

IPACO expert report

Expert name

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Report date

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Type

IFO

Class

A

Explanation

« Ghost-type » lens
flare

Complement

Document

Photos

Imaging location

Monaco principality

Imaging date

January 26 and 27, 2012



Photo n°9907



Photo n°9909



Photo n°9912

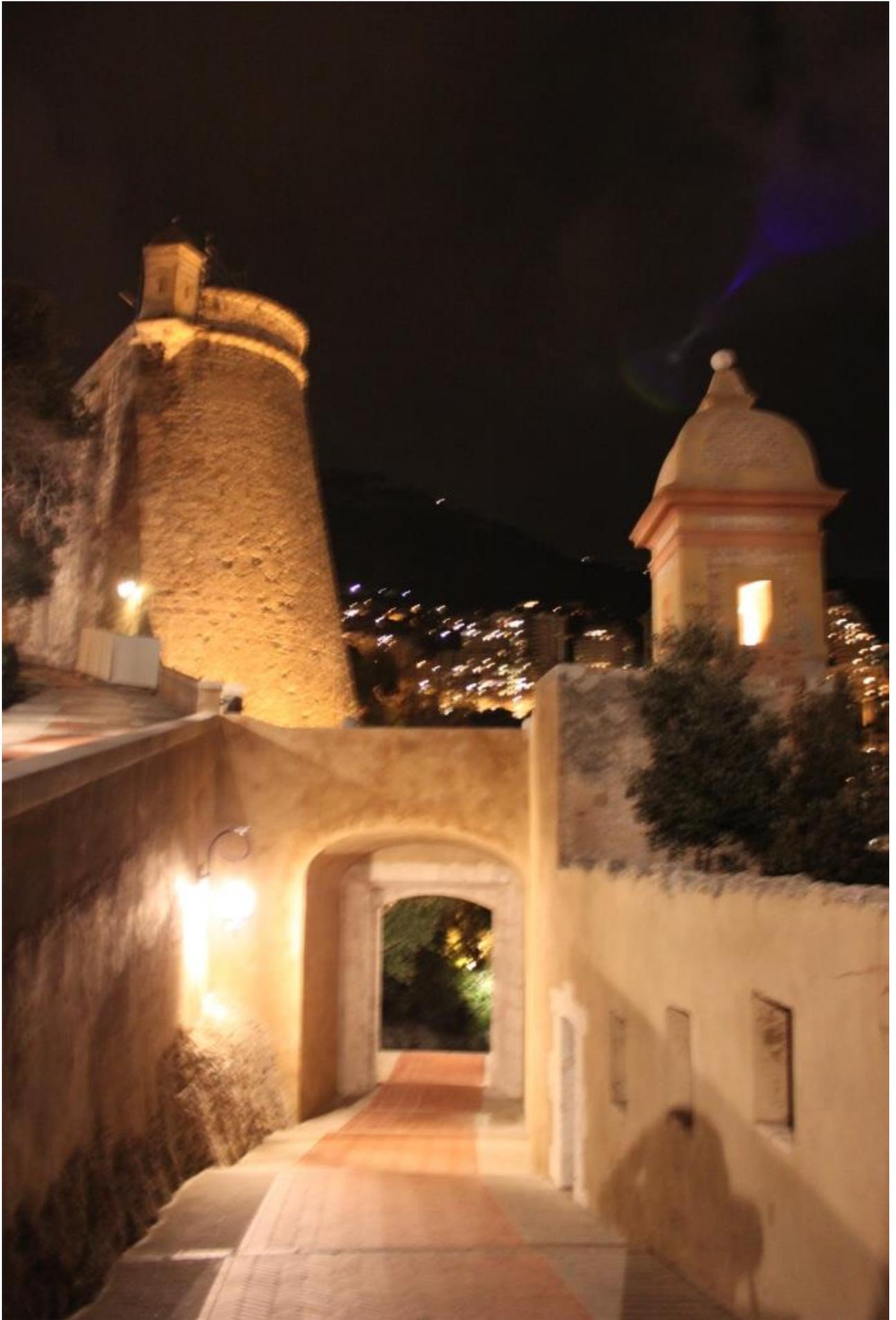


Photo n°0111

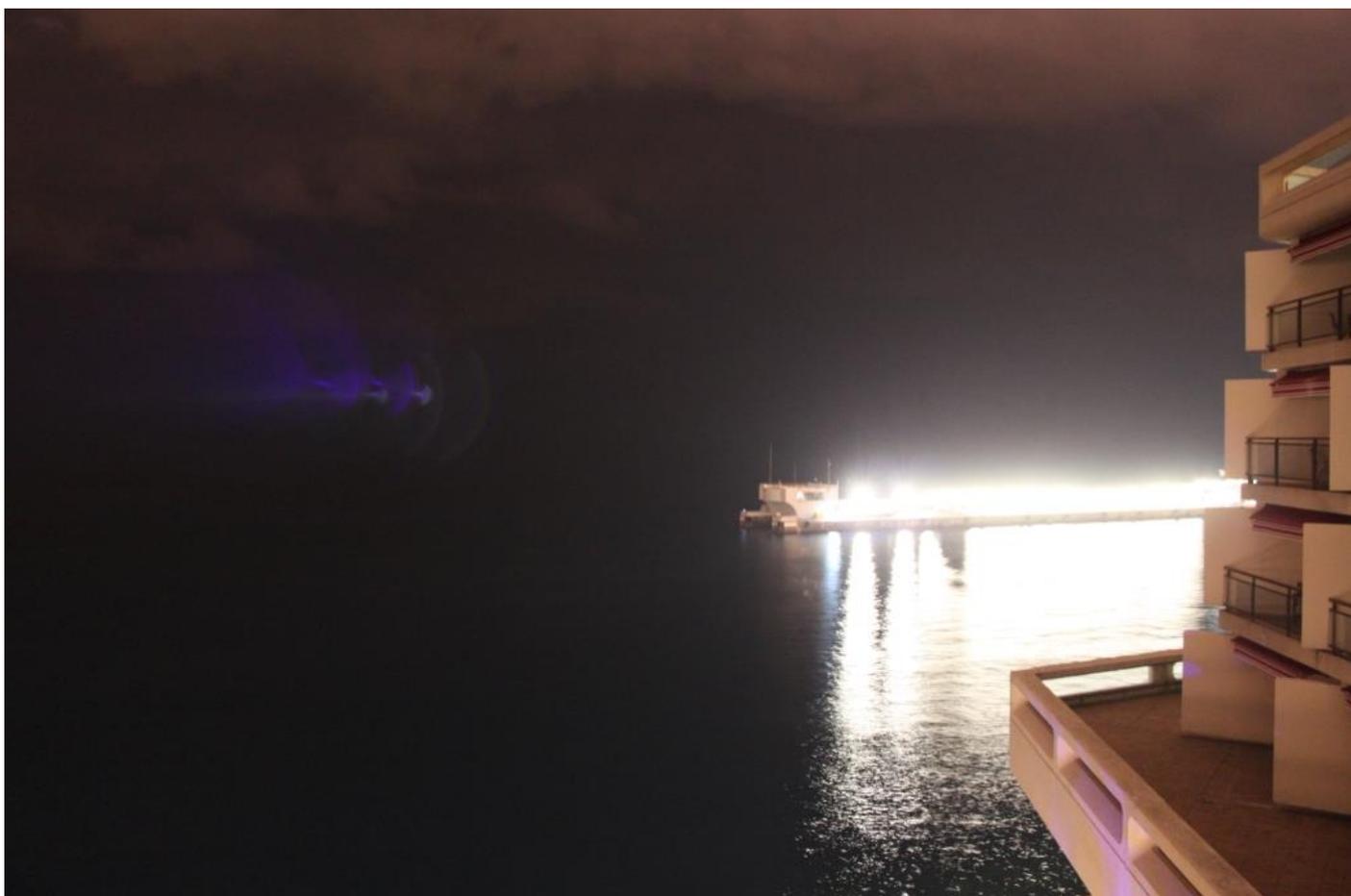


Photo n°2073

I. Shoot circumstances

Here's the witness testimony, taken from the MUFON CMS system:

“During a trip to Monaco last year with my mother, we took some pictures while touring the palace grounds and surrounding areas. Upon inspection, we noticed some strange lights in the pictures. I was using the sports mode in my camera then and it captured a series of pictures in one click. The lights in the pictures could be seen in different angles and at different times. We stayed at the Fairmont Hotel then and the hotel manager suggested that we send the pictures to the press which were later published on their Facebook page [Link moved to FI section/cms/tg]. We have many more of these pictures. We also showed these pictures while in Monaco to the police and they were equally puzzled. One of them pointed out that they could have been caused by the street lights (?!). It has been a year since we took these pictures but have yet to receive a decent explanation. Any input is much appreciated. »

II. Camera settings

The camera model that was used was a Canon EOS 500D. Technical characteristics can be found [here](#).



III. Data examination

The review of EXIF data with IPACO's authentications module does not tell us anything specific that can help in the understanding of this phenomenon.

However, examination of the photographs shows the presence of many bright light sources in each one of them.

Could these lights be the cause of the presence of the "objects" in the sky?

Let's take for example photo n°9912.

With IPACO, it is possible in a simple way to define it using several tools combined into one that allows you to:

1 - Create a figure "Flare" on these lights in two clicks: the center and radius of a circle that approximately delimits the lights in question. ("a" and "b" on the following figure)

2 – Finely reposition the center of this Flare figure by calculating the radiometric center of the chosen circle.

3 - Materialize the Flare, in the form of an asterisk with the same radius as the chosen circle, as well as a dotted circle centered on the center and passing by this flare.

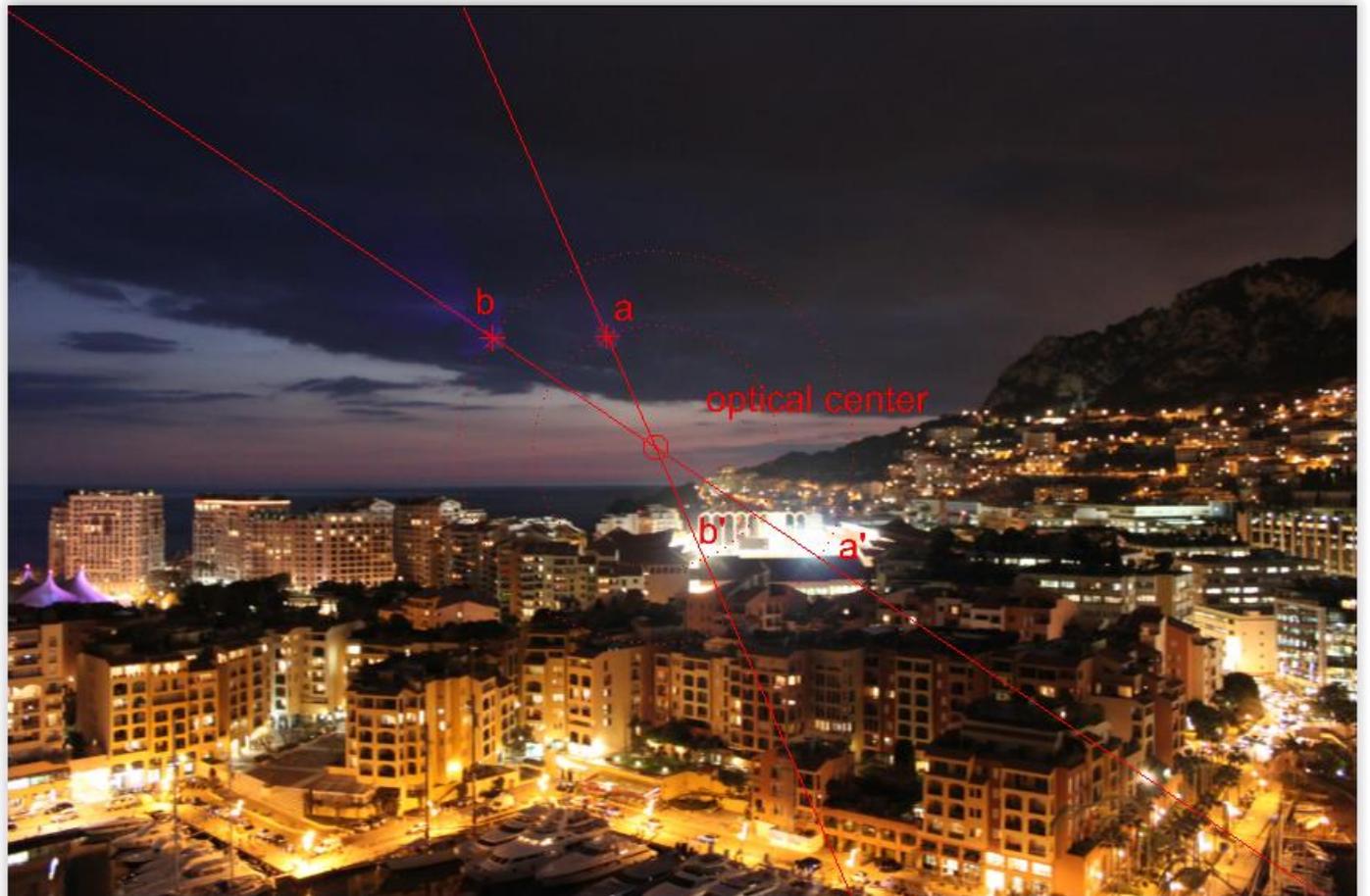
4 - If there is not yet any figure "Center" in the graph displayed, it creates one (definition of the geometric center of the photograph).

5 - Draw a "diameter", i-e a straight line that passes through the flare and the geometrical center, across the entire image:

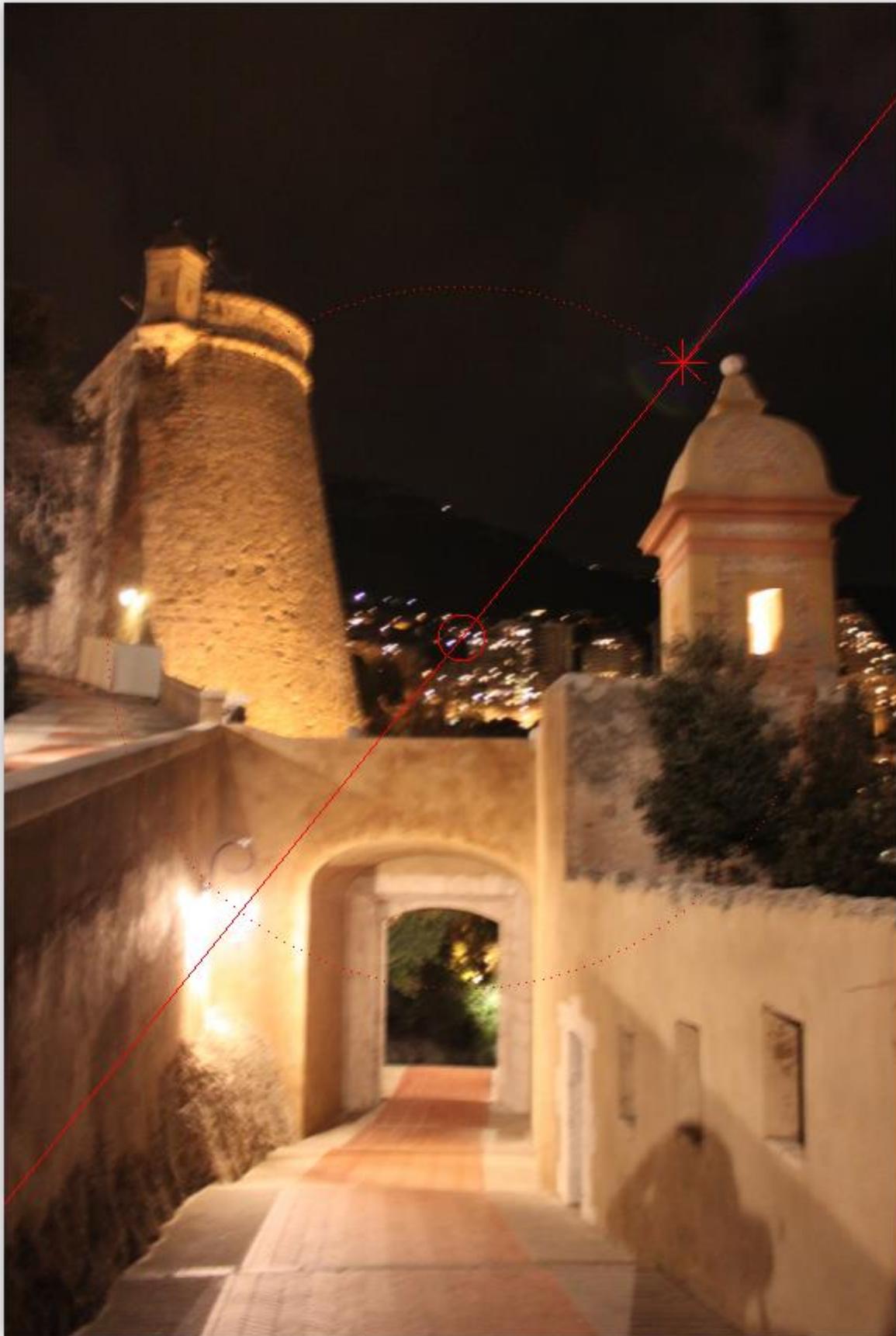


Thereby defining the geometric center of the photograph, it is found that the position of the lights in the sky is substantially coincident with that of the light sources, along a central axis of symmetry passing through the geometric center of the photograph.

The difference is the non-exact coincidence of optical and geometric centers. However, it can also be compensated with IPACO whose tool "Flare" allows us to change manually the geometric center by dragging it gradually to the optical center position and thus check the consistency of the flares (see definition and technical explanations chapter V) and their light source ("a" and "b"):



We can also advantageously check the existence of this alignment with other photographs; for example the number 0111:



Again, the alignment "*flare/optical center/light source*" is perfect, confirming thus that these "*objects*" are just parasitic reflections created in the internal lens system of the camera.

These reflections are always opposite to the light sources, through a central axis of symmetry materialized by the optical center of the picture.

It should be noted that it is possible to reduce or even completely eliminate these unwanted effects, either by use of a better filter quality, use of a shorter focal length, or by increasing the aperture (i-e reducing the value of the [f number](#)., keyed on the photos here to 3.5 and 5.6).

However, by far the most secure way to avoid this type of flare is to remove the filter altogether (and it's particularly true for those lacking [optical coating](#)), if any, from the lens.

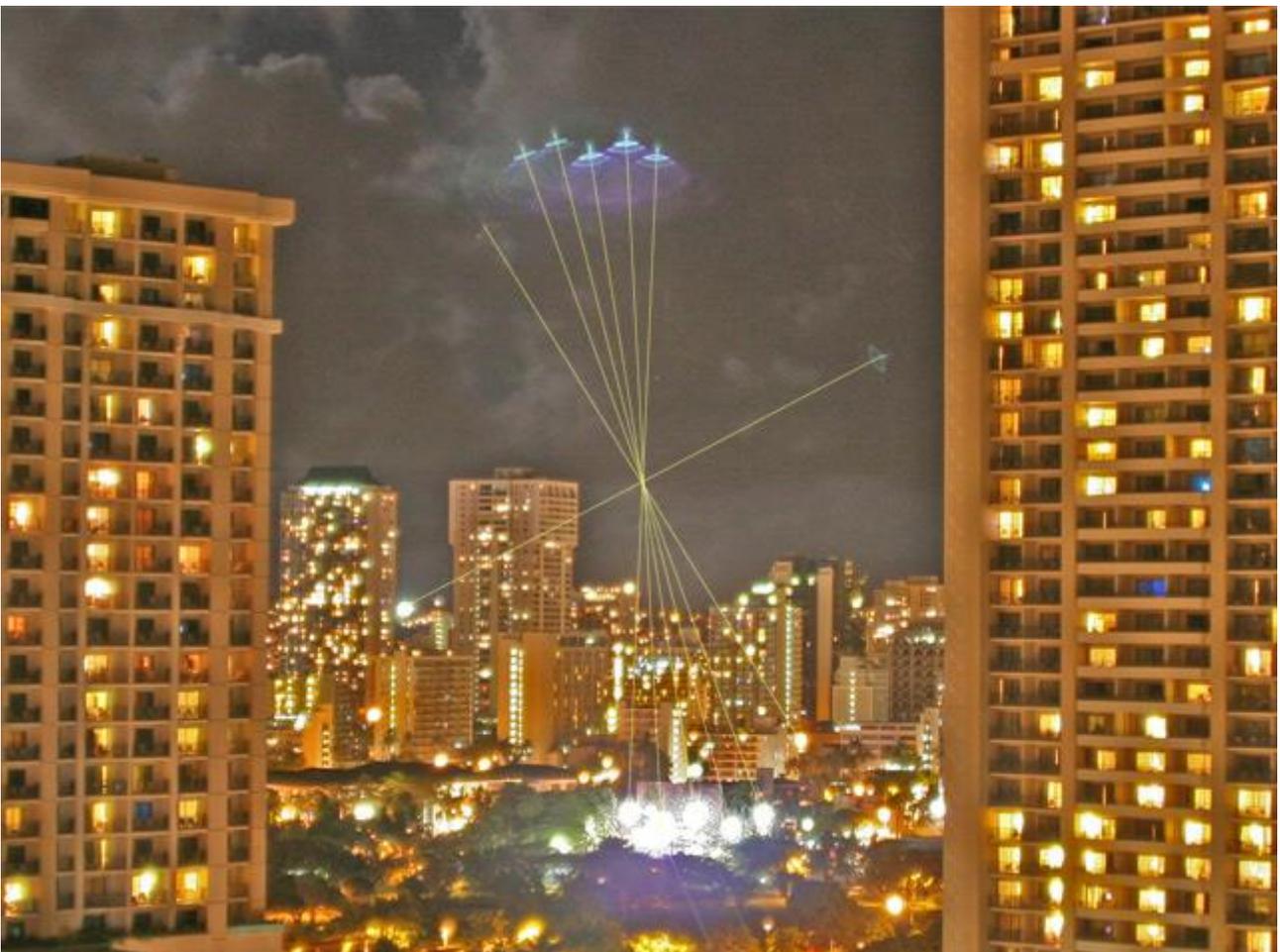


IV. Conclusion

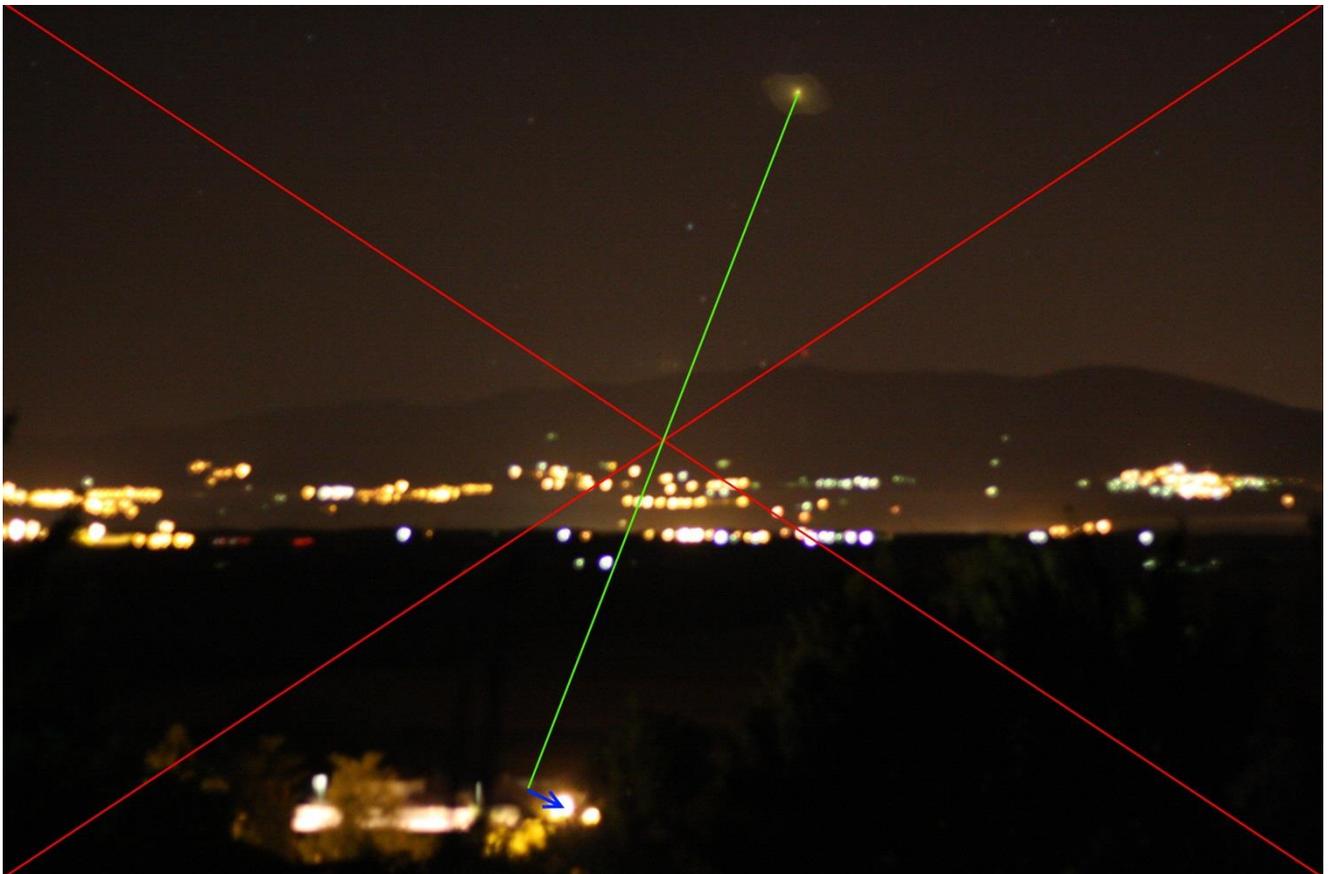
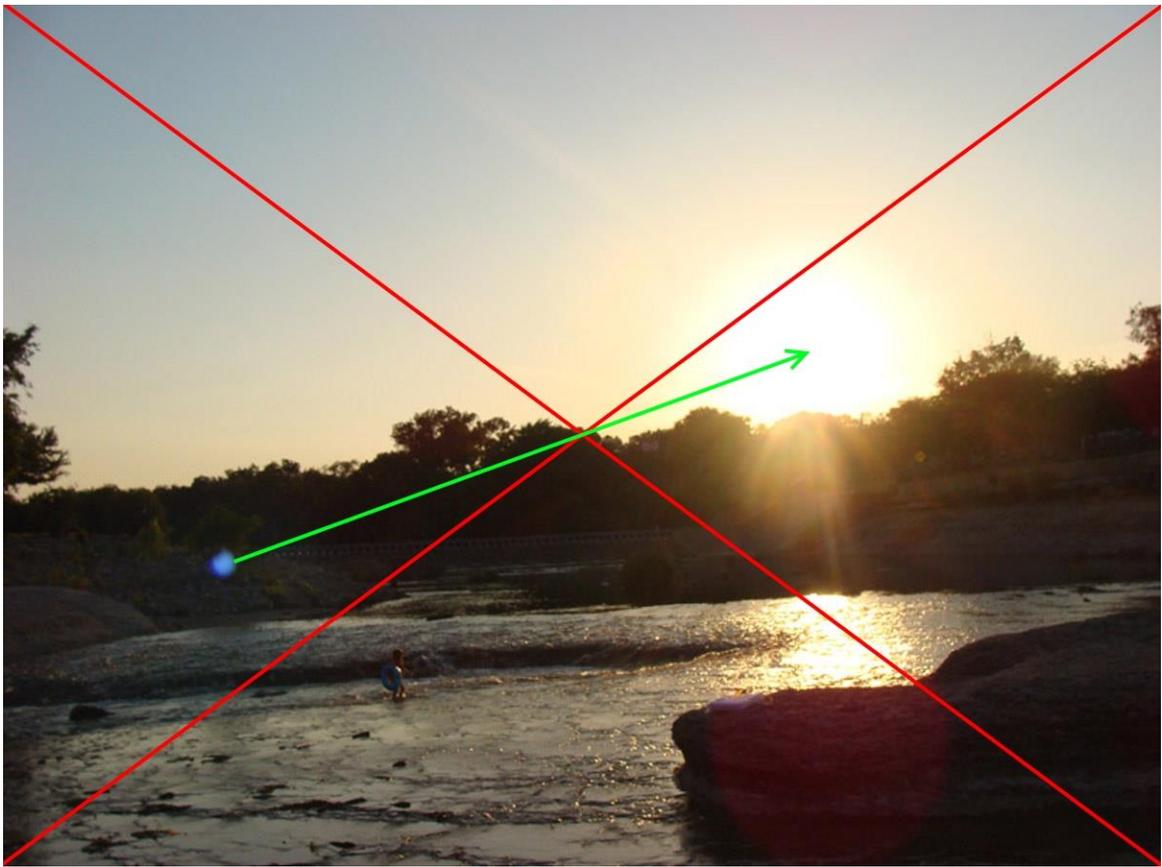
Given the objective data provided by the examination of the photographic record, we conclude that the different objects in this series of photographs are multiple light reflections parasites, also called "*flare phenomenon factor*" or simply "*lens flare*" caused by the presence of two strong light sources found in the field of photography.

V. Technical explanation

These flares are due to the presence of a bright light source in the field of view and can be easily detected as it's a mirror ghost of the original bright object, with generally the image center serving as a point of symmetry (or [point reflection](#)).

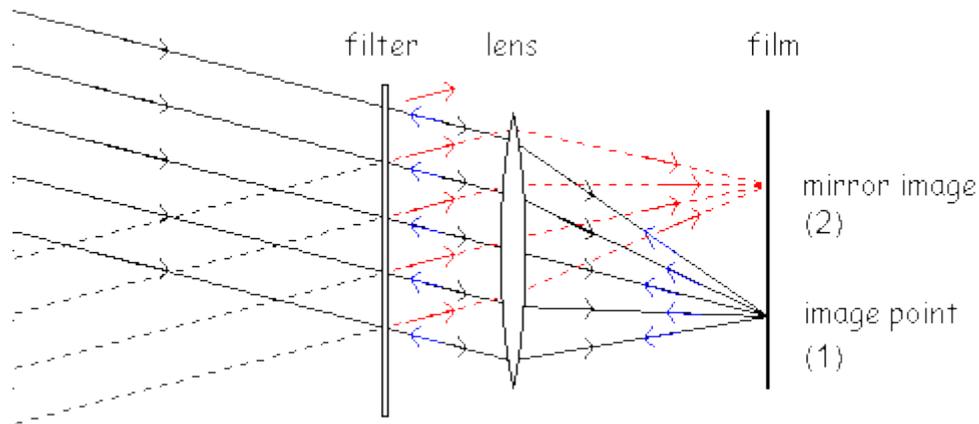


All dimensions are perfectly preserved, suggesting that reflections on flat surfaces are responsible. Otherwise (reflections on concave or convex surfaces), it may be possible to have some differences in geometric measurements; the optical center does not coincide then with the geometrical center:



In the sketch below, black arrows indicate the light rays of a distant bright light source that form a regular image point on the film (1). Values for the reflectance of undeveloped photographic film vary from 15% to 40% [see sources 1, 2], which makes the film a much stronger reflector than any optical component in the lens.

So, a significant percentage of the light is reflected off the film, partly specular and partly diffuse.



(For convenience, we will consider that paths of the reflected light are the same and thus are already drawn for the incident light).

Thus, the **blue arrows** indicate light reflected from the film. This light encounters the filter, which specularly reflects a small fraction (**red arrows**). The red rays are parallel and consequently focused onto a point on the film. (2)

The virtual source of the mirror point is traced by the dashed black lines. Note that the blue rays reflected by the film seem odd from the viewpoint of specular reflection; they merely illustrate the fact that all light rays that originate from a single point on the film, and which are collected by the lens, emerge parallel at the filter.

VI. Sources –photos credits

Photos came from the MUFON CMS system.
Examples are from my personal collection.

[1] “*SPSE handbook of photographic science and engineering*”, published by Woodlief Thomas Jr., John Wiley & sons, p. 204 (1973).

[2] Sidney F. Ray, “*Applied photographic optics*”, 3rd ed., Focal Press, p. 139 (2002).