

# Close focus

**Close-up photography is very enjoyable and does not have to be costly. Canon's high performance double-element close-up 'D' lenses are relatively inexpensive and easy to use.**

There are some types of photography that seem suited for the summer months. Close-up photography is one – who can resist taking photos of flowers or insects on a balmy summer day?

You may think that macro and close-up photography are expensive genres. They certainly can be – a new macro lens plus a specialist flash unit like the Macro Twin Lite MT-24 EX can set you back well over a thousand pounds. Yet close-up photography doesn't have to be expensive. Natural light will serve just as well as flash in most situations, and a close-up lens is much less expensive than a macro lens.

## Close-up lenses

When is a lens not a lens? You may think that a close-up lens, like every other type of lens that Canon makes for EOS, attaches to your camera's lens mount. But a close-up lens is different – it screws into the filter thread of an existing lens just like a filter. For this reason they are also known as close-up filters or supplementary lenses.

In effect, a close-up lens is a high quality magnifying glass positioned in front of your existing lens. Canon makes two close-up lenses, the 250D and 500D (not to be confused with the EOS 500D camera).

## Optical quality

Close-up lenses are an economical way into macro photography, but as with most things photographic there can be a trade off – here it is with optical quality.

There are two types of close-up lens; those with a single element construction and those with a double element construction.

Single element lenses have one element that magnifies the image. They tend to suffer from chromatic aberrations and poor definition at the edges. Single element lenses are inexpensive and a good way of trying out close-up photography if you're on a budget or you just want to have some fun without worrying too much about image quality.

Double element close-up lenses have two



**Above** Canon's 250D close-up lens mounted on the end of the EF 50mm f1.4 lens.

Close-up lenses give the best results with prime and zoom lenses at 50mm and longer focal lengths.

elements. The second element corrects the chromatic aberrations of the first element. The image is sharper, especially at the edges, which is important if you're photographing flat objects like postage stamps or postcards. Double element close-up lenses are heavier and more expensive than single element lenses. The Canon 250D and 500D close-up lenses are both double element lenses (it's what the 'D' stands for).

The optical quality you get from a close-up lens also depends on which lens you use it with. The photos from Ernst Vikne, used to illustrate this article, were taken with either an EF 70-200 f2.8L or an EF 100-400mm f4.5-5.6L lens combined with a Canon 500D double element close-up lens. The image quality and detail are excellent.

## Benefits of close-up lenses

The most obvious benefit of close-up lenses is price – they are an economical way of trying out close-up photography. But they also have several other advantages over extension tubes, macro lenses, and reversed lenses – the other most common ways of taking macro photos.

- **There is no light loss** Extension tubes and macro lenses suffer from light loss as the lens approaches its minimum focusing distance. With close-up lenses, you can use a faster shutter speed or a wider aperture with a lower ISO.
- **Autoexposure metering and autofocus is retained** The reverse lens technique breaks electrical contact with the lens, making it more difficult to set the lens aperture.
- **They are smaller and lighter than macro lenses and extension tubes** Close-up lenses are easy to store in a gadget bag or pocket, ready for immediate use.
- **They work well with zoom and telephoto lenses** Close-up lenses give more magnification at longer focal lengths. Extension tubes give more magnification with shorter focal lengths. The decision on which to buy may depend on the focal lengths of the lenses you already own.
- **They are easy to use** There are no complex techniques to learn – you just screw the close-up lens into the filter thread of the lens on your camera.



**Above** Six-spot burnet moth. The image above shows the full image captured by the camera. However, it is very easy to crop and print digital images, giving the effect of even greater magnifications (main photo). EOS 5D Mk II, EF 70-200mm f2.8L IS USM lens set to 200mm and with 500D close-up lens attached. 1/160 second, f10, ISO 800.

ERNST VIKNE

# How close can I go?



Brimstone Moth on a thistle. EOS 5D Mk II, EF 70-200mm f/2.8L IS USM lens set to 200mm and with 500D close-up lens attached. 1/200 second, f11, ISO 400.

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## Comparing lenses

Just how close can you get with close-up lenses? We started by comparing the Canon EF 50mm f1.4 and EF 85mm 1.8 lenses. The 85mm has a minimum focusing distance of 85cm, which means that it doesn't get very close by itself. But with a 500D or 250D close-up lens, you can get much closer.

The photos taken with the 50mm lens show that you don't get the same level of magnification as the 85mm lens with the close-up lenses. This is why close-up lenses work best with short to medium length telephoto lenses.

We also took some photos with the Canon EF-S 60mm f2.8 macro lens. You can get much closer with this lens, especially when combined with one of the close-up lenses. With regard to image quality we couldn't tell the difference between the photo taken with the 60mm macro lens and the 85mm lens with a 250D close-up lens. The macro lens required two stops more exposure to cope with light fall off at such short focusing distances.

### Macro zoom

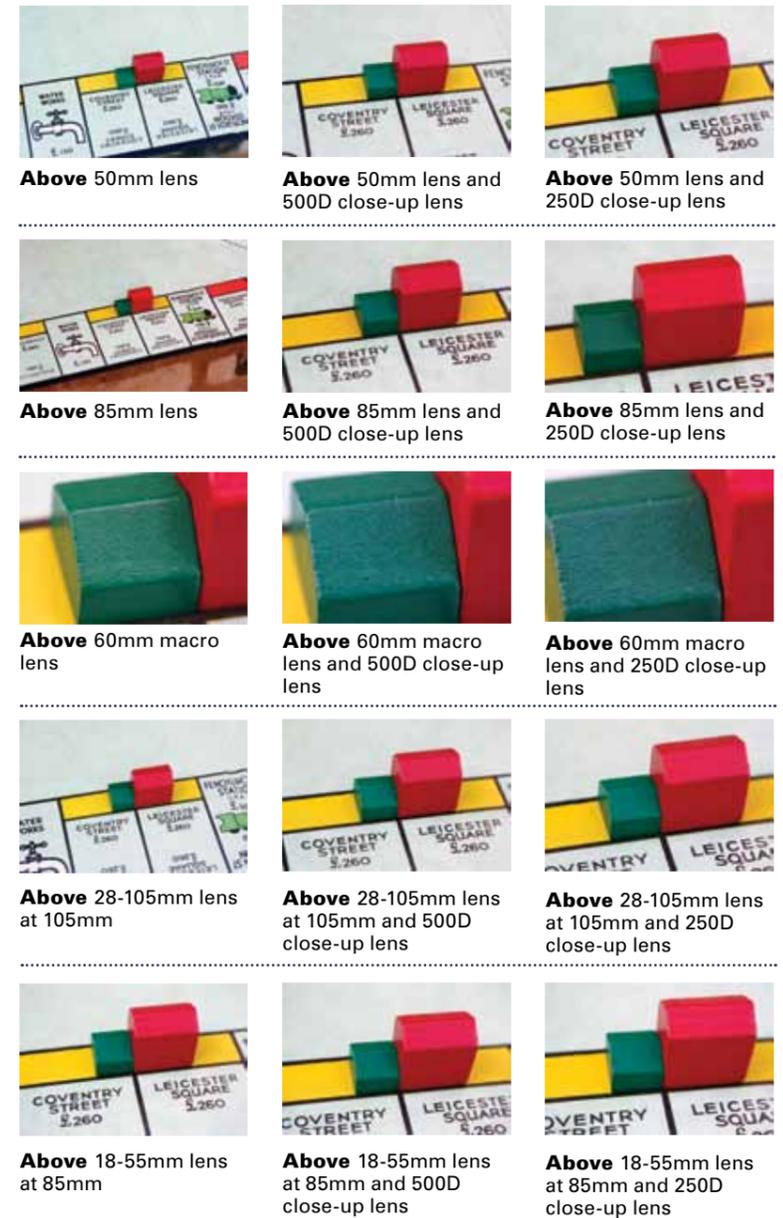
Then we took some photos with a Canon EF 28-105mm f3.5-4.5 II lens. This zoom lens says 'Macro' on the side, but it's not true macro (which would be a 1:1 reproduction). The use of the word macro by Canon simply indicates that the lens can focus quite closely, in this case 50cm from the subject. The photos from this lens weren't as sharp as the others, which is to be expected (prime lenses give sharper images with close-ups).

Finally we took some photos with a Canon EF-S 18-55mm kit lens. This lens doesn't have a dedicated manual focus ring, making it a little harder, but still possible, to use manual focus.

Another difference we noticed between the lenses is that the 50mm and 85mm primes were easier to use because the lenses have wider maximum apertures and the viewfinder image is brighter. The 60mm macro and 24-105mm zoom were more difficult to focus (all focusing was done manually).

### Conclusion

The conclusion? The results from using a close-up lens and the prime 50mm and 85mm lenses with close-up lenses were as good as those from the 60mm macro. However, the 60mm macro lens gave the most magnification. For even more magnification you can combine the close-up lenses with extension tubes or, if you have one, a true macro lens like the 60mm macro.



Above 50mm lens

Above 50mm lens and 500D close-up lens

Above 50mm lens and 250D close-up lens

Above 85mm lens

Above 85mm lens and 500D close-up lens

Above 85mm lens and 250D close-up lens

Above 60mm macro lens

Above 60mm macro lens and 500D close-up lens

Above 60mm macro lens and 250D close-up lens

Above 28-105mm lens at 105mm

Above 28-105mm lens at 105mm and 500D close-up lens

Above 28-105mm lens at 105mm and 250D close-up lens

Above 18-55mm lens at 85mm

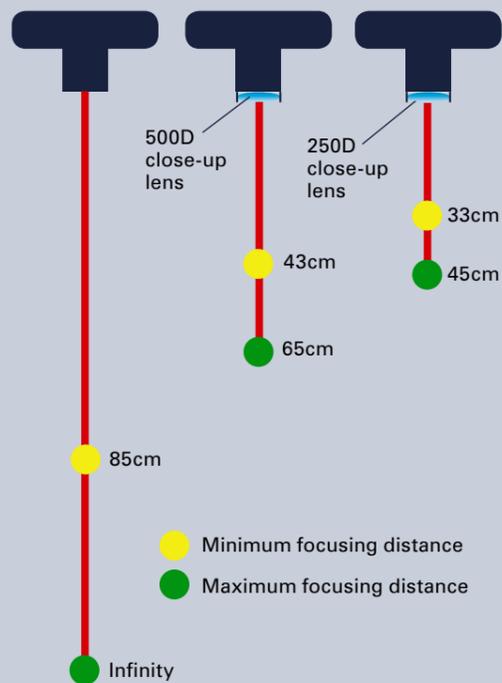
Above 18-55mm lens at 85mm and 500D close-up lens

Above 18-55mm lens at 85mm and 250D close-up lens

### Getting closer

A regular camera lens is limited by its minimum focusing distance. Close-up lenses reduce the minimum focusing distance, allowing you to move the camera closer to the subject and obtain greater magnification.

This diagram shows what happens when you use an EF 85mm f1.8 lens with a 500D or 250D close-up lens. The close-up lens reduces both the minimum and maximum focusing distances of the 85mm lens. These figures will change depending on the lens used with the close-up lenses.



Close-up lenses work by decreasing the minimum focus of your lens. With a close-up lens fitted you can move the camera lens closer to your subject and gain a higher level of magnification.

### Focusing distances

The minimum focusing distance of the Canon EF 85mm f1.8 lens, used for some of the comparison photos in this article, is 85cm. It cannot focus on anything closer than that distance. Its maximum focusing distance is infinity – the same as all Canon EF lenses.

Attaching a 500D close-up lens to the front of the lens reduces the minimum focusing distance to 43 cm. Moving the lens closer to the subject makes the subject appear larger in the frame. The maximum focusing distance is also reduced – from infinity to 65cm. The lens cannot focus on anything further than 65cm from the sensor plane.

A 250D close-up lens reduces the minimum and maximum focusing distances even further. The lens can now only focus on objects between 33cm and 45cm from the camera.

## Camera lens limitations

If all a close-up lens does is decrease your the minimum focusing distance of your camera lens, then why does your lens not have this capability in the first place? Turn the focusing ring on your camera lens and you will see that the front element extends as the distance between the sensor plane and the focal point decreases.

The minimum focusing distance is reached when the front element is fully extended. It could be decreased by allowing the front element to move further forward. But doing so creates its own problems. Non-macro lenses are optimised for optical performance at regular focusing distances. Quality decreases as you move the lens closer to your subject. Macro lenses are optimised for close-up performance. They contain a group of moving elements which change position to ensure sharp photos all the way through the focusing range. This design makes the lens more expensive to make, and impractical to include on all lenses.

## Magnification with EF lenses



Magnification and closest focusing distance are always included in the specifications of Canon lenses. The EF 50mm f1.8 lens, for example, can focus as closely as 45cm, giving a magnification of 0.15x.

This simply means that the subject is reproduced at roughly 1/7th of its actual size. Attaching a 250D close-up lens to the 50mm camera lens reduces the minimum focusing distance of the lens and gives a magnification of 0.35x, or 1/3rd of the subject's size.

The effect is much greater with telephoto lenses. Canon's EF 100-400mm f4.5-5.6L lens has a minimum focusing distance of 1.8 metres and a magnification of 0.2x – not much greater than the 50mm lens. But add a 500D close-up lens and the magnification increases to 0.8x – much closer to true macro photography.

### Calculating magnification

How is magnification calculated? Simply divide the focal length of the camera lens by the focal length of the close-up lens. Conveniently, the focal length of the close-up lens is the number used to identify it. So if you are using a 50mm lens with the 250D close-up lens, the magnification is 50/250, or 0.2x.

This figure is for when the lens is focused at infinity. Magnification is greater at closer focusing distances. Unfortunately, as different lenses that share the same focal length have varying minimum focusing distances, there is no formula for working out the magnification. But the information for some common Canon lenses is provided in the table on the right.

**Above** Emerald Damselfly. The low noise capabilities of the EOS 5D Mk II make it easy for the photographer to work at a high ISO. EOS 5D Mk II, EF 70-200mm f/2.8L IS USM lens set to 200mm and with 500D close-up lens attached. 1/160 second, f7, ISO 800.

### Table

This table provides a comparison of the normal maximum magnification for a selection of EF lenses and the increased magnification possible with the addition of a Canon close-up lens.

All values are for the lens set to its closest focusing position. For zoom lenses, the maximum focal length is set. The Type 250D lens is not available in the required filter mount size for some of the EF lenses.

Lens	Normal	Type 250D	Type 500D
EF50mm f/1.4	0.15x	0.35x	0.25x
EF50mm f/1.8 II	0.15x	0.35x	0.25x
EF50mm f/2.5 Macro	0.50x	0.68x	0.59x
EF85mm f/1.8	0.13x	0.50x	0.31x
EF100mm f/2	0.14x	0.57x	0.35x
EF100mm f/2.8 Macro	1.00x	1.41x	1.21x
EF135mm f/2.8	0.12x	0.70x	0.41x
EF200mm f/2.8L	0.16x	-	0.57x
EF300mm f/4L	0.13x	-	0.70x
EF400mm f/5.6L	0.11x	-	0.91x
EF35-80mm f/4-5.6 III	0.23x	0.49x	0.36x
EF35-105 f/4.5-5.6	0.16x	0.60x	0.37x
EF35-135mm f/4.5-5.6	0.15x	0.54x	0.32x
EF35-350mm f/3.5-5.6L	0.25x	-	0.70x
EF70-200mm f/2.8L	0.16x	-	0.55x
EF70-200mm f/2.8L IS	0.17x	-	0.56x
EF70-210mm f/3.5-4.5	0.17x	0.85x	0.51x
EF75-300mm f/4-5.6 II	0.25x	1.54x	0.89x
EF80-200mm f/4.5-5.6 II	0.16x	0.99x	0.57x
EF100-300mm f/5.6L	0.26x	1.59x	0.92x
EF100-300mm f/4.5-5.6	0.26x	1.22x	0.70x
EF100-400mm f/4.5-5.6L IS	0.20x	-	0.80x

## Close-ups and depth-of-field

One thing you will notice straight away when you're looking through your camera's viewfinder is that in close-up photography you don't have much depth-of-field. The closer you get, the less depth-of-field you have. The image you see in your viewfinder is at the maximum aperture of the lens, so if you are using a lens with a wide maximum aperture of f1.2 to f2, you will see an image with much smaller depth-of-field than if you are using a lens with a maximum aperture of f4 or f5.6.

Regardless of which lens you use, expect to have to stop down to around f8 or more to get a reasonable amount of depth-of-field. Even at these small apertures you won't get back to front sharpness.

This means that you may need to use a high ISO of 800 or 1600 in order to get both reasonable depth-of-field and a fast enough shutter speed to take a photo without camera shake, especially if you are using natural light rather than flash. Don't worry too much about this, you may be surprised at the image quality you can get even at high ISOs. The out-of-focus parts of the photo can take on a pleasing 'painterly' aspect.

**Right** Odd things can happen at wide apertures in close-up photography. The top photo was taken at f1.8; the depth-of-field was so narrow the entire photo appears out of focus. It took an aperture of f4 (bottom) to get a sharp image. Both photos taken with an 85mm lens with a 250D close-up lens attached.



**Above** These three photos were taken with a Canon EF 85mm f1.8 lens fitted with a 500D close-up lens. They show not only the difference in depth-of-field as the aperture gets smaller, but the necessity of

increasing ISO at the same time to maintain a shutter speed suitable for taking a sharp image. Light levels were low as the photo was taken in the shade, in the late evening. Which aperture is best? That

depends on your subject and the look you prefer. If you have a digital camera there's no harm in shooting a variety of photos at different settings then making up your mind when you look at the results on your computer.

### Natural light

Summer is a good time for taking macro and close-up photos. Not only are the birds and insects out but there is plenty of light, which makes taking photos in natural light much easier.

Try to avoid taking photos in direct sunlight. The high contrast levels make it difficult to record all the tones and you will get distracting highlights in the background. Try taking photos at a time of day when your subject is in the shade. You can also create shade by positioning your body between your subject and the sun.

Another good time for taking close-up and macro photos is at the beginning or end of the day, when the sun is low in the sky. The light is warm and soft at these times. You can experiment with backlighting to create photos with a rim of warm light around the subject.

**Right** Two photos taken within a few seconds of each other. The first (top) was taken in direct sunlight. The contrast is too high to get a good photo in these conditions. For the second photo (bottom) the photographer put his body between the sun and the flower so that the flower was in shade, and looked for a flower with a clean background behind it. Both photos taken with an 85mm lens fitted with a 250D close-up lens.



## Close-up technique



### Manual focus

Focusing is a key skill in close-up photography, and it's normally best done manually. Try this exercise. Switch your camera lens to manual focus and set the focus ring to the minimum focusing distance. Now choose a subject, such as a flower, and move your camera towards it until the flower is in focus. If you do this without a close-up lens, you will see how closely you can focus with the lenses you already have.

Now, attach a close-up lens to the front and try the same exercise. You will be able to get a lot closer to your subject. Fine tune focus by moving your body closer or further away from your subject. This is how professional macro photographers work.

### Telephoto lenses

Camera lenses with longer focal lengths are best for macro and close-up photography as you can take photos further away from your subject. Lenses with shorter focal lengths require you to be closer, blocking the light and potentially scaring away animals or insects.

### Close-up photography

A close-up photo is one where the subject is recorded somewhere between its actual size (life size) and one-tenth of its size on the sensor (or film).

### Macro photography

Strictly speaking, this gives images that are life-size or larger on the sensor or film. However, the term is often used to refer to close-up photography. The Canon MP-E65 is a specialist macro lens that gives a magnification of up to 5x life size.

### Image sharpness

Camera shake is always an issue with close-up photography as the effect of camera shake is magnified at higher magnifications.

It seems logical to mount your camera on a sturdy tripod. But in practice if you are photographing insects or flowers you will probably find that a tripod gets in the way. A tripod only helps if your subject is stationary.

Another approach is to hand-hold the camera. This makes it much easier to move around and search for different angles. Even a small adjustment of position can make a big difference to a close-up photo. However, you will need to make sure you're using a high enough shutter speed to avoid the effects of camera shake (an image stabiliser lens will help).

The shutter speed you need depends on the lens you're using, the magnification of the close-up lens and how steady your grip is – the more magnification your set-up gives you the harder it is to hand-hold. Experiment by taking a series of photos at different shutter speeds, but expect to have to use a shutter speed of at least 1/125 second.

A monopod offers the best of both options. It gives you the manoeuvrability of hand-holding, but makes supporting the camera much easier, especially at high magnifications. It's the method we prefer.



**Above** Hand-holding the camera is a good approach to outdoor close-up and macro photography as it gives you the flexibility to move around and find the best angle. A monopod will help keep the camera steady.

## Case study - Ernst Vikne

### What kind of things do you like to take close-up photos of, and how does the 500D close-up lens help you?

I photograph all kinds of interesting small things that I discover when I am out in nature, mostly insects and plants. The 500D close-up lens helps me to get much closer to the subjects when using a telephoto zoom lens, which increases the magnification.

### Have you experimented with other close-up or macro techniques (such as using extension tubes or macro lenses)?

I have tried Canon's 60mm and 100mm macro lenses. The advantage with the close-up lens is that it is very easy to carry in my pocket when I'm out shooting with a telephoto lens. I prefer not to change the main lens when I am outdoors to prevent dust getting into my camera. Until recently there was no dedicated Canon macro lens with built-in image stabilisation, so I've welcomed the opportunity to try the recent EF 100mm f2.8L Macro IS USM. A disadvantage is the heavy weight (625g). The magnification and image quality with IS zoom lenses are not quite as good as a real macro lens, but are very acceptable.

### Which camera lenses do you use with your 500D close-up lens?

I have used the 500D close-up lens together with my EF 70-200mm f2.8L IS USM and EF 100-400mm f4.5-5.6L IS USM. At 400mm the magnification is very close to life-size (1:1).

### Briefly describe the techniques you use to take photos with the 500D close-up lens?

When I am using the 500D close-up lens together

with my 70-200mm lens I usually want as much magnification as I can get. To achieve this, I set the zoom to 200mm, and use manual focus, which is set to the closest possible focusing distance. While I look in the viewfinder, I move the camera gently towards and away from the subject until I've achieved focus the way I want. I usually hold my breath while I do this to avoid camera shake. Together with the heavy weight of the camera and the big lens, this often makes me completely exhausted when I have taken a photo!

### Do you use flash or natural light in your close-up photos?

With the exception of some shots in my garden with a LumiQuest softbox on the flash (good results, but big and clumsy for this use), I have only used natural light for my outdoor close-up shots. I don't use a tripod – my close-up shooting style is more impulsive than well planned.

### In natural light, what shutter speeds do you use to get camera-shake free images?

I mostly use the camera on aperture-priority (Av) with Auto ISO. Usually I don't have the time to fiddle with manual settings when I'm shooting restless insects. I've got good results with a 1/160 second shutter speed at a focal length of 200mm and image stabilisation on. Usually I set the aperture somewhere between f5.6 and f22, depending on the available light (so the ISO doesn't get too high) and how much depth-of-field I want. F11 is a good starting point.

You can see more of Ernst Vikne's beautiful close-up photos at [www.flickr.com/photos/iboy/sets/72157621974336364/](http://www.flickr.com/photos/iboy/sets/72157621974336364/)

## Canon close-up lenses

You can buy close-up lenses made by third-party manufacturers in the camera stores, as well as Canon's 250D and 500D close-up lenses. The D stands for double element, and the number tells you the focal length of the close-up lens in millimetres. The 250D close-up lens gives twice as much magnification as the 500D.

If you buy close-up lenses from a camera shop the magnification is often quoted in dioptres, the same unit used in spectacle prescriptions. The higher the dioptre rating, the greater the magnification. For comparison

Type	Dioptres	Size (filter diameter)*	Suggested retail price**	Weight	Use with focal lengths
Canon 250D	+4	52mm	£79.99	55g	50mm to 135mm
		58mm	£109.99	80g	
Canon 500D	+2	52mm	£79.99	40g	70mm to 300mm
		58mm	£99.99	60g	
		72mm	£149.99	120g	
		77mm	£179.99	145g	

\* Stepping rings can be used to adapt close-up lenses to camera lenses with smaller filter mounts

\*\* Dealer price is normally less

purposes, the 500D close-up lens has the same magnification as a +2 dioptre lens and the 250D the same as +4 dioptre lens.

Close-up lenses are often sold in kits with three or four lenses of different strengths. You can combine close-up lenses for larger magnifications (a +4 dioptre close-up lens combined with a +3 dioptre lens gives you a total magnification of +7 dioptres), but with a subsequent loss of image quality from the combined aberrations of both lenses. Canon also made single-element close-up lenses which have since been discontinued – the 240, 250, 450 and 500 close-up lenses.



**Above** The photo (at 100% magnification) taken with a single element close-up lens (left) has chromatic aberrations around the white petal. A photo taken with a Canon 250D close-up lens (right) shows no chromatic aberrations at all.