Which DSLR Camera?

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This is a tricky question without an absolute right answer. My opinion is likely to be very subjective and full of assumptions. That said, here goes…

1.0 New or Second Hand?

Despite small incremental improvements on DSLR cameras, cameras from 5 years ago are still amazingly good. Since many people buy a DSLR and then hardly use it, a second hand purchase on ebay might be a very good option if you are happy to take the risk.

2.0 Camera Brand

The safest option is to go with Canon. They have a good track record of producing cameras that work well for astrophotography. In particular, as far as I know, they have never tried to sneak noise reduction into the RAW files. Noise reduction applied to the RAW is a serious problem if you want to eventually stack and process the images because it would seriously hinder the ability to remove fixed pattern noise. Noise should only be removed after the RAW files are calibrated and never before.

For some interesting scientific analysis of DSLR cameras:
http://www.astrosurf.com/buil/cameras.htm

However, there are other interesting options. If you simply want to take images from a fixed tripod, there are some cameras that can use their image stabilizer mechanism to provide automatic star tracking. I don't know how well this works for telescopic lenses. If you try it, do let me know! Have a look at these articles:
https://www.outdoorphotographer.com/photography-gear/cameras/pentax-k1-astrophotography-camera/

https://www.cloudynights.com/topic/559584-forget-canon-use-pentax/

Incidentally, at the moment, I think Sony sensors are probably better than Canon.

3.0 Which Model?

This is where it gets very tricky. Slow but steady progress is being made, so a recent camera will probably have a sensor that has higher sensitivity and lower noise.

Newer cameras tend to have smaller pixels in a bid to increase resolution. Due to their smaller size, each individual pixel might be noisier than before. However, the noise per unit area is more important, and this is still improving.

If you plan to use a DSLR without using a laptop to control it, you will be making frequent use of the LCD screen on the back of the camera. Unfortunately, this screen will often be in a very awkward position… Hence you might want to choose a camera that has a 'Vari-angle' LCD screen.

Some camera options are not important for astrophotography; for example frame rate or the latest processor. If a cheaper model uses the same sensor, it might be better value for money. However, the processor might be important if you are only taking single jpg images (e.g. in camera noise removal).

Another option is to look at websites that sell cameras modified for astronomy. They have hopefully chosen models that work well. I have not dealt with any of these websites, so I can neither recommend or advise against:
http://cheapastrophotography.vpweb.co.uk/
http://www.jtwastronomy.com/products/modified_dslr.html
http://www.dslrastromod.co.uk/
http://www.astronomiser.co.uk/booking.htm

Stuart Stebbings has told me that:
"After much discussing with people and reading the internet, the Canon 600d was a very popular choice with many astrophotographers. As of today the 200d is virtually the same but is 24mp and a bit lighter. It can be modified just as the 600d could."

That brings us to another question. Should you buy a normal DSLR or a modified one?

4.0 Modified DSLR Camera?

This is another tricky question.

A standard DSLR has an infrared cut filter fitted for two reasons. The main reason is that the red, green and blue pixel filters are transparent to IR light! This would produce very muddy colours. The IR cut filter is designed to fix this. The other reason is to make portrait photos more flattering. Light in the far red part of the spectrum tends to emphasize spots and blood vessels. Early cameras had quite aggressive filters to prevent this. Due to a race for better efficiency, these IR cut filters are now usually less aggressive, but still tend to block about 50 to 70% of the all important hydrogen alpha emission line.

In a modified camera, the IR cut filter is either removed completely (I would not recommend this, as colours will end up rather inaccurate) or replaced by an astronomical IR cut filter, which is designed to pass the hydrogen alpha line (a much better option).

Hence, if you will only use the camera for astrophotography, a modified camera will make photographing those beautiful red emission nebula much easier. They are likely to boost the sensitivity for emission nebula by a factor of 3.

If the camera is for dual use, you might not want a modified camera because their colour balance for normal photography will probably only be approximate. Note that a standard DSLR camera will perform just as well as a modified camera for stars constellations, star clusters and galaxies. If you change your mind, it might be possible to send you camera to a service that replaces the IR cut filter.

5.0 Full Frame?

Full frame cameras can be wonderful for that extra field of view. This is a really big advantage. However, it comes with two very big disadvantages…

The most obvious disadvantage is the cost. They do tend to be very expensive. The other problem is that camera lenses are not optically perfect. The aberrations towards the corners of the frame can get distracting. On a full frame camera they can start looking downright ugly! Even with high quality lenses, aberrations in the corners remains a problem.

If you have this much money to spend, you might be better off buying a mono CCD camera.