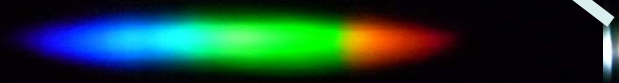
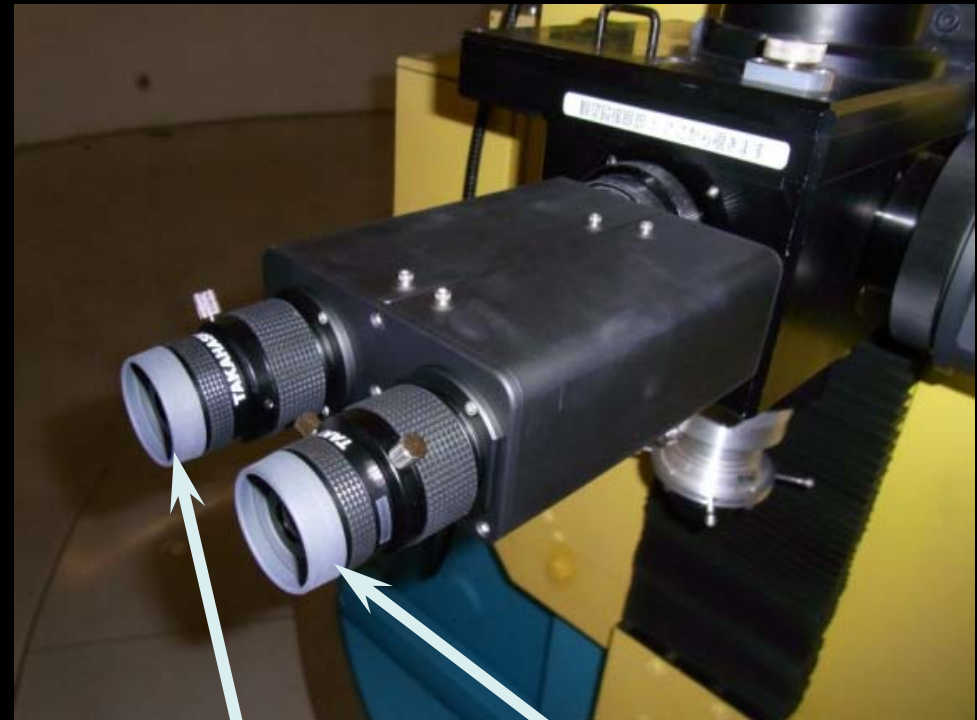
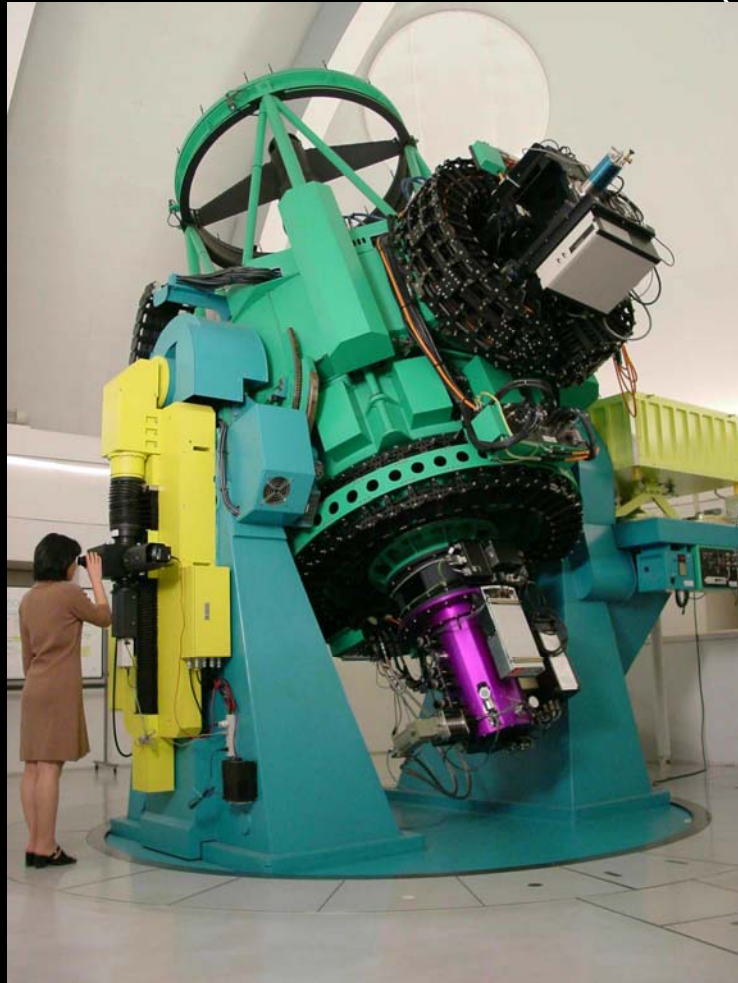
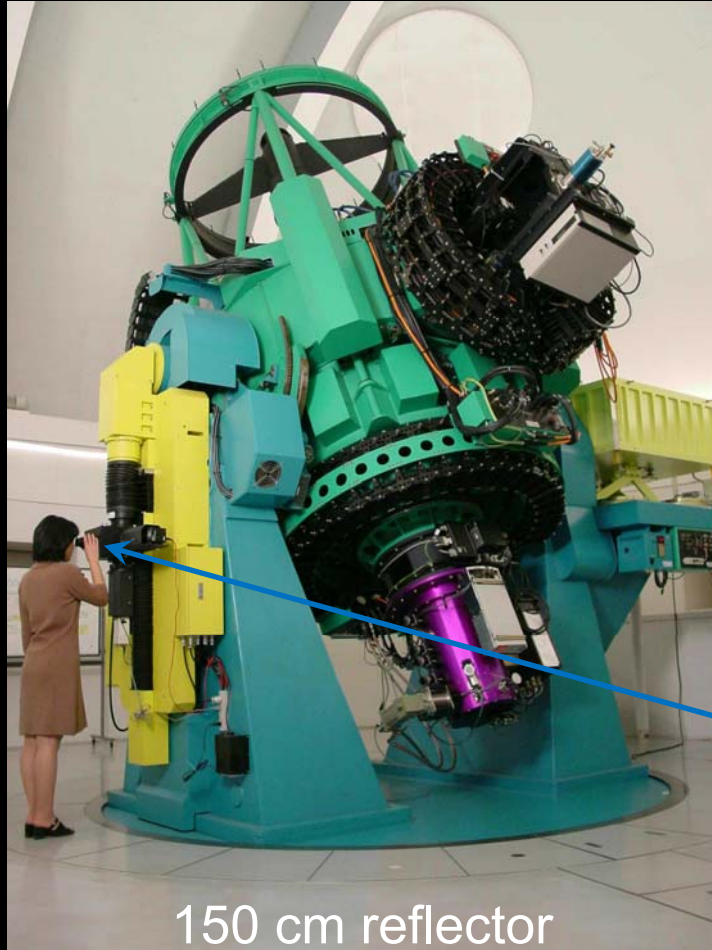


# Spectroscopic eyepiece system for the study of astrophysics

Osamu Hashimoto  
( Gunma Astronomical Observatory, Japan )



# *Gunma Astronomical Observatory (GAO)*



150 cm reflector

## *Gunma Astronomical Observatory*

established in April 1999

by Gunma prefecture local government

designed for both

*astronomical research*

and

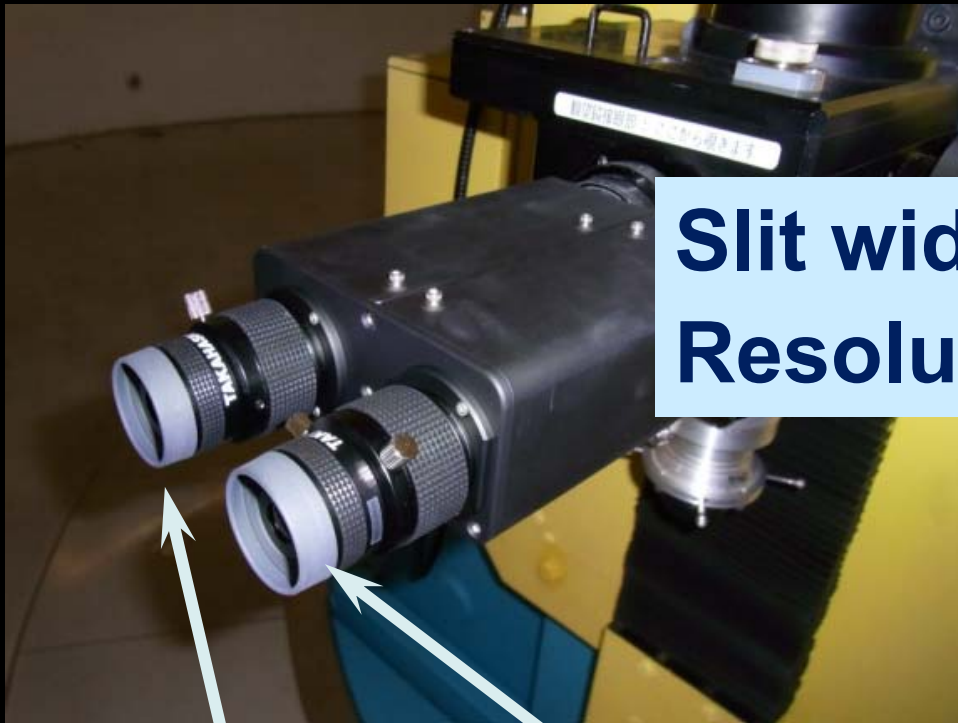
*public use*

**150cm telescope**

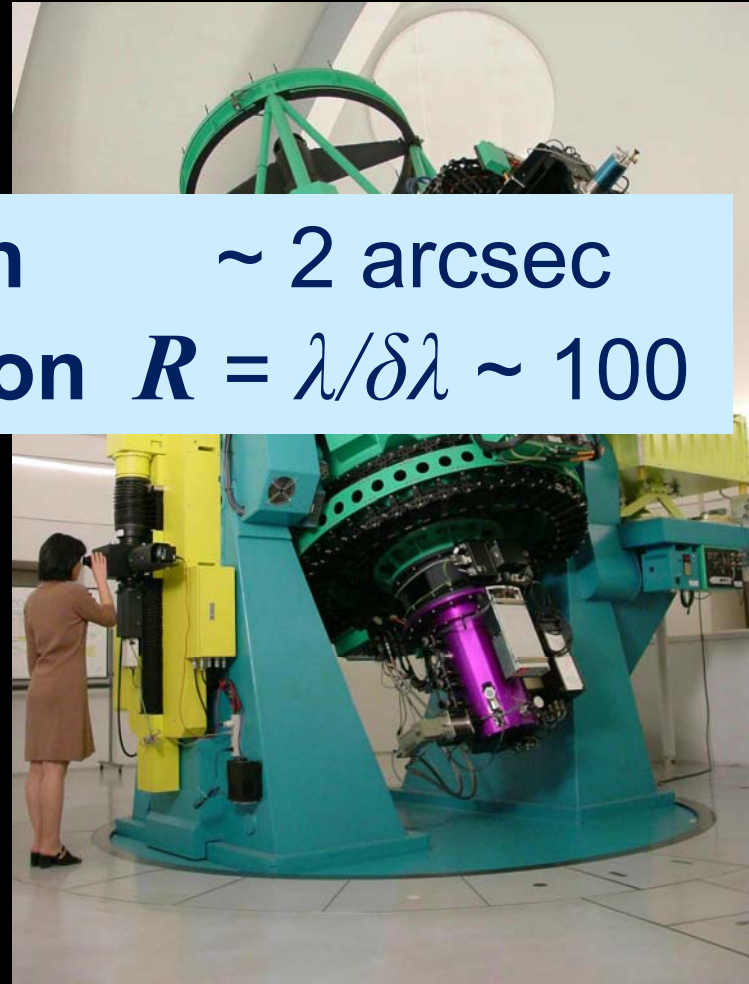
equipped with

**a star gazing optics**

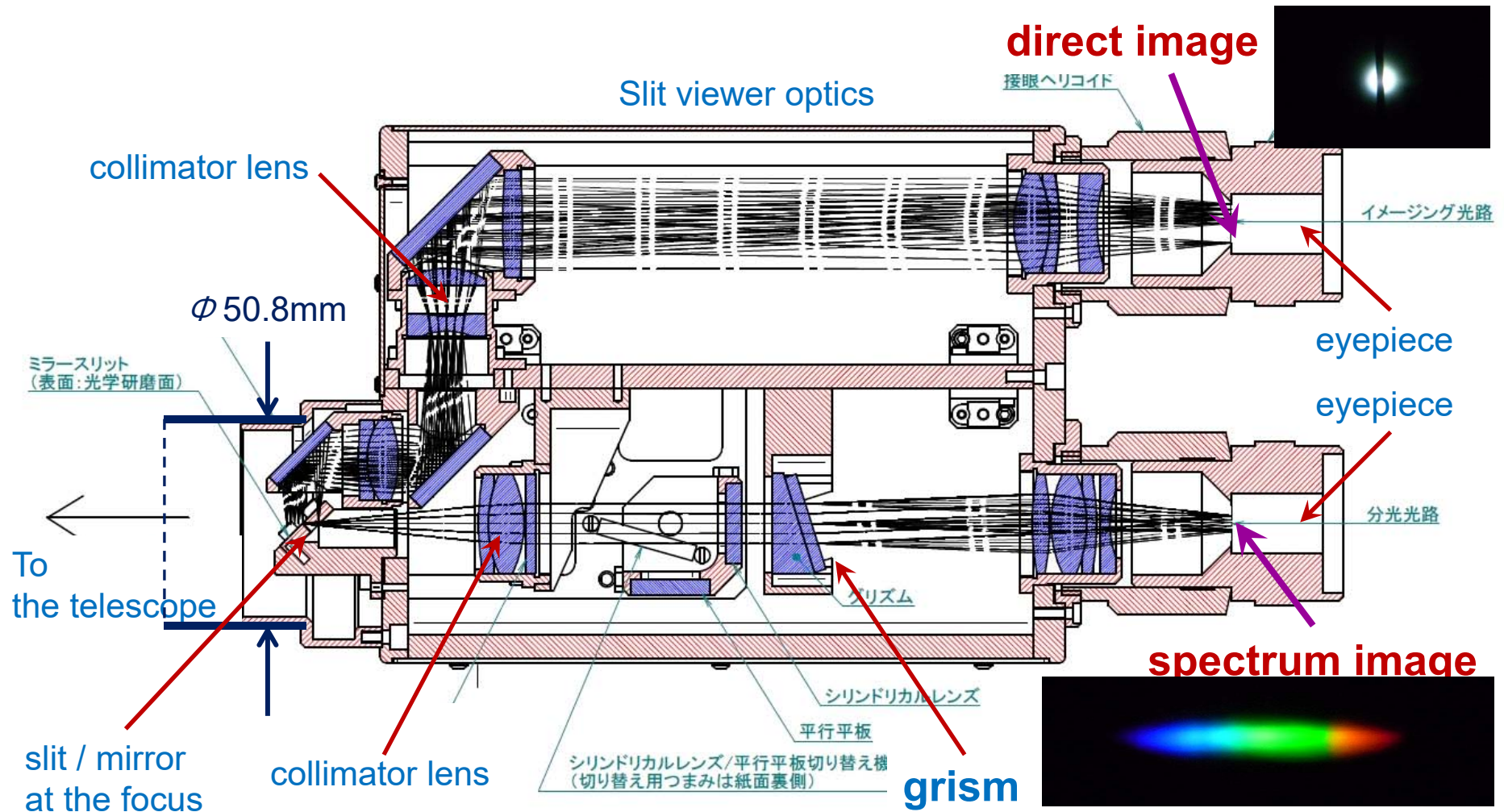
# Spectroscopic eyepiece system



**Slit width**       $\sim 2$  arcsec  
**Resolution**  $R = \lambda/\delta\lambda \sim 100$



# Spectroscopic eyepiece system



## Spectroscopic eyepiece system

High precision Spectrograph to which we can see a stellar spectrum directly



Slit viewer provides direct image as well at the same time

Simultaneous comparison

between the spectrum and the color of stars provides intuitive and easy understanding of the physical meanings of spectra and colors

Small and light : can be used as a usual 50.8mm eyepiece at the star gazing optics of many telescopes of a certain scale at a number of public observatories

# Examples of the observations

In particular,

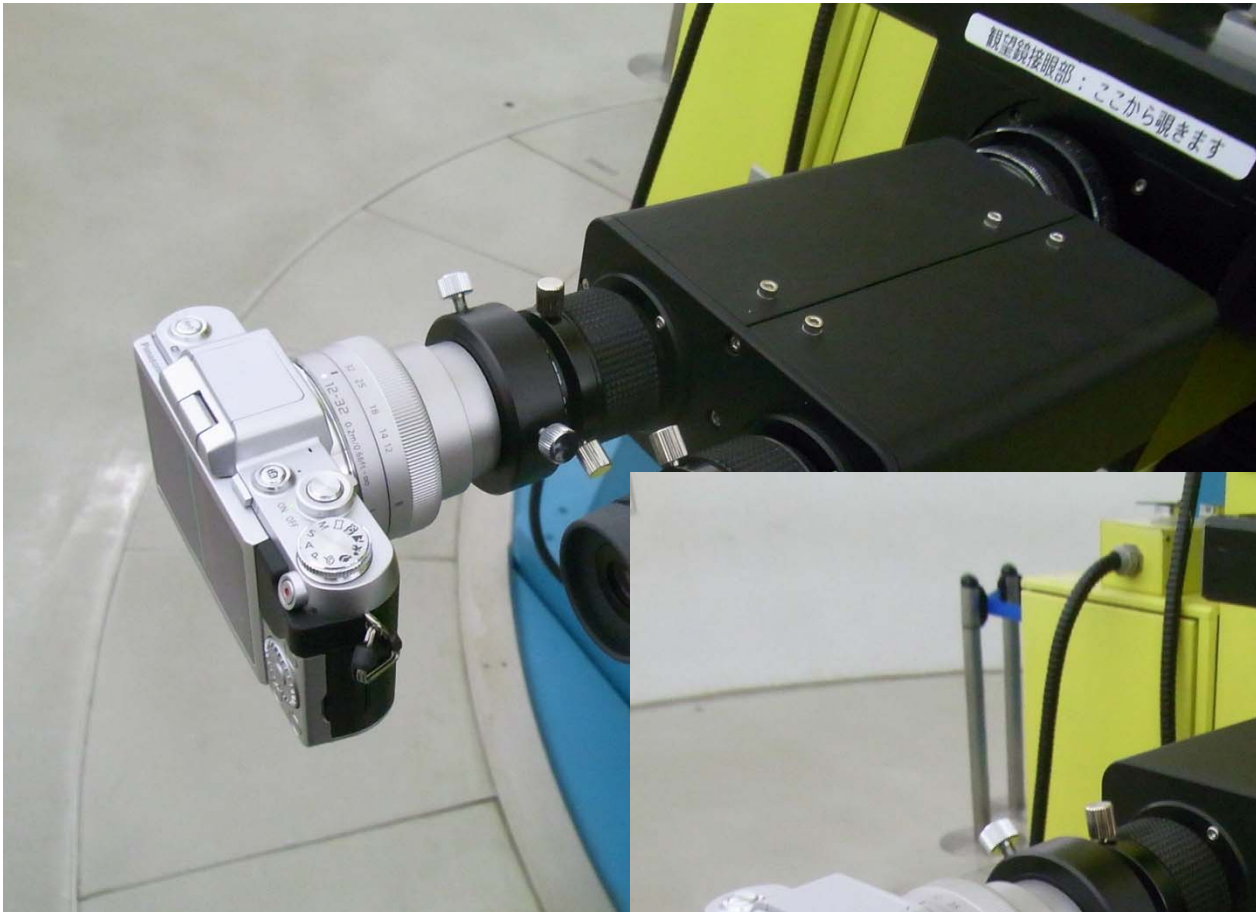
A type, **M type** and **Carbon** stars are  
**impressive and interesting**

useful and suitable for the good  
**understanding** of the essence of  
**Astrophysics**

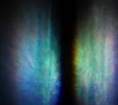
Double stars, Nebulae with stars,  
**planets, Moon, etc.**

Using  
a digital camera

**Panasonic  
DMC-GF7W  
+  
TAKAHASHI  
LE-DCA + DCR-37**



$\beta$  Ori B8Ia





$\alpha$  Lyr A0V



$\epsilon$  Aur A8 Algol-type eclipsing binary



↑  
 $H\beta$



$\alpha$  Aur G5III + G0III



$\alpha$  Tau K5III



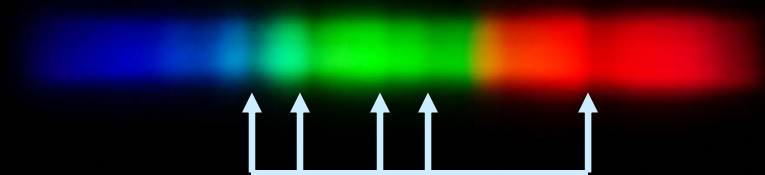
$\alpha$  Ori M2Ia



TiO



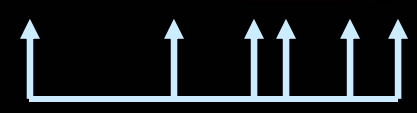
R Lyr      M5III      Mira-type variable



TiO



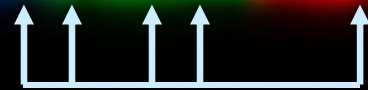
V460 Cyg      Carbon star



C<sub>2</sub>, CN



R Lyr      M5III      Mira-type variable



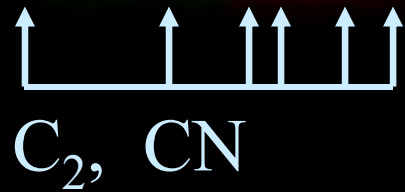
TiO

$\chi$  Cyg      S6-9      Mira-type variable

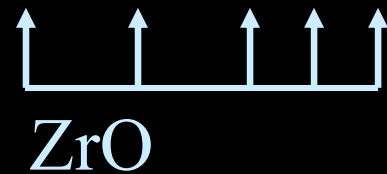


ZrO

V460 Cyg Carbon star



$\chi$  Cyg S6-9 Mira-type variable





$\beta$  Cyg

K3II + B9.5

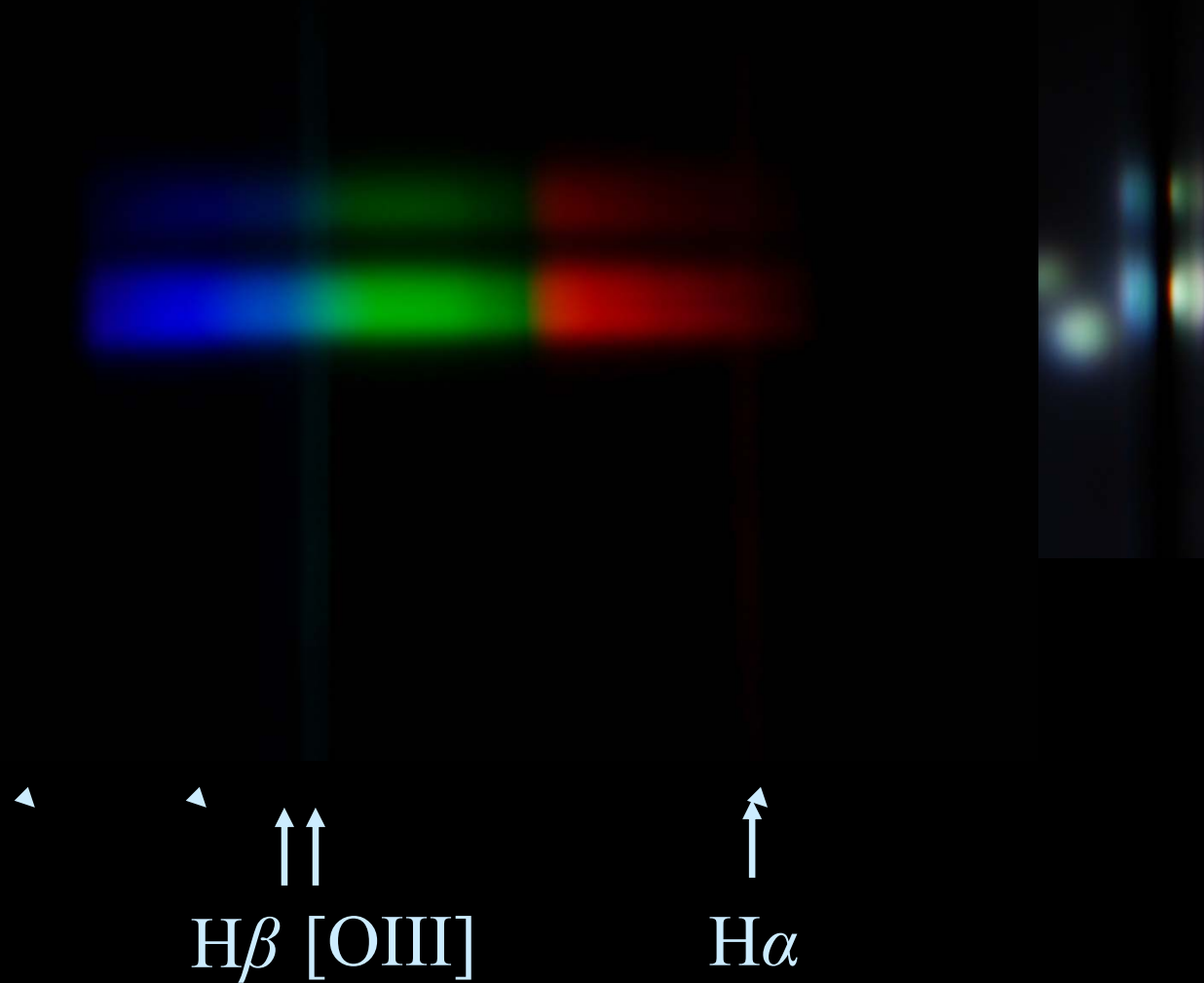
double star



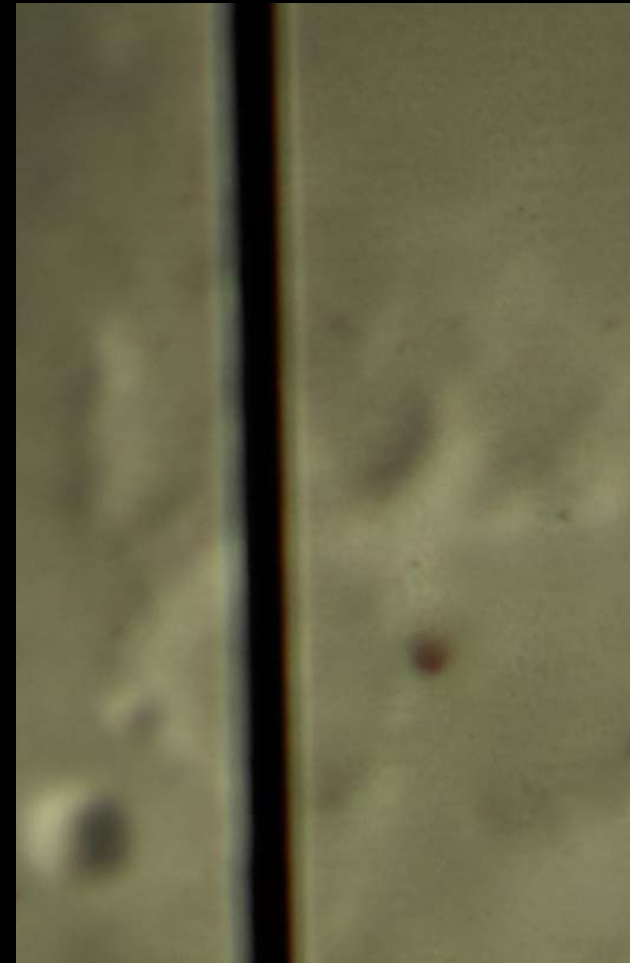
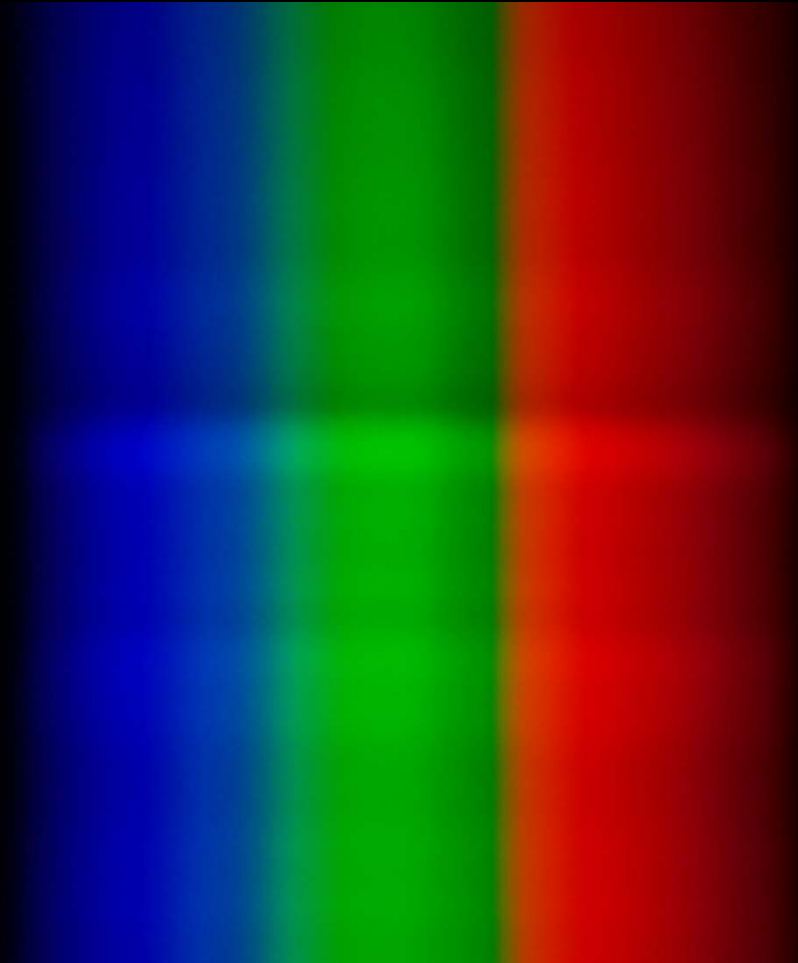
↑  
H $\gamma$

↑  
H $\beta$

$\theta$  Ori Trapezium in M42 Orion nebula



# Moon

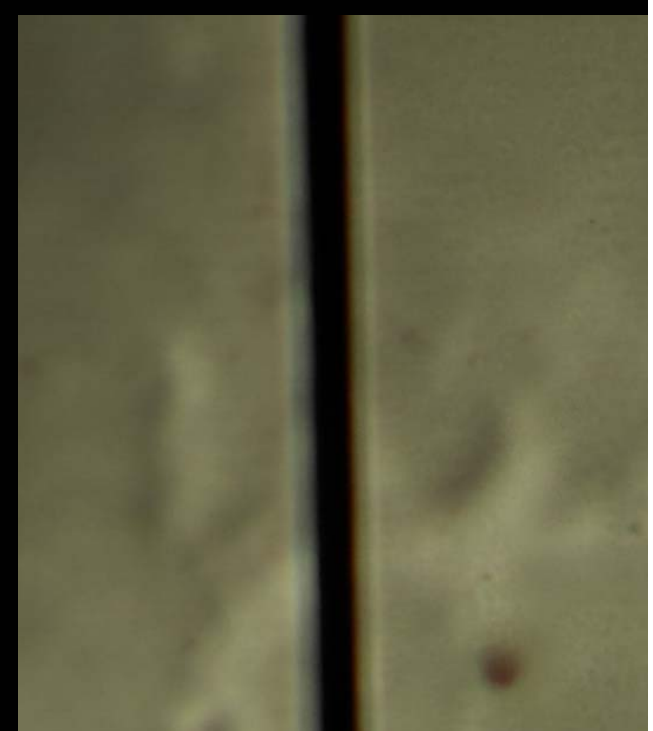
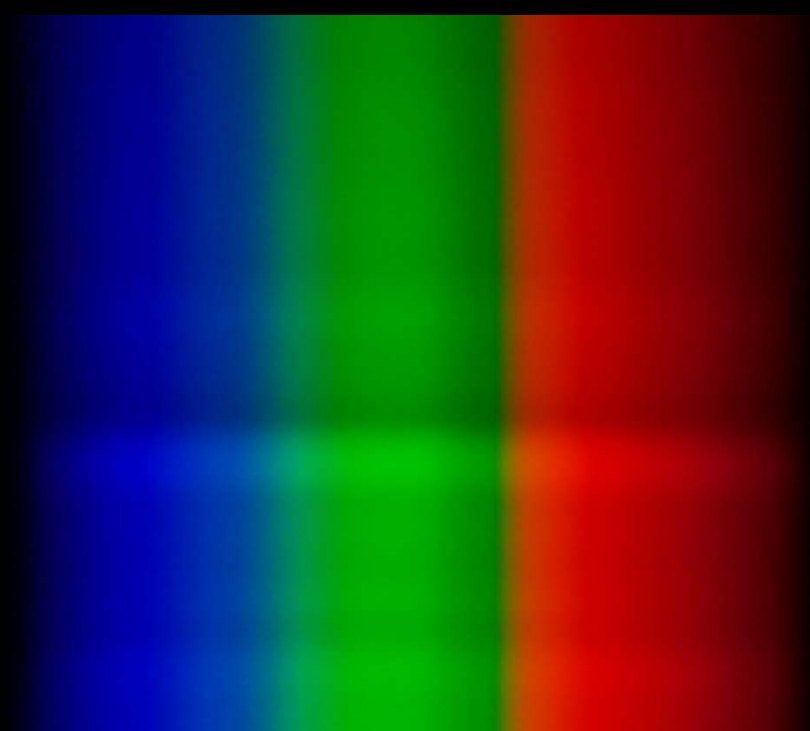


Mars



H $\beta$

Moon



Mars



↑  
 $H\beta$



V460 Cyg

Carbon star



$C_2$ , CN



# Uranus



$H\beta$

$CH_4$

# A number of interesting objects

In particular,

A type, **M type** and **Carbon** stars are  
impressive and interesting

useful and suitable for the good  
understanding of the essence of  
**Astrophysics**

Double stars, Nebulae with stars,  
planets, Moon, etc.

# A number of large telescopes for public in Japan with *star gazing optics*



u , Hokkaido	115cm
Hokkaido Univ.	160cm
Miyagi	130cm
	150cm
	100cm
ngyo Univ.	130cm
Wakayama	105cm
Wakayama	100cm
ma, Hyogo Univ.	200cm
• ( Okayama, NAOJ )	188cm
• Bisei, Okayama	101cm
• Saji, Tottori	103cm
• Hiroshima Univ.	150cm
• Anan, Tokushima	113cm
• Kagoshima Univ.	100cm
• Ishigaki, Okinawa	105cm