersive property. Some lens manufacturers such as Leica never put IR index marks on their lenses. The reason for this is that any index mark is only valid for one particular IR filter and film combination, and may lead to user error. Even when using lenses with index marks, focus testing is advisable as there may be a large difference between the index mark and the subject plane. Film Cameras[ edit ] Infrared negatives fogged by the frame counter of a Minolta Maxxum 4. View of the Hollywood Hills. Kodak Infrared color slide film, 35mm manual focus Nikkon lens no filter used and developed with E-6 process. Many conventional cameras can be used for infrared photography, where infrared is taken to mean light of a wavelength only slightly longer than that of visible light. Photography of rather longer wavelengths is normally termed thermography and requires special equipment. With some patience and ingenuity, most film cameras can be used. However, some cameras of the s that used 35mm film have infrared sprocket-hole sensors that can fog infrared film their manuals may warn against the use of infrared film for this reason. Other film cameras are not completely opaque to infrared light. The notable halation effect or glow often seen in the highlights of infrared photographs is an artifact of Kodak High Speed Infrared HIE black-and-white negative film and not an artifact of infrared light. The glow or blooming is caused by the absence of an anti-halation layer on the back side of Kodak HIE film, this results in a scattering or blooming around the highlights that would usually be absorbed by the anti-halation layer in conventional films. The intent of filters in black-and-white infrared photography is to block blue wavelengths and allow infrared to pass through. Without filters, infrared negative films look much like conventional negative films because the blue sensitivity lowers the contrast and effectively counteracts the infrared look of the film. Some photographers use orange or red filters to allow slight amounts of blue wavelengths to reach the film, and thus lower the contrast. Very dark-red 29 filters block out almost all blue, and visually opaque 70, 89b, 87c, 72 filters block out all blue and also visible red wavelengths, resulting in a more pure-infrared photo with a more pronounced contrast. Certain

infrared-sensitive films like Kodak HIE must only be loaded and unloaded in total darkness. Arguably the greatest obstacle to infrared film photography has been the increasing difficulty of obtaining infrared-sensitive film. Color infrared transparency films have three sensitized layers that, because of the way the dyes are coupled to these layers, reproduce infrared as red, red as green, and green as blue. All three layers are sensitive to blue so the film must be used with a yellow filter, since this will block blue light but allow the remaining colors to reach the film. Early color infrared films were developed in the older E-4 process , but Kodak later manufactured a color transparency film that could be developed in standard E-6 chemistry, although more accurate results were obtained by developing using the AR-5 process. In general, color infrared does not need to be refocused to the infrared index mark on the lens. Since , all formats of color infrared film have been discontinued. Specifically, Aerochrome and SO There is no currently available digital camera that will directly produce the same results as Kodak color infrared film although the equivalent images can be produced by taking two exposures, one infrared and the other full-color, and combining in post-production. A yellow minus-blue filter can also be used, which provides a single image that can also be post-processed to emulate the Ektachrome look. The colors result from varying amounts of infrared passing through the color filters on the photo sites, further amended by the Bayer filtering. While this makes such images unsuitable for the kind of applications for which the film was used, such as remote sensing of plant health, the resulting color tonality has proved popular artistically. Color digital infrared, as part of full spectrum photography is gaining popularity. The ease of creating a softly colored photo with infrared characteristics has found interest among hobbyists and professionals. All Aerochrome medium and large format which exists today came directly from his lab. The trend in infrared photography continues to gain momentum with the success of photographer Richard Mosse and multiple users all around the world. Digital camera sensors are inherently sensitive to infrared light, [17] which would interfere with the normal photography by confusing the autofocus calculations or softening the image because infrared light is focused differently from visible light , or oversaturating the red channel. Also, some clothing is transparent in the infrared, leading to unintended at least to the manufacturer uses of video cameras. However, for some subject matter the long exposure does not matter or the motion blur effects actually add to the image. An example of color digital infrared photography. Red and blue channels have been swapped for more conventional sky color. An alternative method of DSLR infrared photography is to remove the infrared blocker in front of the sensor and replace it with a filter that removes visible light. This filter is behind the mirror, so the camera can be used normally - handheld, normal shutter speeds, normal composition through the viewfinder, and focus, all work like a normal camera. Metering works but is not always accurate because of the difference between visible and infrared refraction. Additionally, because the red, green and blue micro-filters remain and have transmissions not only in their respective color but also in the infrared, enhanced infrared color may be recorded. An alternative approach is to use a Foveon X3 sensor , which does not have absorptive filters on it; the Sigma SD10 DSLR has a removable IR blocking filter and dust protector, which can be simply omitted or replaced by a deep red or complete visible light blocking filter. The result is a very sensitive digital IR camera. A Nikau palm against a clear, sunny sky shows the high contrast that is often typical of outdoors infrared photography. While it is common to use a filter that blocks almost all visible light, the wavelength sensitivity of a digital camera without internal infrared blocking is such that a variety of artistic results can be obtained with more conventional filtration. For example, a very dark neutral density filter can be used such as the Hoya ND which passes a very small amount of visible light compared to the near-infrared it allows through. Wider filtration permits an SLR viewfinder to be used and also passes more varied color information to the sensor without necessarily reducing the Wood effect. Wider filtration is however likely to reduce other infrared artefacts such as haze penetration and darkened skies. This technique mirrors the methods used by infrared film photographers where black-and-white infrared film was often used with a deep red filter rather than a visually opaque one. Another common technique with near-infrared filters is to swap blue and red channels in software e. Nightshot infrared photography of a stove with nm red-filter and polarizing filter at daylight. Several Sony cameras had the so-called Night Shot facility, which physically moves the blocking filter away from the light path, which makes the cameras very sensitive to infrared light. The reverse of the United States five-dollar bill

has two rectangular strips that are blanked out when viewed in the infrared spectrum, as seen in this image taken by an infrared camera. Fuji have produced digital cameras for use in forensic criminology and medicine which have no infrared blocking filter. Optimum UV sensitivity requires special lenses, but ordinary lenses usually work well for IR. FujiFilm restricts the sale of these cameras to professional users with their EULA specifically prohibiting "unethical photographic conduct". They may be multispectral and use a variety of technologies which may not resemble common camera or filter designs. Cameras sensitive to longer infrared wavelengths including those used in infrared astronomy often require cooling to reduce thermally induced dark currents in the sensor see Dark current physics. Lower cost uncooled thermographic digital cameras operate in the Long Wave infrared band see Thermographic camera Uncooled infrared detectors. These cameras are generally used for building inspection or preventative maintenance but can be used for artistic pursuits as well, such as this image of a cup of coffee. See also[ edit ] Digital infrared using a 50mm lens, D and the program Exposure. Infrared photography typically produces false-color artifacts, such as turning greens into pinks and purples as shown in this example.

## Chapter 5 : Infrared and ultraviolet photography

*Infrared and Ultraviolet Photography and Cameras. likes. You are invited to join this group and share your infrared images. No rules, just post your.*

Infrared examination also can be used as a tool to differentiate between certain groups of pigments and inks. Infrared imaging is the recording of the variable absorption and reflectance of infrared light by an object. The infrared wavelengths may penetrate an object below the surface, unlike visible light. The way that a material interacts with infrared radiation, reflection, absorption or transmission can aid in the characterization and differentiation of materials. In the case of paint or paper with charcoal or carbon-based inks, the contrast can be dramatic. A modified DSLR is used for reflected infrared digital photography. Most DSLRs have IR-cut filters on the sensors that increase the quality of the visible light image by blocking any infrared radiation from the sensor. The modification of this camera included the removal of the IR-cut filter and the color filter array CFA allowing the camera to have a maximum sensitive of around nm to nm and to acquire monochrome images. Tungsten halogen lamps are used for illumination. Kodak Wratten IR filters are used on the camera. These filters included 88A, 87, 87C, 87B and 87A cutting on at different wavelengths within the near infrared. Infrared Reflectography Infrared Reflectography reveals underdrawing as seen in the first image that was not seen in the visible light right image. In the case of the systems at MCI, infrared reflectography has a higher spectral resolution than reflectance infrared digital photography. Due to the low spatial resolution of the camera for IRR x pixels , we either can only acquire details of an image or we take enough overlapping images to stich a mosaic of the area of interest. MCI is equipped with a system that has an uncooled InGaAs indium gallium arsenide detector with a spectral range of nm near infrared. It was the first system of its kind in the Smithsonian Institution, allowing advanced non-destructive documentation of latent images. Ultraviolet Imaging The left images are of a copybook illuminated and photographed using visible light and with Ultraviolet Radiation. The right images are looking closer at the text of the copybooks with both visible and ultraviolet light. Ultraviolet radiation has been widely used in art conservation as a non-destructive examination technique. UV-induced fluorescence is used for the identification, characterization, condition assessment, and treatment of objects. It is particularly useful in the cases of organic materials such as plastics, coatings, and adhesives. The technique often shows alterations of objects over time, as in the case of varnishes on paintings. UV-induced fluorescence technique can be documented using a digital camera. We have used the technique to record changes in objects, and to make documents legible as seen above. Delaney, Elizabeth Walmsley, Barbara H. Barrie, and Colin F.

## Chapter 6 : Infrared and Ultraviolet Photography | Nikonians

*Ultraviolet photographs of flowers, landscapes and other subjects. Ultraviolet photographic equipment and techniques. I've been wanting to get started in UV and IR video capture for a project combining the visual spectrum with IR.*

Ultraviolet image of the globular cluster NGC in the southern constellation Columba. Light which is visible to the human eye covers the spectral region from about to nanometers. This is the radiation spectrum used in normal photography. UV spectrographers divide this range into three bands: Only near UV is of interest for UV photography, for several reasons. UV photographers subdivide the near UV into: These terms should not be confused with the parts of the radio spectrum with similar names. There are two ways to use UV radiation to take photographs - reflected ultraviolet and ultraviolet induced fluorescence photography. Reflected ultraviolet photography finds practical use in medicine , dermatology , botany , criminology and theatrical applications. Sunlight is the most available free UV radiation source for use in reflected UV photography, but the quality and quantity of the radiation depends on atmospheric conditions. A bright and dry day is much richer in UV radiation and is preferable to a cloudy or rainy day. Another suitable source is electronic flash which can be used efficiently in combination with an aluminium reflector. Some flash units have a special UV absorbing glass over the flash tube , which must be removed before the exposure. Most modern UV sources are based on a mercury arc sealed in a glass tube. By coating the tube internally with a suitable phosphor , it becomes an effective long wave UV source. Grouping several UV-LEDs can produce a strong enough source for reflected UV photography although the emission waveband is typically somewhat narrower than sunlight or electronic flash. Special UV lamps known as " black light " fluorescence tubes or bulbs also can be used for long wave ultraviolet photography. Equipment and techniques[ edit ] Reflected UV photography[ edit ] A portrait taken using only UV light between the wavelengths of and nanometers. In reflected UV photography the subject is illuminated directly by UV emitting lamps radiation sources or by strong sunlight. A UV transmitting filter is placed on the lens, which allows ultraviolet light to pass and which absorbs or blocks all visible and infrared light. UV filters are made from special colored glass and may be coated or sandwiched with other filter glass to aid in blocking unwanted wavelengths. Examples of UV transmission filters are the Baader-U filter or the StraightEdgeU ultraviolet bandpass filter, both of which exclude most visible and infrared light. Filters for use with digital camera sensors must not have any "infrared leak" transmission in the infrared spectrum ; the sensor will pick up reflected infrared radiation as well as ultraviolet, which may obscure the details that would be resolved by ultraviolet alone. For UV photography it is necessary to use specially developed lenses having elements made from fused quartz or quartz and fluorite. UV induced fluorescence photography[ edit ] Fluorescent materials lit by UV light. No filter is used to absorb violet visible light. Photo taken with daylight film Photography based on visible fluorescence induced by UV radiation uses the same ultraviolet illumination as in reflected UV photography. However, the glass barrier filter used on the lens must now absorb or block all ultraviolet and infrared light and must permit only the visible radiation to pass. Visible fluorescence is produced in a suitable subject when the shorter, higher energy ultraviolet wavelengths are absorbed, lose some energy and are emitted as longer, lower energy visible wavelengths. UV induced visible fluorescence photography must take place in a darkened room, preferably with a black background. The photographer should also wear dark-colored clothes for better results. Many light-colored fabrics also fluoresce under UV. Any camera or lens may be used because only visible wavelengths are being recorded. UV can also induce infrared fluorescence and UV fluorescence depending on the subject. Filters are sometimes added to the UV illumination source to narrow the illuminant waveband. This filter is called an exciter filter, and it allows only the radiation to pass which is needed to induce a particular fluorescence. As before, a barrier filter must also be placed in front of the camera lens to exclude undesired wavelengths. Forensic use[ edit ] Ultraviolet photography was used as evidence in court at least as early as  These can serve as evidence of assault.

## Chapter 7 : Documenting Child Maltreatment: Introduction to Infrared and Ultraviolet Photography #

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*A large part of the spectrum and its relationship to the world around us is invisible because we are limited to seeing electromagnetic wavelengths which extend only from those characteristic of violet-blues to those of the deep reds.*

## Chapter 8 : Infrared photography - Wikipedia

*Infrared & Ultraviolet Imaging Reflected Infrared Digital Photography. Infrared imaging is a non-destructive technique used by conservators to examine paintings and artworks and detect hidden details under the upper layers such as added paint, underdrawings, and hidden signatures or watermarks.*

## Chapter 9 : Infrared & UV Photography Filters | B&H Photo Video

*Here at Life Pixel Infrared we have converted thousands of digital cameras to infrared, using various infrared filters as well as our UV IR Visible conversion or simply the full spectrum conversion. So look around, browse our pages, view the sample infrared photos, our new infrared Photoshop tutorials and order your infrared conversion today.*