

Macro Photography Methods and Techniques

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Photo courtesy of
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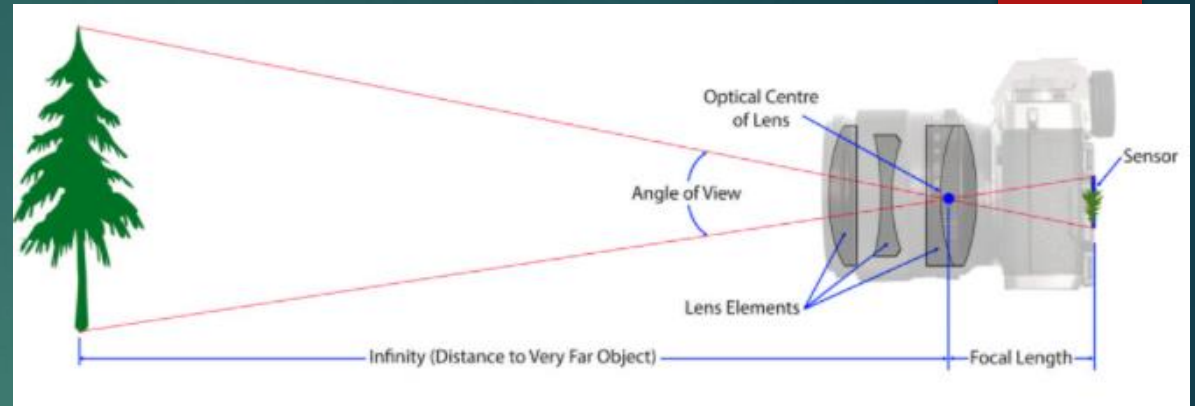
Disclaimers

1. I'm not an expert in macro photography, or anywhere close. I'm mostly going to talk about the **mechanics** of different ways to make high magnification images. I'll leave the **creativity** to someone else to teach.
2. I shoot with Micro 4/3 format sensors. Your own lens configuration options will probably yield different options, but the basic ideas will still apply
3. Some, but not all, of these techniques require special equipment, but it doesn't have to be expensive
4. Unless otherwise noted, the images are mine
5. Get messy, make mistakes! Electrons are cheap.

What is “Macro” Photography?

- ▶ Definition: a macro photograph is one in which the size of the subject on the negative or image sensor is life size or greater.
 - ▶ So, a 36 mm or smaller object filling the frame on a full-frame camera for 1.00 X
 - ▶ 23 mm for APS-C, 17 mm for four-thirds to get 1.00 X
- ▶ But, does the number really matter?
 - ▶ Many images are expanded on a monitor or print to well over 1X anyway
 - ▶ Macro techniques preserve full resolution in the detailed image
 - ▶ Image appearance is the real driver – is there enough area to show context?
 - ▶ Numbers can be handy in understanding and comparing your equipment options (see Characterization)

Terms



photography

- ▶ Focal Length: a design property of the lens; The distance, in millimeters, between the optical center of the lens and the camera's sensor (or film plane)
- ▶ Working Distance: the distance between the front of the lens and the subject; make sure you have enough distance to get light in there; longer WD means less disruption to live subjects
- ▶ Depth of Field: the range of working distance that is in focus; may depend on the aperture; some setups inherently have short DoF

Methods to Achieve Extreme Close-up Images

- ▶ Macro-designed Lens
- ▶ Digital Zoom (cropping)
- ▶ High Focal Length at Close Range
- ▶ Reversed Single Lens
- ▶ Reversed Double Lens
- ▶ Extension Tubes
- ▶ Maybe some others I haven't heard of

Macro-designed Lens

- ▶ “Macro” usually printed on the lens
- ▶ Tend to have long working distance
- ▶ Can have shallow depth of field
- ▶ Useful for other things as a prime lens
- ▶ Magnification is a function of distance
 - ▶ Smaller working distance (closer focus) means higher mag.
 - ▶ Use the focus ring to set the magnification, and focus by moving the camera closer and further away
- ▶ This example from Olympus has a dial for focusing ranges, and also directly to 1:1 (\$500)



Digital Zoom

- ▶ Also called cropping
- ▶ Not truly macro, because the resolution of the cropped image is much lower
- ▶ Has the overall effect of making the smaller section of the flower look bigger, though



High Focal Length Zoom at Close Range

- ▶ Again, not really macro, but you can approximate the effect up to a point
- ▶ This cicada (~4 cm long) was captured using a 100-400 mm zoom lens at 400 mm focal length and minimum working distance (952 mm); 0.30 X magnification
- ▶ Gives you incredible working distance for dangerous snakes, skittish bugs, etc.
- ▶ Also allows longer depth of field



400 mm Focal Length (uncropped)

Reversed Single Lens

- ▶ The lens mounts backwards on the camera
- ▶ Requires a special adapter (~\$10)
 - ▶ Camera mount to filter ring thread diameter
 - ▶ “Macro Reverse Ring”
 - ▶ This one is for 46 mm filter lenses
 - ▶ Can use step up/down rings to adapt to other lenses
- ▶ Focus by moving the camera closer/further from subject
- ▶ Works well with ancient film lenses
- ▶ Good working distance, wide range of magnifications



Reversed Double Lens

- ▶ Similar idea, but with the reversed lens mounted to the front of another lens
- ▶ Again, requires a special adapter for the filter threads of both lenses
- ▶ I couldn't find the adapter for sale, so I used electrical tape and step up/down rings
- ▶ I also needed to use adapters from OM film to 4/3 and to Micro 4/3 (40 year old film lenses)
- ▶ Again, focus by moving the camera forward and back
- ▶ Greater tendency to have a vignette, only a few combinations worked at all



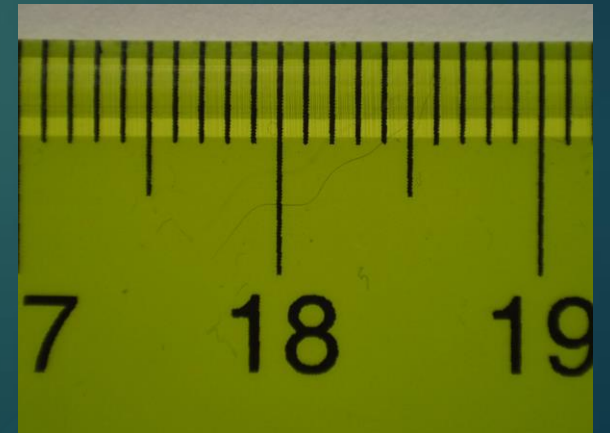
Extension Tubes

- ▶ Extension tubes specific to your camera mount
- ▶ Go between the lens and your camera, effectively increasing the focal length
- ▶ Can be combined to form a longer extension (to a point)
- ▶ They do not include any optics, but do include electrical feedthroughs for focusing, etc.
- ▶ Worked well to increase almost all combinations tried
- ▶ One or two combinations failed to focus



Characterizing Your Options

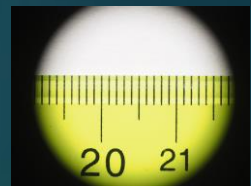
- ▶ You can photograph a ruler (or even just use Live View) to measure the width of the field
- ▶ Then divide the sensor width by the measurement in the field to get magnification
- ▶ Measure the working distance while you're at it
- ▶ This example is 1:1 macro for my 17 mm wide Micro 4/3 sensor
- ▶ Helps to compare setups available with your lenses and equipment
- ▶ A copy stand made this much easier to do quickly



Characterization Example

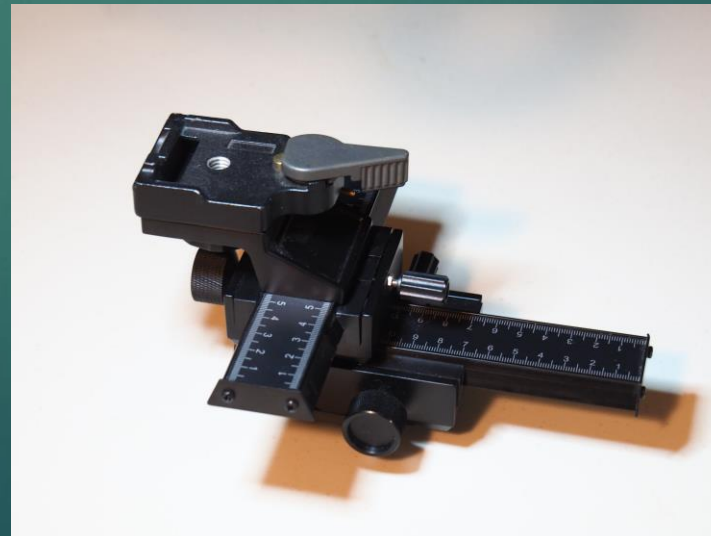
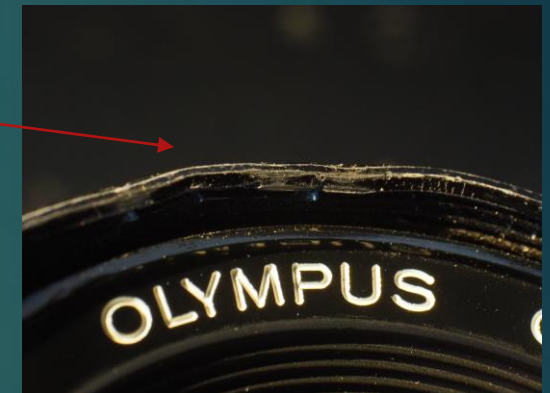
- ▶ I measured the magnification and working distance for 68 combinations
- ▶ This is a reduced sample of about half the list
- ▶ Easy to compare different setups, resulting mag., and working distance
- ▶ Up to 4.5 X magnification
 - ▶ Slight reduction in mag. gives longer working distance

Description	Ruler	Mag.	WD (mm)
14-42 zoom @ 14, Reversed, + 26 mm tube	3.8	4.47	20
28,f/2.0 Reversed on M40-150 on camera	4.3	3.95	30
14-42 zoom @ 14, Reversed, + 16 mm tube	4.7	3.62	20
14-42 zoom @ 14, Reversed, + 10 mm tube	5	3.40	20
14-42 zoom @ 18, Reversed, + 16 mm tube	6	2.83	22
14-42 zoom @ 18, Reversed, + 10 mm tube	7	2.43	22
M25, Reversed, + 26 mm tube	8	2.13	30
14-42 zoom @ 18, Reversed	8.5	2.00	24
M60 Forward + 26 mm tube	10	1.70	69
28,f/3.5 Reversed on M14-42 on camera	11	1.55	30 Severe vignette
M25, Reversed, + 10 mm tube	11.7	1.45	38
25, f/2 Reversed	12.5	1.36	50
M60 Forward + 10 mm tube	13	1.31	75
14-42 zoom @ 25, Reversed	15	1.13	38
28,f/3.5 + two adapters (26 mm) + 26 mm tube	16	1.06	25
28,f/2.0 + two adapters (26 mm) + 26 mm tube	17	1.00	20
M60 Forward	17	1.00	85
14-42 zoom @ 35, Reversed, + 10 mm tube	18	0.94	53
14-42 zoom @ 42, Reversed, + 16 mm tube	19.5	0.87	63
M25 Forward + 16 mm tube	20	0.85	28
14-42 zoom @ 42, Forward, + 26 mm tube	24	0.71	65
M25 Forward + 10 mm tube	28	0.61	38
70-300 Forward @ 300 + 26 mm tube	28	0.61	595
50 mm Reversed on 28, f/3.5 on camera	30	0.57	30 vignette
70-300 Forward @ 300 + 16 mm tube	31	0.55	627
70-300 Forward @ 300 + 10 mm tube	34	0.50	650
14-42 zoom @ 424, Reversed	35	0.49	100
70-300 Forward @ 300	38	0.45	700
M100-400 @100 + 26 mm tube	40	0.43	743
M100-400 @400 + 26 mm tube	41	0.41	200
14-42 zoom @ 35, Forward, + 10 mm tube	49	0.35	108
14-42 zoom @ 424, Forward, + 10 mm tube	52	0.33	132
M100-400 @400	57	0.30	925



Considerations/ Useful Gadgets

- ▶ Lighting
 - ▶ Getting light in with short working distance can be a problem
 - ▶ Ring lights are great; USB for portability
- ▶ Messed up filter ring threads may need fixing
 - ▶ I straightened these with a crab mallet and a dowel
- ▶ Focusing Rail (demo)
- ▶ Tripod
- ▶ Copy stand



Subjects

- ▶ Flowers
- ▶ Bugs
- ▶ Coins
- ▶ Mechanisms
- ▶ Seeds
- ▶ Dew drops
- ▶ Small animals – be careful

All images on this page from
<https://www.getolympus.com/us/en/lenses/m-zuiko-digital-ed-60mm-f2-8-macro.html>



Focus Stacking

- ▶ Taking images as you focus at different distances
 - ▶ Assemble them with software
- ▶ Can be done manually with great patience and care
 - ▶ Keep track of the area in focus as you move the camera in slowly
 - ▶ Focusing rail is a must
- ▶ Some cameras have this capability built in, including the stacking
 - ▶ Focus on the front of the subject, and set up a sequence
 - ▶ Camera changes the focus distance very slightly in preset increments
 - ▶ Holds the same subject to camera distance, so it must change the magnification slightly
- ▶ Why not just close the aperture?
 - ▶ Some setups won't allow this (no manual aperture control on digital lenses)
 - ▶ Tack-sharp focus at all points with focus stacking

Equipment

- ▶ Of course, most items will be tailored to your camera mount system, as opposed to Micro 4/3 for Olympus
- ▶ Reversing Ring: 49mm Filter Thread Macro Reverse Mount Adapter Ring, Micro Four Thirds M4/3 Cameras, [Amazon](#), \$11
- ▶ Step Up/Down Rings: K&F Concept 18 Pieces Filter Ring Adapter Set, [Amazon](#), \$25
- ▶ Extension Tubes: Mcoplus EXT-M4/3-M 10mm 16mm Automatic Extension Tube for Micro 4/3 System Camera, [Amazon](#), \$26
- ▶ Focusing Rail: Neewer Pro 4-Way Macro Focusing Focus Rail Slider/Close-Up Shooting, [Amazon](#), \$32
- ▶ USB Ring Light: Bekada LED Desk Light with Clamp for Video Conference Lighting, Clip on LED Ring Light for Computer Webcam, [Amazon](#), \$20