

# VISUAL ASTRONOMY and the USE OF FILTERS

Prepared by John Bambury - October 2011

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# **WHAT ARE WE TRYING TO ACHIEVE BY USING A FILTER?**

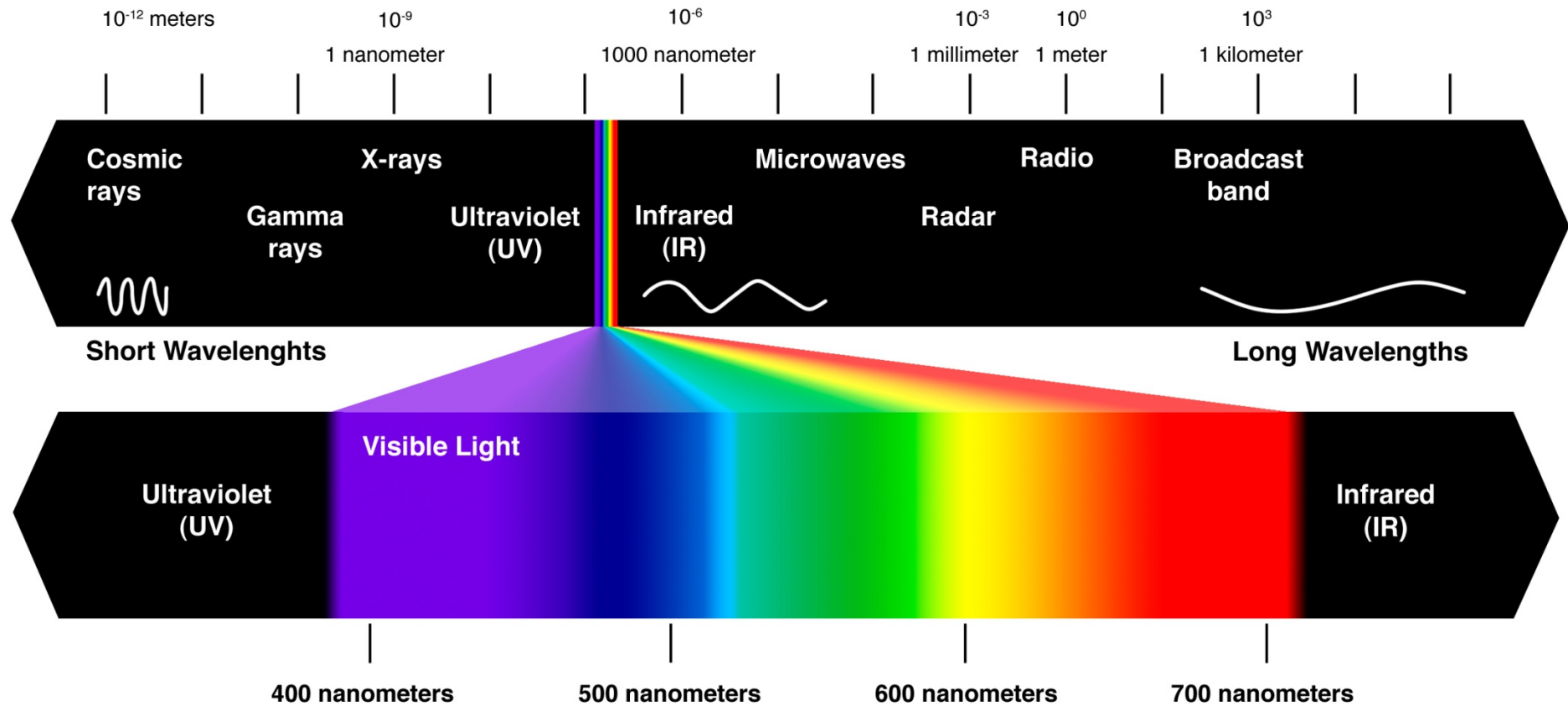
The sole goal of using a filter is to see an increase in overall visible detail, or to enhance the amount of detail we can see of a specific feature of the target.

# HOW DO FILTERS WORK?

They do not increase the flow of photons to your eye, or increase the brightness of any feature of the target. Nothing of a physical nature can do that.

Filters work by improving the **signal to noise ratio**, which improves **contrast**

# To see how filters work we need to look at the wave nature of light

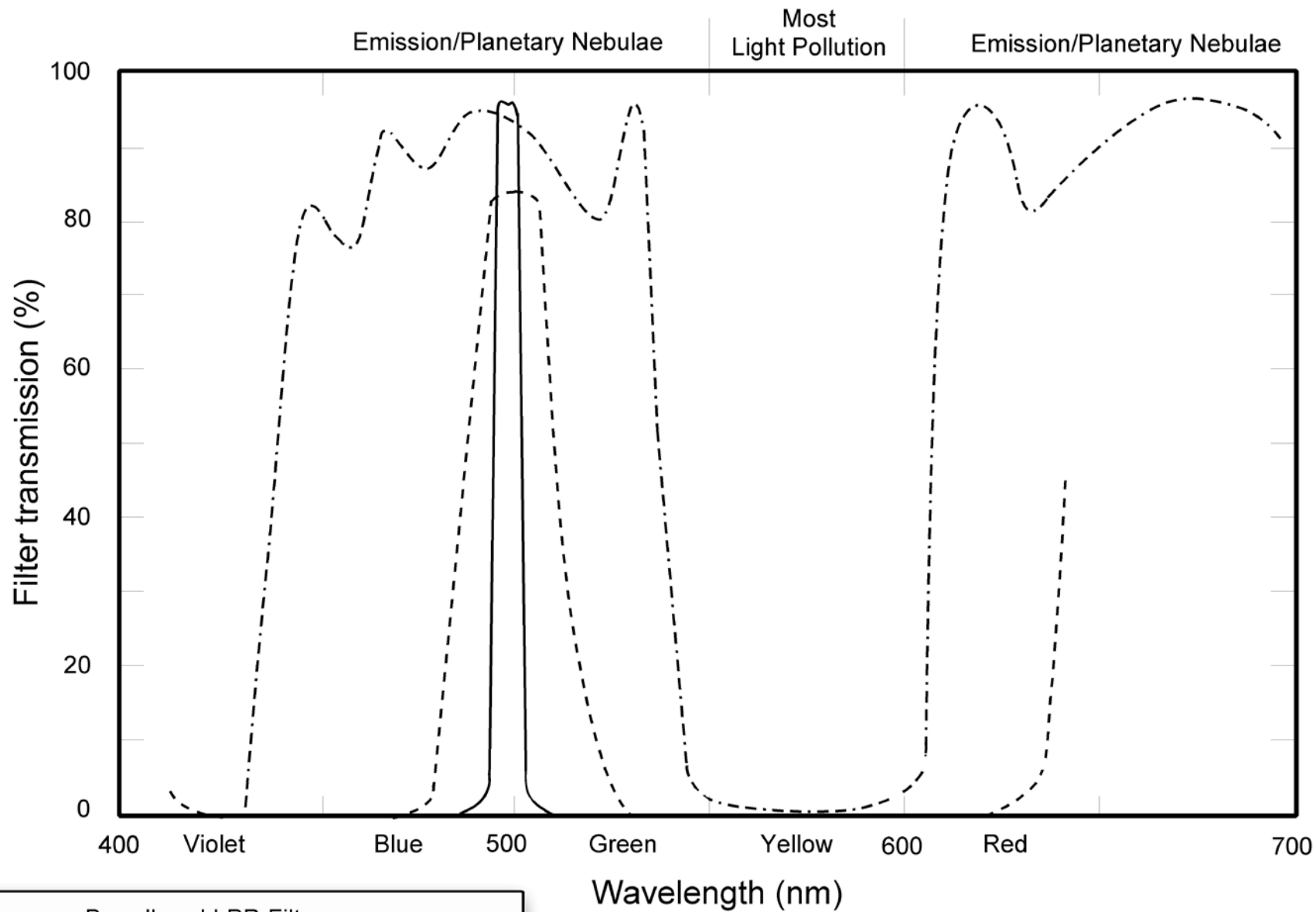


# The Electro Magnetic Spectrum

**Different Individuals eyes can have a different sensitivity to light, at the ends of the visible spectrum. However the normal visible range is considered to be from about 380nm to 750nm. A light adapted human eye usually has its maximum sensitivity at about 550nm, which is in the green range of the spectrum.**

**Filters improve the signal to noise ratio by blocking out the unwanted wavelengths of light. All they do is cut out all the stuff we don't want to see that "muddies the waters."**





- Broadband LPR Filter
- Narrowband nebula filter
- Line nebula filter (Oxygen-III shown)

# WHAT ARE THE DIFFERENT TYPES OF FILTERS

- \* DEEP SKY

- \* LUNAR AND PLANETARY

- \* SOLAR (Not covered in this presentation)



# DEEP SKY FILTERS

- \* BROADBAND OR LIGHT POLLUTION REDUCTION (LPR)
- \* NARROWBAND OR ULTRA HIGH CONTRAST (UHC & Comet)
- \* LINE FILTERS (OIII, H-Beta)

# DEEP SKY FILTERS

## HOW THEY ARE CONSTRUCTED

- \* GENERALLY THERE ARE TWO CONSTRUCTION METHODS USED
- \* LAMINATED SANDWICH FILTERS
- \* DIELECTRIC FILM COATINGS WITH HARD OXIDE OVERCOAT

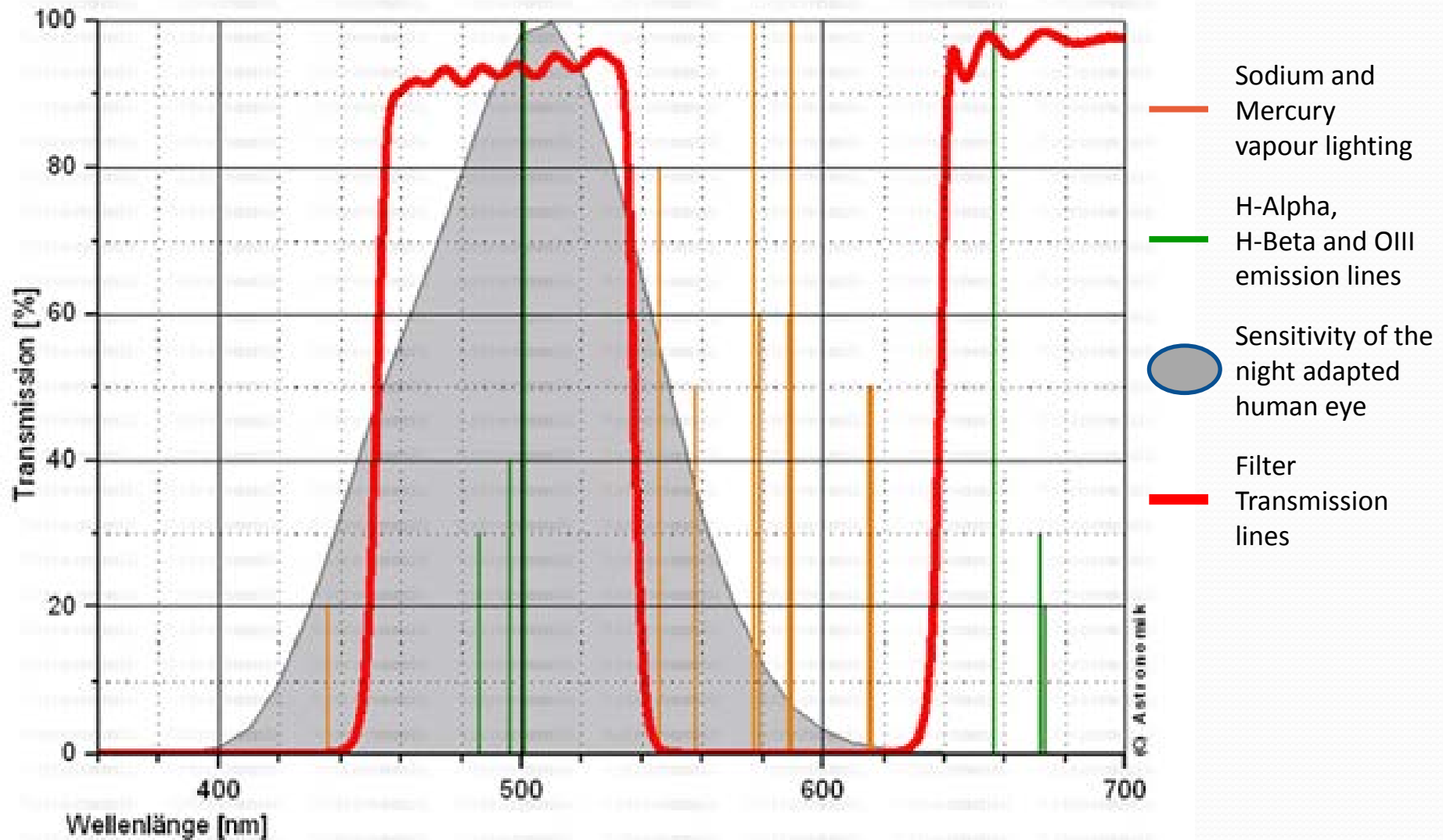
# DEEP SKY FILTERS

## HOW ARE THEY MOUNTED

- \* USUALLY MOUNTED IN A 1.25" OR 2" METAL FILTER CELL. THE 1.25" FILTERS ARE THREADED 28.4mm x .6mm AND THE 2" FILTERS ARE THREADED 48mm x .75mm
- \* USUALLY MOUNTED TO THE BOTTOM OF THE EYEPIECE
- \* CAN BE MOUNTED ONTO THE BOTTOM OF VARIOUS ACCESSORIES LIKE A BARLOW OR AN EXTENSION TUBE
- \* CAN BE MOUNTED IN A FILTER SLIDE
- \* CAN BE MOUNTED WITH A STEPDOWN RING TO THE BOTTOM OF THE FOCUSER DRAWTUBE OF SOME FOCUSERS

# **BROADBAND FILTERS**

- \* BROADBAND FILTERS ARE VERY EFFECTIVE FOR IMAGING. THEY OFFER SMALLER GAINS FOR VISUAL OBSERVATION BUT HELP TO A NOTICEABLE DEGREE**
- \* FOR VISUAL DEEP SKY ASTRONOMY THERE IS NO SUBSTITUTE FOR DARK SKIES**
- \* BROADBAND FILTERS WORK BY BLOCKING OUT THE VISIBLE EMISSION LINES IN THE YELLOW PART OF THE SPECTRUM OF SODIUM AND MERCURY VAPOUR LIGHTS AND NEON SIGNS**



# Astronomik CLS

# BROADBAND FILTERS

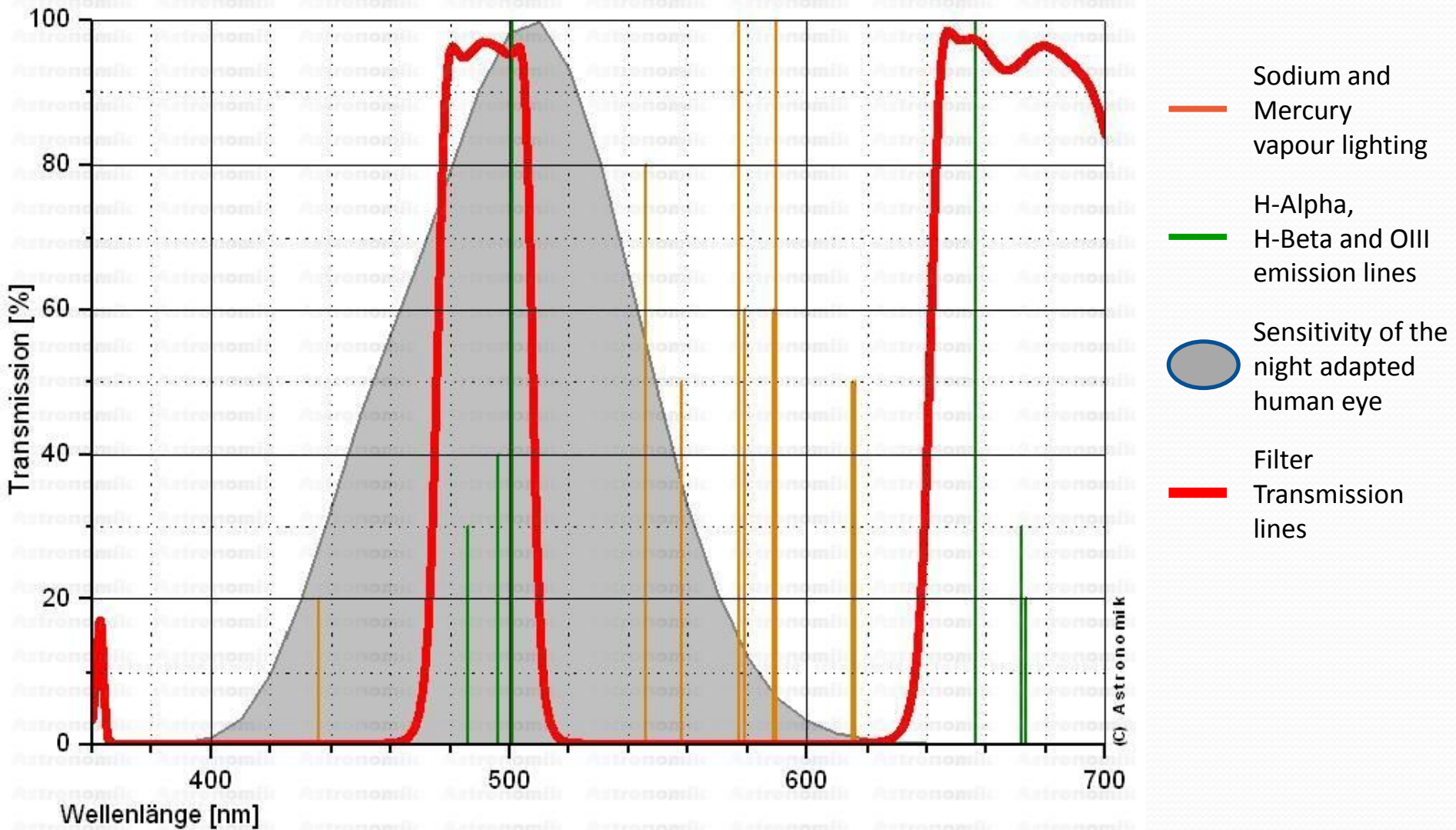
Manufacturer	Name	Type
Astronomik	CLS	Broadband
Lumicon	Deep Sky	Broadband
Orion	Skyglow	Broadband
Thousand Oaks	LP1	Broadband
	(Broadband)	Broadband
DGM Optics	GCE	Broadband
DGM Optics	VHT	Broadband
		UHC Hybrid
Baader	Contrast Booster	Broadband

# **NARROWBAND FILTERS**

## **UHC FILTERS**

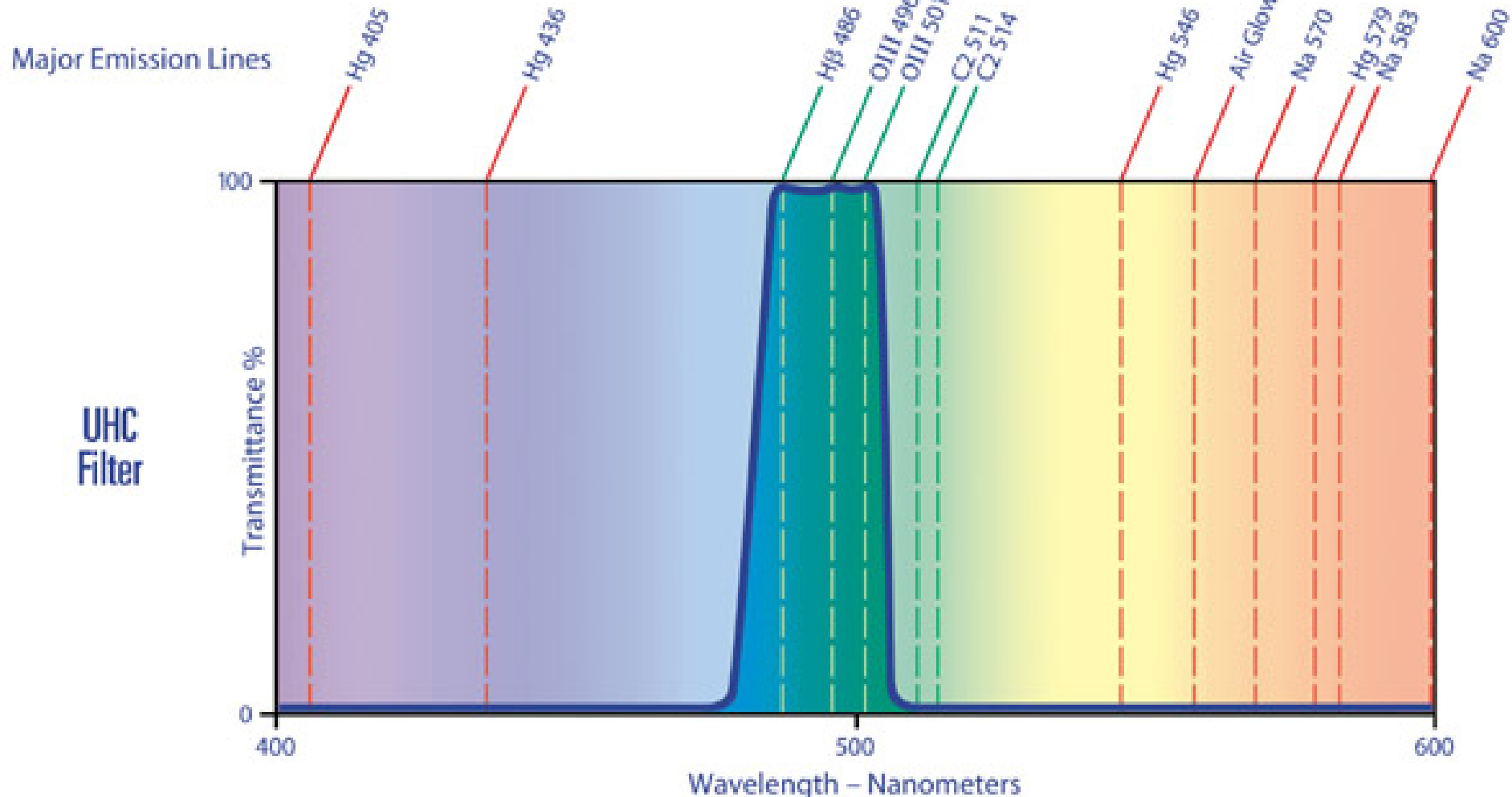
- \* UHC FILTERS ARE VERY EFFECTIVE ON PLANETARY AND EMISSION NEBULA AND ALSO SUPERNOVA REMNANTS. THEY ASSIST UNDER LIGHT POLLUTED SKIES BUT ARE MORE EFFECTIVE UNDER DARK SKIES
- \* A UHC FILTER WORKS BY ALLOWING ALMOST 100% TRANSMISSION THROUGH A NARROW PART OF THE SPECTRUM FROM ABOUT 480nm TO 505nm (25nm Bandpass). THIS INCLUDES THE H-BETA LINE AT 486nm AND BOTH OIII LINES AT 496nm AND 501nm. IT BLOCKS OUT ALL OTHER TRANSMISSIONS IN THE VISIBLE PART OF THE SPECTRUM





# Astronomik UHC

# LUMICON FILTER PROFILES



# **NARROWBAND FILTERS**

## **COMET FILTERS**

- \* COMET FILTERS WORK BY ALLOWING A NARROW BANDPASS OF ABOUT 25nm FROM ~498nm TO 523nm. THIS INCLUDES THE 501nm OIII LINE AND THE TWO CYANOGEN (C2) LINES AT 511nm AND 514nm. THIS BANDPASS HIGHLIGHTS THE IONISED GASES IN THE TAIL OF GASEOUS COMETS. THESE FILTERS DO NOT HELP MUCH WITH DUST COMETS AS DUST COMETS ARE ILLUMINATED BY REFLECTED SUNLIGHT AND HAVE NO VISIBLE SPECTRUM EMISSIONS.

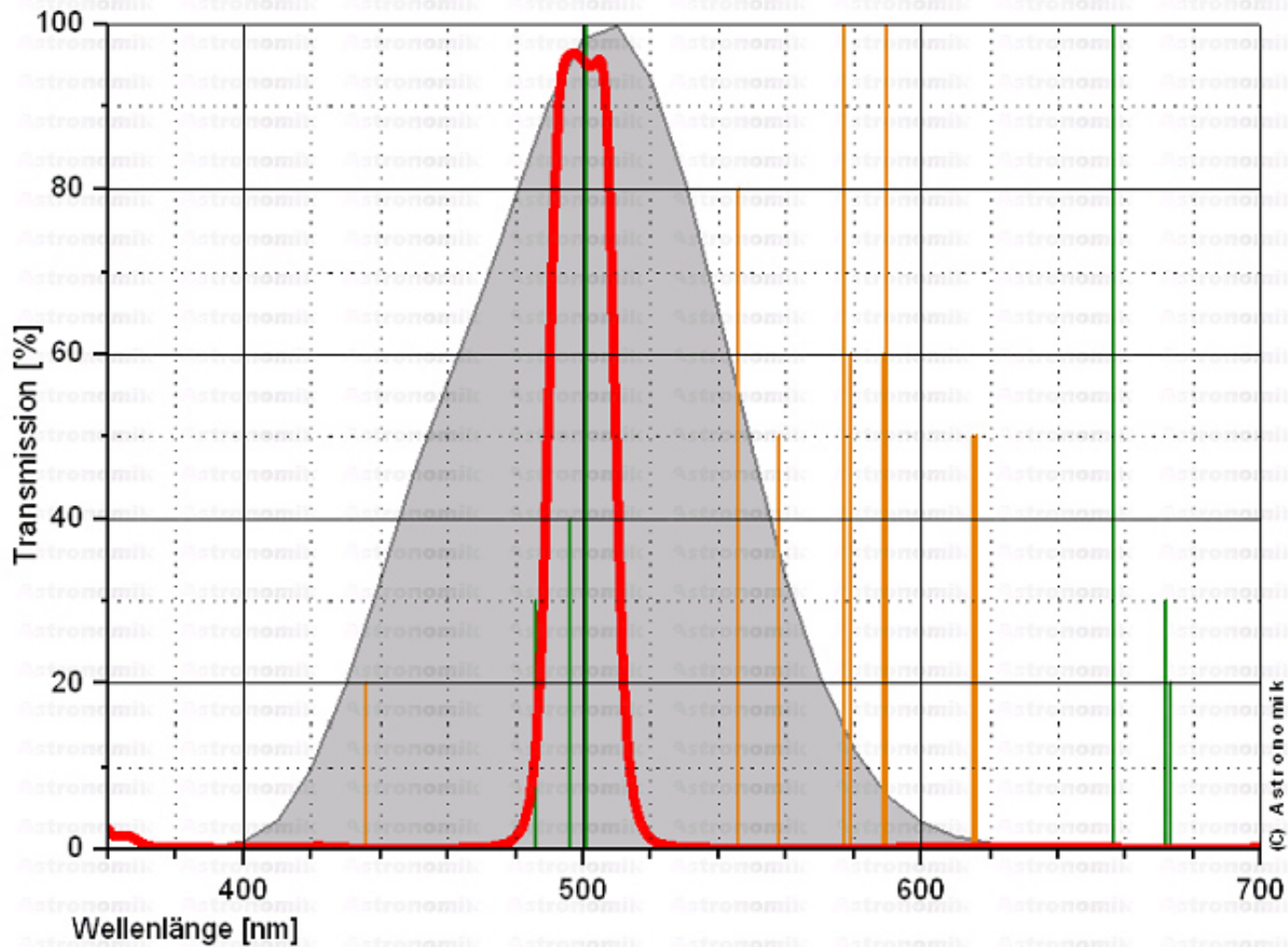
# NARROWBAND FILTERS

Manufacturer	Name	Type
Astronomik	UHC	Narrowband
Lumicon	UHC	Narrowband
Orion	Ultrablock	Narrowband
Thousand Oaks	LP2 (UHC)	Narrowband
DGM Optics	NPB	Narrowband
Baader	UHC-S	Narrowband
Lumicon	Comet	Special Narrowband

# LINE FILTERS

## OIII FILTERS

- \* ARE VERY EFFECTIVE ON PLANETARY AND EMISSION NEBULA AND ALSO SUPERNOVA REMNANTS. THEY ASSIST UNDER LIGHT POLLUTED SKIES BUT ARE MORE EFFECTIVE UNDER DARK SKIES
- \* AN OIII FILTER WORKS BY ALLOWING ALMOST 100% TRANSMISSION THROUGH A NARROW PART OF THE SPECTRUM FROM ABOUT 493nm TO 504nm (11nm Bandpass). THIS INCLUDES BOTH OIII LINES AT 496nm AND 501nm. IT BLOCKS OUT ALL OTHER TRANSMISSIONS IN THE VISIBLE PART OF THE SPECTRUM



- Sodium and Mercury vapour lighting
- H-Alpha, H-Beta and OIII emission lines
- Sensitivity of the night adapted human eye
- Filter
- Transmission lines

# Astronomik OIII

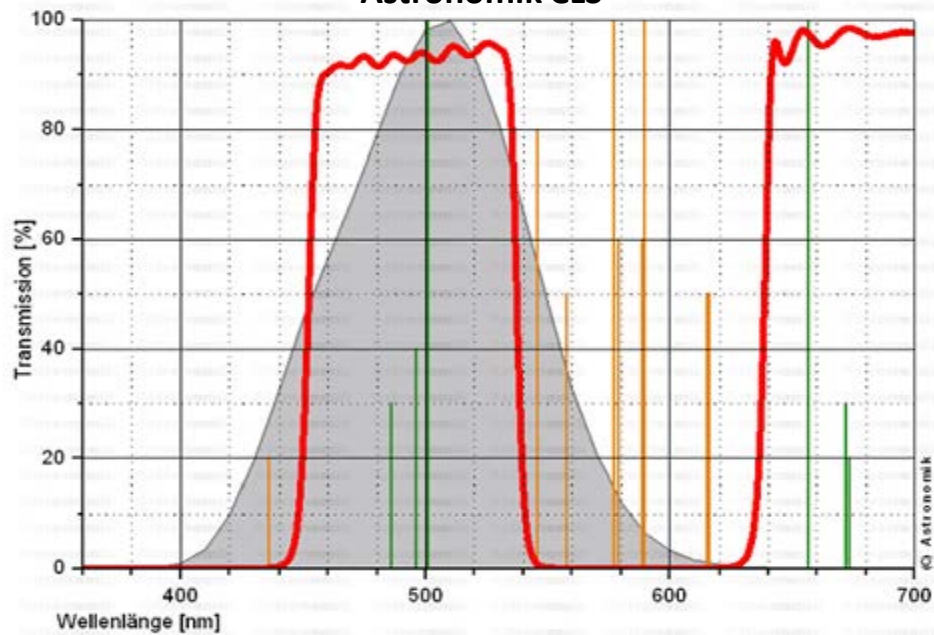


# WHICH FILTER ?

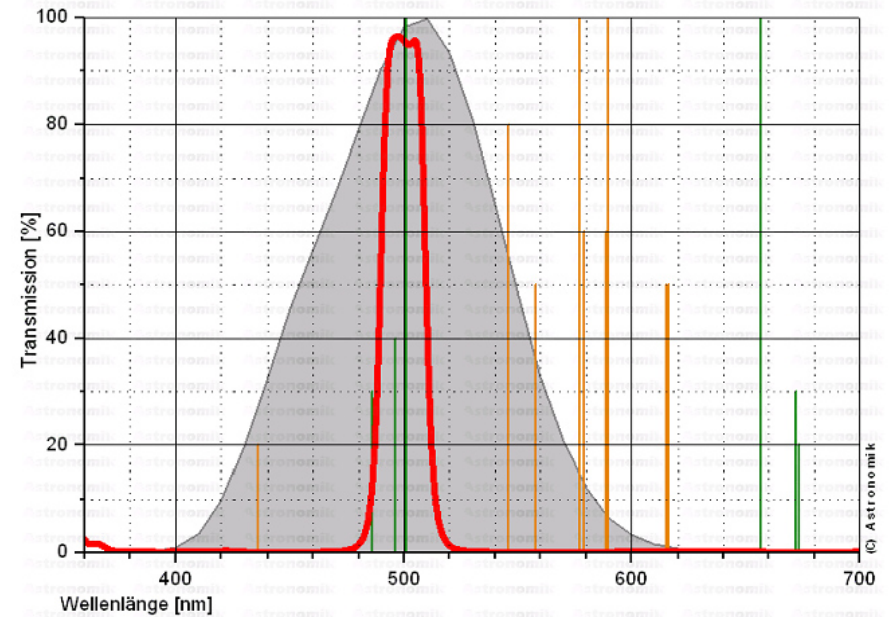
Target	Common Name	Constellation	Type	Best Filter
M8	Lagoon Nebula	Sagittarius	Emission Nebula	UHC/OIII
M20	Triffid Nebula	Sagittarius	Emission & Reflection Nebula	UHC/H-Beta
M42	Orion Nebula	Orion	Emission Nebula	UHC/OIII
M43	North part of Orion Nebula	Orion	Emission Nebula	H-Beta/UHC
NGC246	Not named	Cetus	Planetary Nebula	OIII/UHC
NGC2237	Rosette Nebula	Monoceros	Emission Nebula	OIII/UHC
NGC2359	Thors Helmet	Canis Major	Emission Nebula & Wolf-Rayet bubble	OIII/UHC
NGC3242	Ghost of Jupiter	Hydra	Planetary Nebula	OIII/UHC
NGC7293	Helix Nebula	Aquarius	Planetary Nebula	OIII/UHC
B33 & IC434	Horsehead Nebula	Orion	Emission Nebula	H-Beta/UHC
NGC2070	Tarantula Nebula	Dorado	Emission Nebula	OIII/UHC
NGC3372	Eta Carina Nebula	Carina	Emission Nebula	UHC/OIII
NGC3132	Eight Burst Nebula	Vela	Planetary Nebula	OIII/UHC
NGC3918	Blue Planetary	Centaurus	Planetary Nebula	OIII/UHC



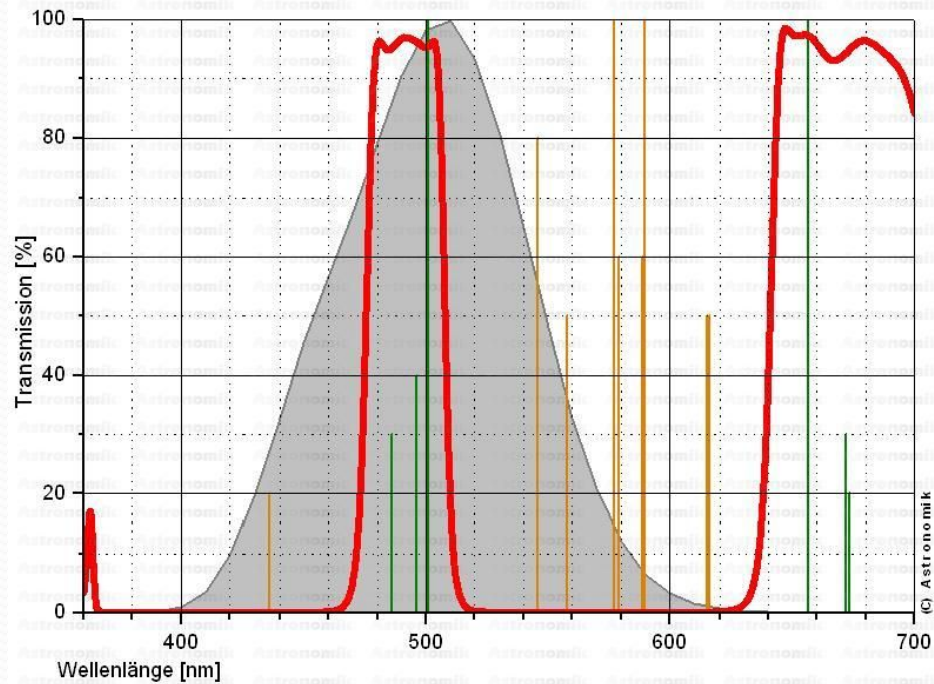
**Astronomik CLS**



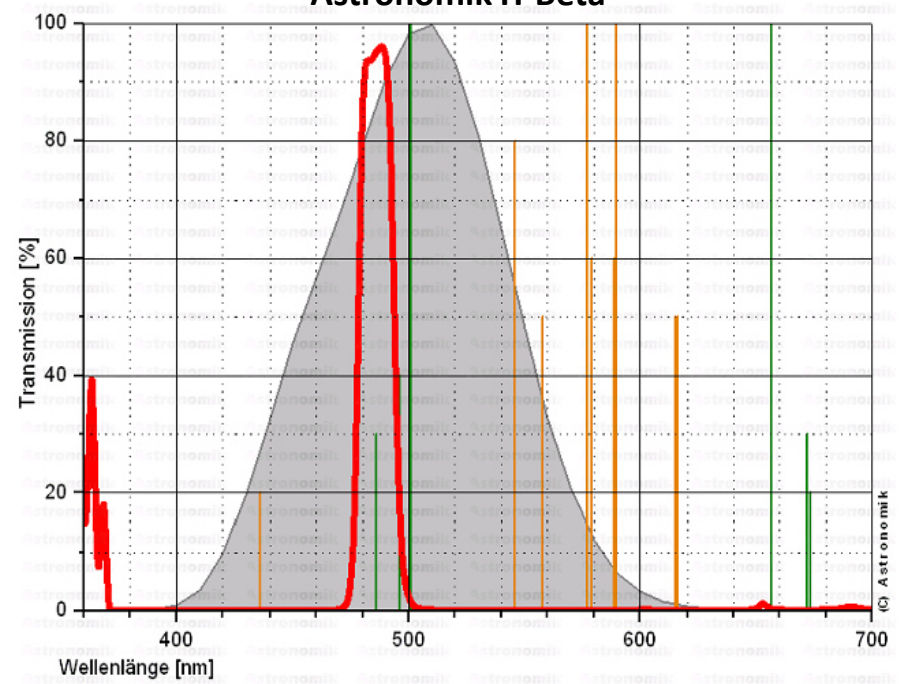
**Astronomik OIII**



**Astronomik UHC**



**Astronomik H-Beta**



# **LUNAR & PLANETARY FILTERS**

WHILE DIFFERENT WORK IN VERY SIMILAR WAYS. THEY REDUCE IRRADIATION (DISTORTION OF THE BOUNDARIES BETWEEN LIGHT AND DARK) AND BY SOFTENING THE TONE OF ONE COLOUR OF SIMILAR ADJACENT COLOURS IN THE TARGET WHICH IMPROVES CONTRAST.

# LUNAR FILTERS

## NEUTRAL DENSITY FILTERS

REDUCE THE TRANSMISSION OF ALL WAVELENGTHS OF LIGHT EQUALLY. THEY CAN BE SOURCED WITH DIFFERENT TRANSMISSION LEVELS. FOR INSTANCE A 15% ND FILTER BLOCKS 15% OF ALL WAVELENGTHS AND ALLOWS 85% OF ALL WAVELENGTHS. THEY ARE AVAILABLE FROM ABOUT 5% TO 95% TRANSMISSION.

## VARIABLE POLARISER

FOR ALL PRACTICAL PURPOSES WHEN OBSERVING IN THE NIGHT WORKS LIKE A VARIABLE NEUTRAL DENSITY FILTER. IT IS ACTUALLY QUITE DIFFERENT TO A NEUTRAL DENSITY FILTER. IT IS MADE BY JOINING TWO CIRCULAR POLARISING FILTERS TOGETHER AND HAVING THEM ROTATE RELATIVE TO EACH OTHER. EACH FILTER BLOCKS OUT CIRCULARLY POLARISED LIGHT, NOT JUST A PERCENTAGE OF ALL LIGHT. GENERALLY THOSE AVAILABLE FOR ASTRONOMY ARE VARIABLE FROM ABOUT 5% TO 40% TRANSMISSION RESTRICTION.

THEY BOTH DIM THE TARGET WHICH WILL HELP SOME PEOPLE SEE MORE DETAIL. MY PREFERENCE OF THE TWO IS A VARIABLE POLARISER, BUT I PERSONALLY PREFER TO OBSERVE THE MOON UNFILTERED.

# PLANETARY FILTERS

THERE ARE SPECIALISED PLANETARY FILTERS AVAILABLE. THESE ARE SLIGHTLY DIFFERENT FROM EACH DIFFERENT MANUFACTURER. MOST EXPERIENCED PLANETARY OBSERVERS USE DIFFERENT COLOURED FILTERS TO HIGHLIGHT DIFFERENT FEATURES OF EACH TARGET.

Wratten #	Colour	Object	Comments
11	yellow-green	Jupiter	Reveals cloud and haze layers
15	deep yellow	Saturn	Reveals cloud and haze layers
21	orange	Mars	Lightens reddish areas and accentuates dark surface markings; penetrates atmosphere
		Jupiter	May be helpful for revealing cloud bands
		Saturn	May be helpful for revealing cloud bands
		Mercury	Helps to see planets phases
23A	light red	Venus	Darkens blue sky background in daytime and twilight observations
		Mars	Same as 21 but deeper in colour
		Mercury	Darkens blue sky background in daytime and twilight observations
25	deep red	Mars	For surface details with large aperture scopes
		Venus	Reduces glare; may reveal cloud markings
30	magenta	Mars	Blocks green; transmits red and blue



# PLANETARY FILTERS

## CONTINUED

38A	deep blue	Mars	Reveals cloud and haze layers
47	deep violet	Venus	Reduces glare; may help reveal cloud markings; a very dark filter
56	light green	Jupiter Saturn	Accentuates reddish bands and great red spot Accentuates cloud belts
58	green	Mars Jupiter Saturn	Accentuates detail around polar caps Same as 56 but deeper colour Same as 56 but deeper colour
80A	light blue	Mars Jupiter	Accentuates high clouds, particularly near limb and polar caps Accentuates details in belts and white ovals
82A	very light blue	Mars Jupiter	For martian clouds and hazes Similar to 80A but very light tint
85	salmon	Mars	Similar to 21; for surface details

# SUGGESTED WEBSITES

Lumicon Website

<http://www.lumicon.com/filterspec.php>

Astronomik Website

<http://www.astronomik.com/en/visual-filters.html>

Dave Knisely filter performance comparison

[http://www.cloudynights.com/item.php?item\\_id=1520](http://www.cloudynights.com/item.php?item_id=1520)

**QUESTION TIME**