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# High-power eyepieces

## Martin Mobberley sets his sights on high-power eyepieces and puts eight through their paces

Eyepiece design has come along in leaps and bounds since the late 1970s, largely because of the birth of Tele Vue. Its founder, Al Nagler, brought his experience in designing Moon landing simulators to the amateur astronomy world when he left NASA. Around the same time the short focus Dobsonian revolution provided a need for new and better eyepieces, and Nagler's Tele Vue company was perfectly positioned to start a quality eyepiece revolution of its own.

Thirty years ago orthoscopic eyepieces used to be the benchmark for high-power observing with lots of magnification. Only the trusty Erfle had what could be called a wide field of view as well. Now things are different and there are quite a few eyepieces that combine high magnification with a wide field of view.

Essentially though, the cost of a high-power eyepiece is largely determined by three factors. First is that field of view – do you feel like you are floating in space or looking down a tunnel? Second, how sharp is the view, right across the field? And finally, how much eye relief is there – how far from the optimum position can you place your eye without the field of view disappearing at the edges? In this test, we reveal which eyepiece best fulfils these functions.

With the right eyepiece it's possible to feel like you're walking in space



## How we tested

### EYE RELIEF

The further you can move your eye back from the optimum position and still see the whole field the better, especially for spectacle wearers.

### EYE SHADE

Is there an eye shade or cup to keep out stray light? Is it fixed or is it a twist-up design, and does it exclude stray light from the edge of your visual field?

### BULK

How heavy and physically large is the eyepiece? High-power eyepieces do not need to be massive.

### OPTICS

Do the optics deliver crisp views in the centre, and how good is the view at the edge of the field? Is the field as wide as advertised, and are the optical coatings doing their job?

### ERGONOMICS

How does the eyepiece feel in the dark? Is it slippery, or is there a good solid rubber grip and a safety notch to prevent it falling out of the drawtube?



We compared the eyepieces at around 200x magnification using an Orion Optics 250mm f/6.3 Newtonian telescope. We then double-checked them, at around 45x magnification, using a Takahashi FS-60C f/5.9 refractor.

Next, we confirmed the true field of view of each eyepiece by timing the drift of a star across the field with the drive switched off. We then used this and the known magnification to verify the apparent field, or what you'd actually see through the eyepiece, using a bit of maths: apparent field equals true field x magnification.

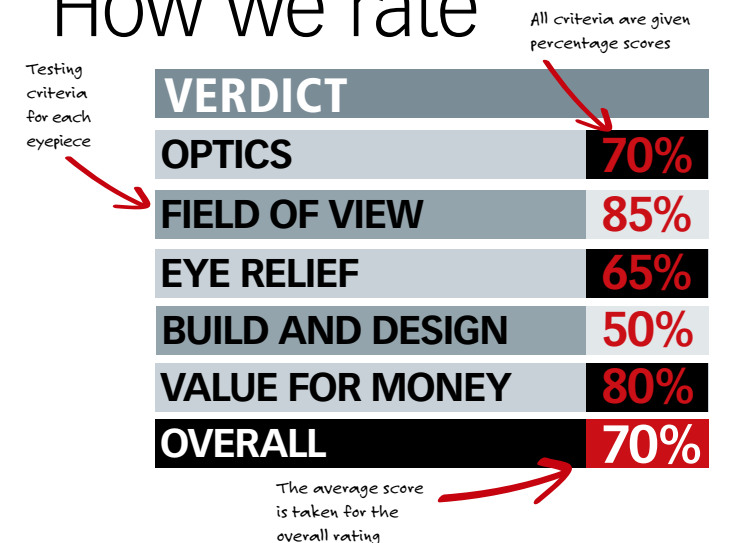
We also used the true field of view to generate charts for each

eyepiece, showing how the area of sky you see changes depending on the focal length of the telescope.

Saturn and the first quarter Moon provided an excellent test for all the eyepieces. We paid close attention to the sharpness of stars across the field and to the eye relief. In our ratings, an eye relief of 65 per cent was satisfactory, over 75 per cent was good, and over 90 per cent was very good. Near to the lunar limb, we looked for evidence of ghost images or colour fringing, which would indicate poor quality.

Finally, in Moon-free skies, we compared the limiting magnitude, or the faintest stars we could see, using the different eyepieces.

## How we rate



# Group test

HIGH-POWER EYEPIECES UNDER £270

## Sky-Watcher 8mm SWA

### VITAL STATS

- **PRICE** £89
- **FOCAL LENGTH** 8mm
- **FIELD DIAMETER** 70°
- **WEIGHT** 474g
- **MANUFACTURER** Sky-Watcher
- **SUPPLIER** The Widescreen Centre
- **TEL** 0207 9352580
- **WWW** widescreen-centre.co.uk

**FOR** A good value eyepiece  
**AGAINST** Huge and heavy

### VERDICT

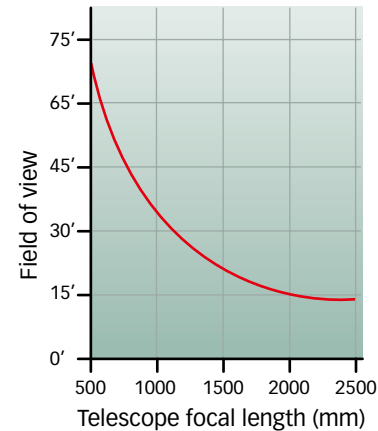
<b>OPTICS</b>	<b>70%</b>
<b>FIELD OF VIEW</b>	<b>85%</b>
<b>EYE RELIEF</b>	<b>65%</b>
<b>BUILD AND DESIGN</b>	<b>50%</b>
<b>VALUE FOR MONEY</b>	<b>80%</b>
<b>OVERALL</b>	<b>70%</b>

The Sky-Watcher 8mm SWA is an unusual newcomer to the high-power, wide-field market. It fits both 1.25-inch and 2-inch drawtubes by virtue of its two-stage barrel diameter, a design initially offered by Tele Vue 20 years ago. However, there is really no optical need to have such a massive barrel on an 8mm focal length 70° eyepiece. You only need a barrel bigger than 1.25 inches in diameter when the focal length is above 20mm. As a result, the eyepiece is unnecessarily large, and very heavy for its focal length, weighing in at just under half a kilo.

The Sky-Watcher had to be racked into focus much further than any of the other eyepieces tested – almost 15mm further in towards the Newtonian tube than

the Tele Vue Nagler. This was largely a consequence of its huge size.

Like the Meade eyepiece, the Sky-Watcher has an adjustable twist-up hard rubber eyeguard which you adjust to the optimum position for best eye relief. The field of view was a wide 70°, as advertised, and the field was very crisp in the centre, but it deteriorated notably at the edges. This does the job, and is good value, but it is uncomfortably bulky for an 8mm eyepiece.



## Meade 5000 Series 6.7mm Ultra Wide

### VITAL STATS

- **PRICE** £147.99
- **FOCAL LENGTH** 6.7mm
- **FIELD DIAMETER** 82°
- **WEIGHT** 273g
- **MANUFACTURER** Meade
- **SUPPLIER** Telescope House
- **TEL** 01892 550100
- **WWW** telescopehouse.co.uk

**FOR** 'Spacewalk' experience  
**AGAINST** Eye relief at 82°

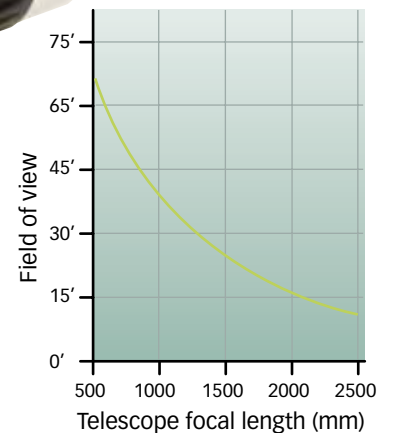
### VERDICT

<b>OPTICS</b>	<b>90%</b>
<b>FIELD OF VIEW</b>	<b>100%</b>
<b>EYE RELIEF</b>	<b>70%</b>
<b>BUILD AND DESIGN</b>	<b>80%</b>
<b>VALUE FOR MONEY</b>	<b>80%</b>
<b>OVERALL</b>	<b>84%</b>

This was the highest power eyepiece tested. It may seem like splitting hairs when comparing a 6.7mm to a 7mm or 8mm focal length, but the Meade definitely provided that little extra bit of magnification. It was quite noticeable, even next to the 7mm models.

This is an attractive, compact, and fairly light eyepiece with a slightly bulbous top end. Like the Nagler 7mm, the apparent field of view was huge at 82°. You have to slam your eye right up to the lens to see the whole field because it's so wide. So even though the eye relief is pretty good, under our strict criteria it is only 'fair'. If you wear glasses the whole field isn't accessible.

Eye relief is quoted as 15.7mm, but it was not anywhere near the top-scoring Vixen in this category, even for the central 65°. The Meade



ocular features an adjustable twist-up rubber eyeguard, similar in principle to the enormous Sky-Watcher one, but much more manageable and compact.

The field was very crisp in the centre, with slight deterioration near the edge. This is a nice, light ultra-wide field eyepiece that's not too expensive.

## Vixen Lanthanum LVW-8mm

### VITAL STATS

- **PRICE** £187
- **FOCAL LENGTH** 8mm
- **FIELD DIAMETER** 65°
- **WEIGHT** 447g
- **MANUFACTURER** Vixen
- **SUPPLIER** Orion Optics
- **TEL** 01270 500089
- **WWW** orionoptics.co.uk

**FOR** Exceptional eye relief  
**AGAINST** Heavy bit of kit

### VERDICT

<b>OPTICS</b>	<b>95%</b>
<b>FIELD OF VIEW</b>	<b>80%</b>
<b>EYE RELIEF</b>	<b>100%</b>
<b>BUILD AND DESIGN</b>	<b>90%</b>
<b>VALUE FOR MONEY</b>	<b>85%</b>
<b>OVERALL</b>	<b>90%</b>

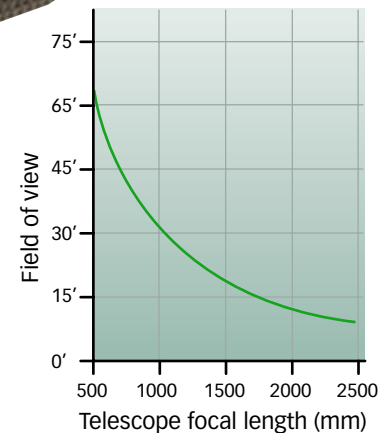
Vixen has an excellent reputation for quality astronomical optics and this Japanese-manufactured ocular does not disappoint. Due to the eight-element construction, this is another heavy eyepiece, but with a 1.25-inch barrel it is nowhere near as cumbersome as the Sky-Watcher.

The 65° field will be more than enough for most users, but the real advantage of this ocular is how comfortable it is to use, even if you're wearing glasses. The Vixen LVW range boasts a long 20mm of eye relief, which is achieved by having more optical elements in the light path. Some of the other pricey eyepieces boasted 15mm or 16mm of eye relief, but we found that they came nowhere near the Vixen.

On faint objects there was the

merest suggestion of less light transmission than some of the other eyepieces, but the field of view was razor sharp almost to the very edge, where distortion (coma) from the Newtonian scope came into play.

If you place observing comfort at the top of your list this eyepiece will never disappoint, especially if you wear glasses. The only downside is the weight.



## Tele Vue Nagler 7mm Type 6

### VITAL STATS

- **PRICE** £235
- **FOCAL LENGTH** 7mm
- **FIELD DIAMETER** 82°
- **WEIGHT** 221g
- **MANUFACTURER** Tele Vue
- **SUPPLIER** Telescope House
- **TEL** 01892 550100
- **WWW** telescopehouse.co.uk

**FOR** 'Spacewalk' experience  
**AGAINST** Eye relief and price

### VERDICT

<b>OPTICS</b>	<b>90%</b>
<b>FIELD OF VIEW</b>	<b>100%</b>
<b>EYE RELIEF</b>	<b>70%</b>
<b>BUILD AND DESIGN</b>	<b>90%</b>
<b>VALUE FOR MONEY</b>	<b>70%</b>
<b>OVERALL</b>	<b>84%</b>

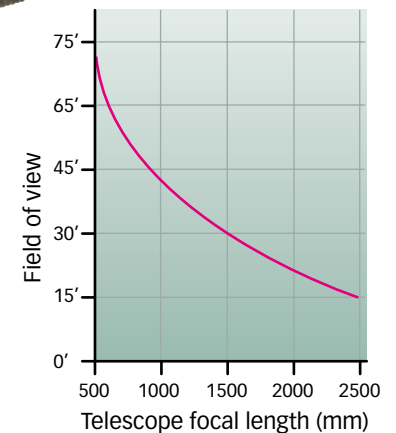
Tele Vue Nagler eyepieces have set the standard for the past 25 years and this 7mm is a lightweight gem. It goes head-to-head with the Meade 6.7mm in this test. The Nagler also has an 82° 'spacewalk' field, which should not come as a shock, as Naglers were the first amateur astronomers' eyepieces to go that wide when they were introduced in 1982.

The Nagler is even lighter and more compact than the Meade and it features a non-adjustable rubber eyecup, which works well. Tight fitting caps protect the eyepiece at both ends when in use and the eye lens cap fits exactly – the Meade cap is loose by comparison.

In terms of eye relief the quoted figure is 12mm. However, we could not discern any difference between the Nagler's eye relief and the

allegedly longer eye relief of the Meade. With its massive field you need your eye close to see it all, hence our eye relief rating of 'fair'.

Trying to split the Nagler and the Meade in performance terms was a tall order, especially as the Meade gave a slightly higher magnification. The Nagler is physically smaller and much neater, but it costs 30 per cent more, which may be a deciding factor.



# Group test

HIGH-POWER EYEPIECES UNDER £270

## Celestron X-Cel 8mm

### VITAL STATS

- ▶ **PRICE** £59
- ▶ **FOCAL LENGTH** 8mm
- ▶ **FIELD DIAMETER** 55°
- ▶ **WEIGHT** 194g
- ▶ **MANUFACTURER** Celestron
- ▶ **SUPPLIER** David Hinds
- ▶ **TEL** 0845 2604770
- ▶ **WWW** celestron.uk.com

**FOR** Exceptional value  
**AGAINST** Field of view

### VERDICT

<b>OPTICS</b>	<b>85%</b>
<b>FIELD OF VIEW</b>	<b>45%</b>
<b>EYE RELIEF</b>	<b>90%</b>
<b>BUILD AND DESIGN</b>	<b>80%</b>
<b>VALUE FOR MONEY</b>	<b>95%</b>
<b>OVERALL</b>	<b>79%</b>

The Celestron X-Cel range of eyepieces are highly affordable upgrades from the standard Plössl design of eyepiece supplied with its telescopes.

The improvement gives you a 5° wider field of view, up to 55°, and very good eye relief despite using a six-lens element design, rather than the heavier eight-lens element design of the Vixen LVW.

However, the Vixen has a 10° wider field, or 40 per cent more area coverage.

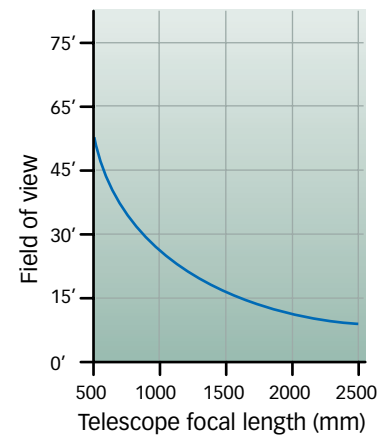
With a field of view of only 55°, the X-Cel 8mm is not in the same league as the other eyepieces tested here. The Celestron only covers 45 per cent of the area that the Meade and the Nagler would.

However, the eyepiece is very attractive for a variety of reasons. Firstly, the central field is very



sharp and well suited to high-power work. Secondly, spectacle wearers will appreciate the eye relief and soft eyecup. Thirdly, it was the lightest eyepiece tested. And fourthly, the eyepiece is parfocal with all the others in the X-Cel range, so swapping eyepieces involves virtually no refocusing. It is also great value for money at only £59.

If you have a tight budget, this is the best high-power eyepiece for you.



## Pentax 7mm XW

### VITAL STATS

- ▶ **PRICE** £269.99
- ▶ **FOCAL LENGTH** 7mm
- ▶ **FIELD DIAMETER** 70°
- ▶ **WEIGHT** 387g
- ▶ **MANUFACTURER** Pentax
- ▶ **SUPPLIER** Green Witch
- ▶ **TEL** 01954 211288
- ▶ **WWW** greenwich-observatory.co.uk

**FOR** Overall quality  
**AGAINST** Very expensive

### VERDICT

<b>OPTICS</b>	<b>95%</b>
<b>FIELD OF VIEW</b>	<b>86%</b>
<b>EYE RELIEF</b>	<b>92%</b>
<b>BUILD AND DESIGN</b>	<b>97%</b>
<b>VALUE FOR MONEY</b>	<b>65%</b>
<b>OVERALL</b>	<b>87%</b>

Pentax has an enviable reputation for manufacturing top quality optics, albeit traditionally in the camera lens market. More recently it has quietly moved into making premium grade astronomical refractors and eyepieces too.

The Pentax 7mm XW lives up to the company's reputation. The finish is excellent – just handling this beauty makes you realise it is a high quality product that will last a lifetime. The twist up eye guard is silky smooth and it works perfectly, and the front and back lens caps fit precisely too.

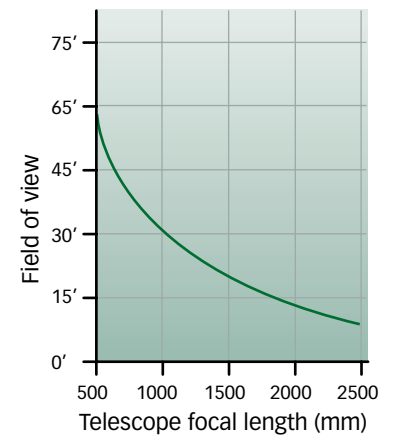
In use the eye relief is very good, but it's certainly not as long as the top-scoring Vixen's. However, the Pentax is noticeably lighter than that competitor, weighing in at 387g, compared to the Vixen's 447g.



The 70° apparent field is wider than the Vixen's too, but in use the Vixen's real field is slightly wider, due to its longer focal length and lower magnification.

Optically, the eyepiece did not disappoint: ultra-sharp views in the centre and, at the field edge, you got the impression that you were seeing everything that the telescope could deliver.

The only problem with this eyepiece is the price – despite the quality, only a perfectionist with deep pockets will shell out £269.99 for a high-power eyepiece.



## William Optics UWAN 7mm

### VITAL STATS

- ▶ **PRICE** £169.51
- ▶ **FOCAL LENGTH** 7mm
- ▶ **FIELD DIAMETER** 82°
- ▶ **WEIGHT** 211g
- ▶ **MANUFACTURER** William Optics
- ▶ **SUPPLIER** Altair Astro
- ▶ **TEL** 07768 108690
- ▶ **WWW** altiraastro.com

**FOR** 'Spacewalk' experience  
**AGAINST** Eye relief at 82°

### VERDICT

<b>OPTICS</b>	<b>90%</b>
<b>FIELD OF VIEW</b>	<b>100%</b>
<b>EYE RELIEF</b>	<b>70%</b>
<b>BUILD AND DESIGN</b>	<b>82%</b>
<b>VALUE FOR MONEY</b>	<b>83%</b>
<b>OVERALL</b>	<b>85%</b>

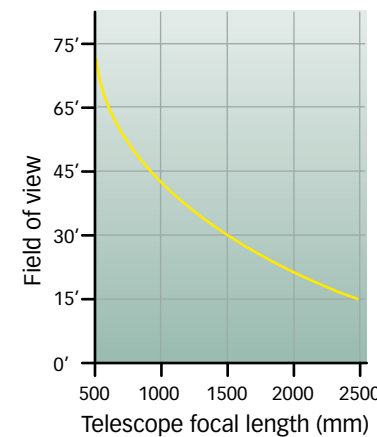
With an 82° ultra-wide field, the William Optics UWAN 7mm competes most closely with the 6.7mm Meade Ultra-Wide eyepiece and also with the 7mm Nagler. At 211g it is even lighter and more compact than the latter.

The entire eyepiece is black, even the 1.25-inch barrel, but optically there is very little difference between all three ultra-wide field models.

As with all these 'spacewalk' eyepieces, seeing the entire field at once is bordering on the impossible as it is so wide. Hence its eye relief score is only 'fair' as we rated on being able to see the whole field. For anyone who has to wear glasses at the telescope because of an astigmatism, 82° fields will be a bit of a wasted investment and eye relief will be much more relevant.



Nevertheless, if you want an ultra-wide field but also want to spend under £200, you will be hard pushed to choose between the William Optics and the Meade. The £10 price difference, lighter weight, or the handsome black finish may well push you to the William Optics eyepiece. Like the Meade, it also comes supplied in a contoured foam case and features a very effective twist-up rubber eyeguard.



## Baader Hyperion 8mm

### VITAL STATS

- ▶ **PRICE** £79.99
- ▶ **FOCAL LENGTH** 8mm
- ▶ **FIELD DIAMETER** 68°
- ▶ **WEIGHT** 383g
- ▶ **MANUFACTURER** Baader
- ▶ **SUPPLIER** Green Witch
- ▶ **TEL** 01954 211288
- ▶ **WWW** greenwich-observatory.co.uk

**FOR** Great value eyepiece  
**AGAINST** Questionable features

### VERDICT

<b>OPTICS</b>	<b>84%</b>
<b>FIELD OF VIEW</b>	<b>80%</b>
<b>EYE RELIEF</b>	<b>78%</b>
<b>BUILD AND DESIGN</b>	<b>78%</b>
<b>VALUE FOR MONEY</b>	<b>90%</b>
<b>OVERALL</b>	<b>82%</b>

The Baader Hyperion range represents an innovative modular approach to eyepiece design, although it makes assessing the eyepiece even more complex. As well as the 1.25-inch barrel, the lower body has a machined 50.8mm recess so that it will fit into a 2-inch diameter drawtube.

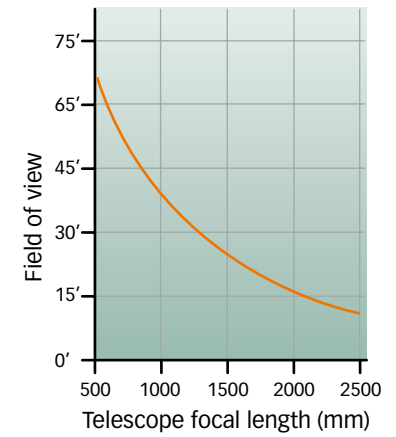
However, if you try this with a 2-inch star diagonal inserted, the eyepiece will be so long that the 1.25-inch chrome barrel may well clang into the diagonal's prism. Uniquely, that chrome barrel, containing half the lens elements, can be unscrewed. It transforms the eyepiece into a very low power, but low quality 2-inch barrel eyepiece. Somehow we cannot see most amateurs wanting to perform this action outside in the dark.

The Hyperion's top surface is



threaded to accept photographic/DSLR type adaptors, which may be useful, although most amateurs interested in high-power imaging will go down the Barlow/Powermate webcam or video route and just use the camera's 1.25-inch barrel.

This eyepiece performed well and it sits somewhere between the Sky-Watcher and the Vixen in terms of field of view, sharpness and eye relief. It's excellent value, but the modular approach is not necessarily a good thing.



# Group test

HIGH-POWER EYEPIECES UNDER £270

**NEXT MONTH**

We put 8-inch Go-To telescopes to the test and find out how easy they are to use

## Overall winner

### Vixen Lanthanum LVW-8mm

Ultra-wide fields, good eye relief, a sharp image, and a compact size always come at a price.

If you seek quality, rather than a bargain, the five oculars in the £169 to £270 range will be the ones to go for. An 82° apparent field – as provided by the Nagler, Meade and William Optics eyepieces – is a magical thing, but it proved difficult to comfortably see the whole field at once. The 70° and 65° fields provided by the eight-element Pentax and Vixen Lanthanum eyepieces are more than sufficient and, in use, these eyepieces had a long eye relief.

In the lower half of the price range the Sky-Watcher, Baader and Celestron eyepieces can all be acquired for a modest outlay,

but they all fall short of the other five in some way, even if the Baader Hyperion is very innovative and great value.

The Celestron X-Cel, at £59, is an absolute bargain, if you are happy with its relatively narrow 55° apparent field.

Ultimately, the high power eyepiece you use most will be the

one that delivers maximum eye comfort and crisp views. In this respect the Vixen and Pentax are a joy to use and, despite its weight, the Vixen gets our vote because the eye relief is exceptional and the Pentax is too expensive. 🚀



### At-a-glance guide

				
MANUFACTURER	Sky-Watcher	Tele Vue	Meade	Vixen
MODEL	SWA	Nagler Type 6	5000 Ultra Wide	Lanthanum LVW
PRICE	£89	£235	£147.99	£187
FOCAL LENGTH	8mm	7mm	6.7mm	8mm
FIELD DIAMETER	70°	82°	82°	65°
EYE RELIEF	Satisfactory	Fair	Fair	Excellent
WEIGHT	474g	221g	273g	447g
VERDICT	<b>70%</b>	<b>84%</b>	<b>84%</b>	<b>90%</b>
				
MANUFACTURER	Celestron	William Optics	Pentax	Baader
MODEL	X-Cel	UWAN	XW	Hyperion
PRICE	£59	£169.51	£269.99	£79.99
FOCAL LENGTH	8mm	7mm	7mm	8mm
FIELD DIAMETER	55°	82°	70°	68°
EYE RELIEF	Very Good	Fair	Very Good	Good
WEIGHT	194g	211g	387g	383g
VERDICT	<b>79%</b>	<b>85%</b>	<b>87%</b>	<b>82%</b>