What are the factors that determine the definition of a pinhole? What is the best focal length of a pinhole?

dujingtou.com/article_31122.shtml

What factors determine the sharpness of a pinhole lens? Some people say it is the diameter of the pinhole, while others say the thickness of the pinhole, the material, and the smoothness of the pinhole. And the best focal length.
When making pinholes, the smoothness, material, thickness, and diameter can all be controlled. When making them, I use a microscope to detect the edges, and use tungsten steel ultra-fine drills to trim irregular pinholes. These parameters It can be improved through process optimization.

Only the best focal length is calculated by formula and “fixed” unchanged.

Joseph Petzval of Vienna apparently was the first, in 1857, to attempt to find a mathematical formula of the optimal pinhole diameter for the sharpest definition in a pinhole image. The British Nobel Prize winner Lord Rayleigh (John William Strutt, 1842–1919) worked on pinhole diameter formulas for ten years and published his work in Nature (1891). Lord Rayleigh's formula is still one of the formulas used to today. A number of others have been published since the 1880s.

But, but. . . Everything is afraid. However, first of all, in the actual application process, I found that the best focal length is not very effective. In actual application, due to the unreliable processing manufacturers, the custom-made 0.2 is not standard, and I found it in the follow-up measurement. size exists
0.2 0.25 0.3 0.4 and other sizes, but in use because of the 50MM focal length test, no obvious difference was found in the samples taken. . First of all, this is caused by the impreciseness of the test, and secondly, it also reflects a problem. Is it possible that the optimal imaging focal length is a technical indicator that is more accurate and has a large influence on technical parameters, but has little influence on the actual observation effect?

With questions, I read © Jon Grepstad's《Pinhole Photography – History, Images, Cameras, Formulas》

link：
https://jongrepstad.com/pinhole-photography/pinhole-photography-history-images-cameras-formulas/

In the article, we found that even the precise calculation of the optimal imaging focal length has multiple calculation methods, and the optimal imaging focal length varies greatly in different calculation versions.

The following content and pictures are from:《Pinhole Photography – History, Images, Cameras, Formulas》

The diameter of the pinhole is not really important. But for each focal length there is an "optimal" diameter, the one that produces the sharpest image.

The word best is actually not an appropriate word, as the pinhole photographer or artist may not be aiming for the greatest possible sharpness. There are beautiful pinhole images, intentionally larger than

Softer than technically possible. A good pinhole image is different from a blurry, out-of-focus lens image.

At a certain point, a small pinhole will produce a sharper image than a large pinhole. If the pinhole is too small, the image will be less sharp due to diffraction. The hole should be perfectly round with no ragged edges. Can be checked with a magnifying glass or microscope.

Bogre (1988)

Focal length	Best aperture diameter	Equivalent f-stop	Exposure factor for f/22
50 mm	0.29 mm	f/174	63 x
75 mm	0.35 mm	f/213	94 x
100 mm	0.41 mm	f/246	125 x
125 mm	0.45 mm	f/275	157 x
150 mm	0.50 mm	f/203	188 x
200 mm	0.57 mm	f/348	250 x
250 mm	0.64 mm	f/389	313 x
300 mm	0.70 mm	f/426	376 x

Fuller (1992)

Focal length (mm)	Pinhole diameter (mm)	Approx. f-stop
50	0.26	200
75	0.32	220
100	0.45	240
150	0.55	270
200	0.63	320
250	0.71	350
300	0.77	390
350	0.83	420
400	0.89	450
500	1.00	500

Holter (1990)

Focal length (mm)	Pinhole diameter (mm)	f-stop	Exposure factor for f/16
10	0.14	70	20
20	0.20	100	40
30	0.24	125	60
40	0.28	140	80
50	0.31	160	100
60	0.34	180	125
70	0.37	190	140
80	0.40	200	160
90	0.42	214	180
100	0.45	220	190
150	0.54	280	300
200	0.63	318	400
250	0.70	360	500
300	0.78	380	560

Platt (1989)

Focal length (mm)	Pinhole diameter (mm)	f-stop
130	0.33	380
210	0.40	500
260	0.46	550
320	0.50	650
420	0.58	690
550	0.66	800
650	0.74	930
750	0.79	960
1000	0.91	1120

The sharpness of pinhole photography is its biggest shortcoming, but it is also one of its characteristics, so with so many versions of the focal length calculation formula, we don't have to worry about it. In actual use, I used a pinhole of 0.2 from 40mm to 120mm, from 4X5 format to 810 format can provide a relatively satisfactory definition, of course, this definition is only relative and cannot be compared with optical lenses.

When we use equipment, we are often entangled in the gap of technical parameters, but in actual use, the impact on the results is often not important.

Pinhole photography has a large angle at the wide-angle end and there is no corresponding viewfinder, so even people who often shoot pinholes will be troubled by framing and composition. My suggestion is to place the subject in the center of the frame, and getting

closer to the subject will help improve clarity. Then keep the frame level and parallel to the subject.
Because the edge of the pinhole will become black with the loss of light, and because the film is a plane, the imaging at the corner of the film will also show radial deterioration. The pinhole atmosphere is actually caused by these two shortcomings, so when some pinhole cameras design a 120 wide format structure, they will design the focal plane as an arc with the pinhole as the center point, which will Significantly improved image quality.

There are still many skills in pinhole photography that we hope we will continue to explore in use.

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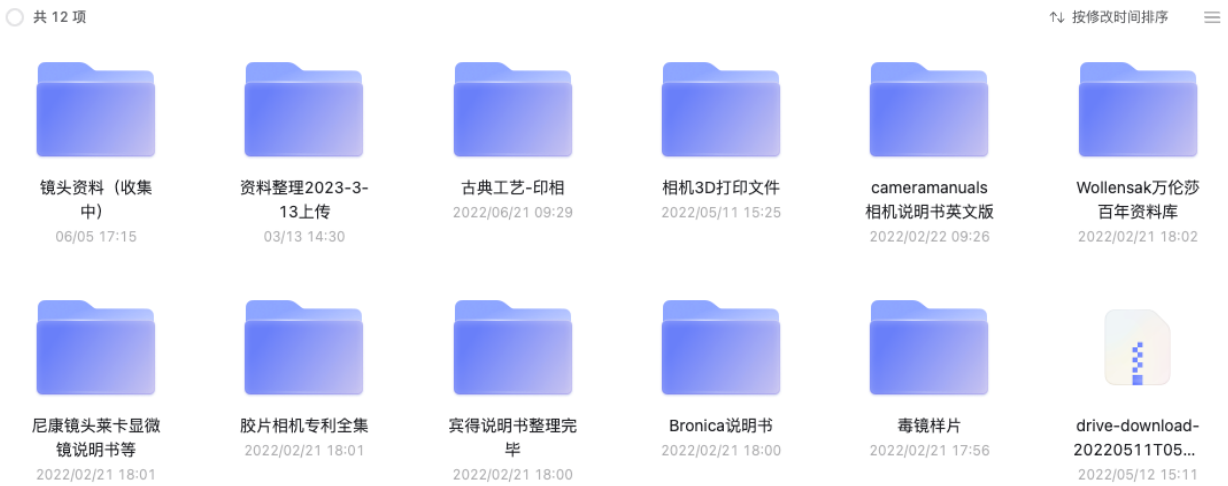

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