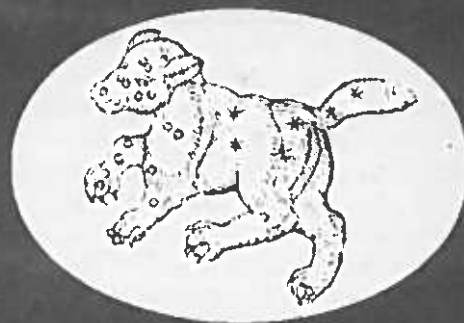


Nikon

ASTRONOMICAL INSTRUMENTS



Nippon Kogaku K.K. was established in Tokyo in 1917 as a comprehensive manufacturer of a full line of optical machinery. The superior technical know-how which has been nurtured and accumulated by the company during the nearly 50 years since then is crystallized today in the "Nikon" brand of products.

It is extremely gratifying to us that such a large segment of the world public is familiar with the "Nikon" brand name in connection with the company's regular line of cameras, binoculars, microscopes, measuring instruments, surveying instruments, etc. However, it may be less well known overseas that, ever since the foundation of our company, we have also been consistently exerting massive efforts in the production of instruments for astronomical observation, and that we have already accumulated quite an extensive record in the production of many types of such instruments. Since these products are always intended for specialized uses, they have been designed and produced under contracts on a case-by-case basis with special clients such as astronomical observatories, weather bureaus, schools, research laboratories, etc.

In this brochure you will find a representative selection of the instruments for astronomical observation which our company has produced in the past. We shall be deeply pleased if the efforts which we have made in the past and which we shall continue to make in the future may contribute in a small way to furthering man's knowledge about the universe in which he lives, and we promise to redouble our efforts to this end in the future.

As can be readily imagined, theoretical research of a very high order, as well as a high degree of precision, are required in the production of these machines. There are, in addition, various types of observations, to each of which different considerations apply. It is essential, therefore, to design and produce machines fully matching the individual requirements in each case.

If you should happen to require machines of these types, we shall be glad to send you detailed information on the products of interest to you. It is our desire to co-operate fully in fulfilling your specialized requirements. Please do not hesitate to send us your inquiries. Our experts would like very much to co-operate with you in your research ventures.



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30cm (12 inch) Reflector

This Cassegrain type reflector consists of a main telescope, German type equatorial mounting, clock device driven by a synchronous motor, finder telescope, photo equipment and other accessories. It is used for visual and photographic observation of celestial bodies.

Also, it may be used for spectroscopic or photo-electric observation by attaching accessories.

1. Cassegrain type reflector

Focal length: 5m

Focal ratio: F/17

a) Main mirror: parabolic mirror

Aperture: 300mm

Focal length: 1.5m

b) Secondary mirror

Aperture: 80mm

2. Finder telescope

a) Objective

Aperture: 50mm

Focal length: 750mm

b) Eyepiece with reticle

Focal length: 28mm

Magnification: 27x

c) Field of view: $1^{\circ}50'$

3. Viewfinder

Objective aperture: 18mm

Magnification: 6x

Field of view: 5°

4. Equatorial mounting: German type

5. Clockwork is driven by synchronous motor

6. Photo equipments

a) Plate size: 82 x 107mm

b) Shutter: 1 to 1/125 second, Time and Bulb

c) Filter: Green, yellow and red filters.

7. Accessories

a) Eyepiece

Huygenian: 60mm, 25mm and 18mm

Orthoscopic: 9mm

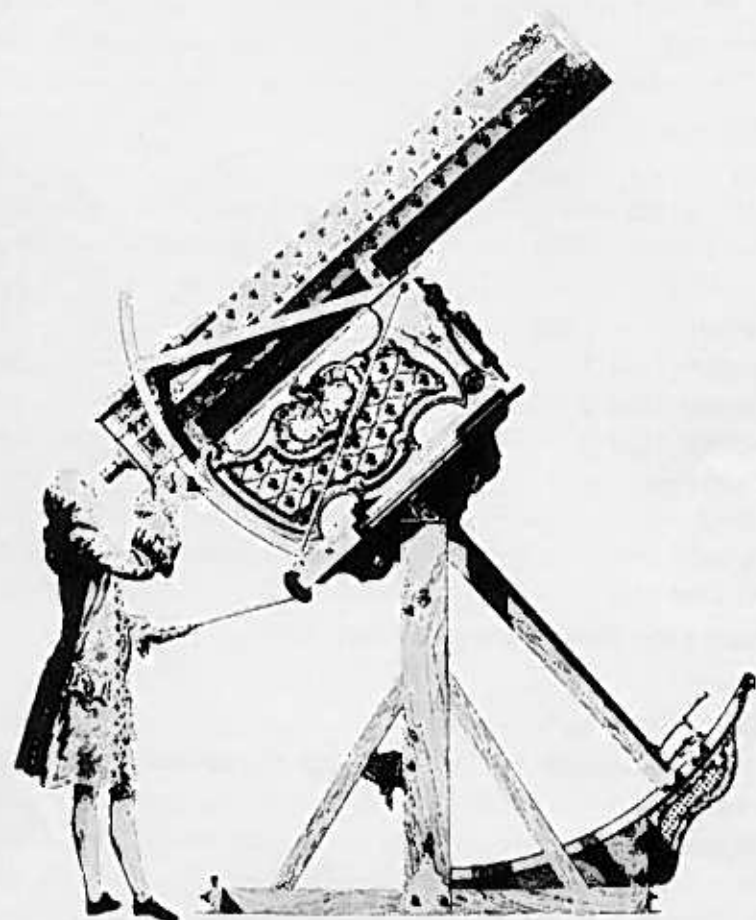
b) 3 sun glasses, a diagonal prism and a triple revolving nose-piece.

8. Size and weight

Length of main telescope: 2.1m

Maximum height: 2.5m

Approximate weight: 260kg



1. TELESCOPES

91cm (36 inch) Reflector for Photoelectric Photometry

Used with the photoelectric photometer.

Fork type mounting.

The main telescope can be set to the right ascension and declination angle from the control desk equipped with a preset system.

For greater accuracy, it can be aimed at a star by means of slow and fine adjustments on the hand-set-box while sighting through the guiding telescopes.

Sidereal drive is operated by means of a synchronous motor.

A crystal oscillator controls motor speed, which is variable for trailing in spectrographic work or in compensating for atmospheric refraction.

1. Main telescope

Main mirror: Parabolic mirror of low-expansion glass
($\alpha = 300 \times 10^{-6}$)

Secondary mirror: Hyperbolic mirror of low-expansion glass ($\alpha = 300 \times 10^{-6}$)

Aperture of main mirror: 914mm

Focal length of main mirror: 3.2m

Focal ratio of main mirror: F/3.5

Cassegrain focal length: 12.0m

Cassegrain focal ratio: F/13

2. Guiding telescope (Refractor)

Aperture of objective (Achromat): 200mm

Focal length of objective: 2.4m

Magnification: 185 and 40x

Field of view: 13' and 1°07'

3. Equatorial mounting Fork type

4. Driving device

a) Sidereal drive

The precision worm gear on the end of the polar axis is driven by means of a synchronous motor controlled by a constant-frequency crystal oscillator in the control desk. For trailing in spectrographic work or in compensating for atmospheric refraction, the

frequency is continuously variable between +0.05 and -0.15% of sidereal rate. Also, it is provided with crystal oscillators whose frequencies are available in -0.2, -0.25, -0.35, -0.45, -0.6, -0.8, and -1% of sidereal rate.

b) Speed of quick drive: 45"/min, for both polar and declination axis.

c) Speed of slow drive: 1"/sec for both polar and declination axis.

d) Speed of fine drive: 1.5"/sec for polar axis.
2"/sec for declination axis.

5. Control desk

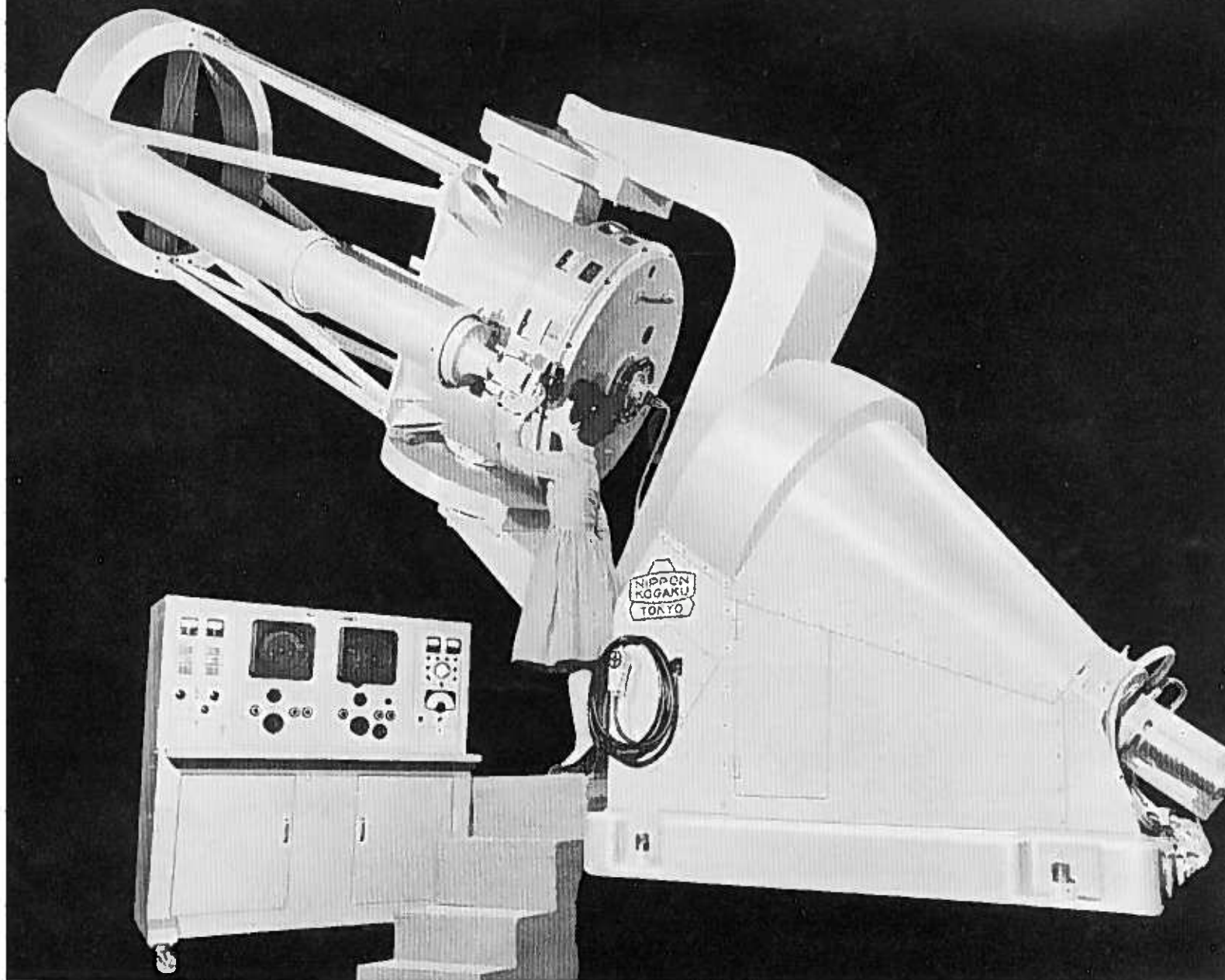
It contains automatic setting device (with quick drive) and manual adjustment device (with slow and fine drive) for declination and right ascension, crystal oscillators for sidereal drive, several power supplies and relays. Safety device prevents dangerous positioning.

6. Size and weight

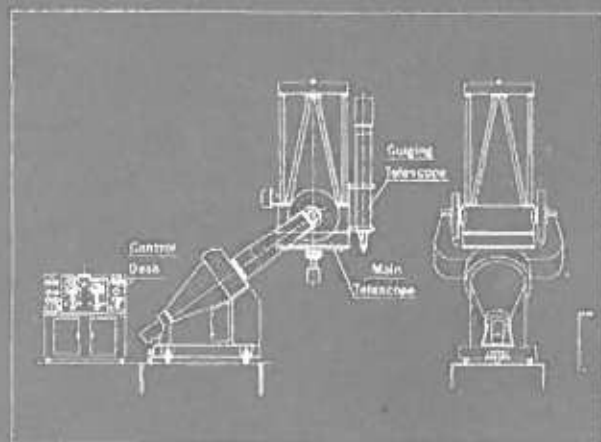
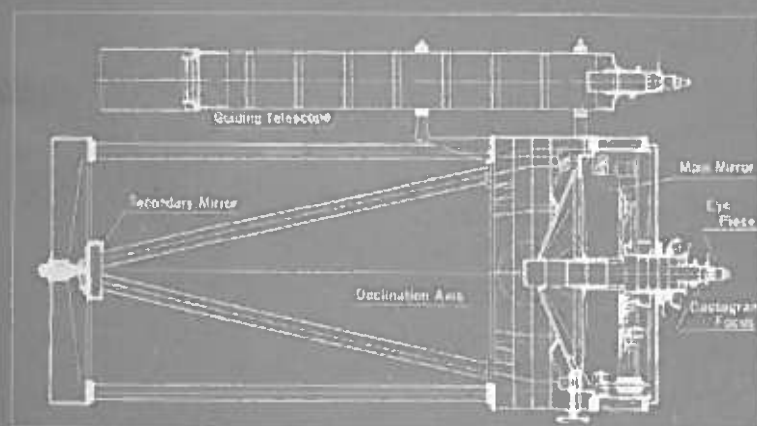
Length of main telescope: 3.2m

Maximum height: 5.2m

Approximate weight: 6.0 ton



91cm (36 inch) Reflector for Photoelectric Photometry



91cm (36 inch) Reflector

For photographic astrometry, spectroscopic and photoelectric observation.

Used with photo equipment, spectrograph, photoelectric photometer.

English type mounting.

The main telescope can be operated at both the prime focus and the Cassegrain focus. For use at the prime focus, a Ross correcting lens and a photo equipment with a remote control device from the hand-set-box are provided. The main telescope can be set to the right ascension and declination angle from the control desk equipped with a preset system. For greater accuracy, it can be aimed at a star by means of slow and fine adjustments on the hand-set-box while sighting through the guiding telescopes. Sidereal drive is operated by means of a synchronous motor. A crystal oscillator controls motor speed, which is variable for trailing in spectrographic work or in compensating for atmospheric refraction.

1. Main telescope

Main mirror: Parabolic mirror of low-expansion glass
($\alpha = 300 \times 10^{-6}$)

Secondary mirror: Hyperbolic mirror of low-expansion glass
($\alpha = 300 \times 10^{-6}$)

Aperture of main mirror: 914mm

Focal length of main mirror: 4.6m

Focal ratio of main mirror: F/5

Cassegrain focal length: 16.5m

Cassegrain focal ratio: F/18

Minimum diameter of iris diaphragm opening: 700mm

2. Photo equipment

a) Prime focus photo equipment

Plate size: 82×107 mm ($1.0^\circ \times 1.3^\circ$)

Travel range of double slide carrier: 20mm

Remote control shutter: Bulb and Time

Ross lens diameter (detachable): 170mm

Guiding telescope at the prime focus side

Magnification: 10x

This telescope is also used for focusing

Magnification: 13.3x

Field of view: 15mm

Guiding telescope at the primary mirror side

Magnification: 20x and 10x

b) Cassegrain focus photo equipment

Plate size: 82×107 mm ($0.3^\circ \times 0.4^\circ$)

Travel range of double slide carrier and shutter are same as those of the prime focus photo equipment.

Rotating sector: Used to decrease excessive brightness of an adjacent star.

Guiding eyepieces

Magnification: 10x and 20x

3. Two guiding telescopes (Refractors)

Aperture of objective (Achromat): 150mm

Focal length of objective: 2.25m

Magnification: 90 and 28x

Field of view: $30'$ and $1'35''$

4. Equatorial mounting: English type

5. Driving device

a) Sidereal drive

The precision wormgear on the end of the polar axis is driven by means of a synchronous motor, controlled by a constant-frequency crystal oscillator in the control desk. For trailing in spectrographic work or in compensating for atmospheric refraction the frequency is continuously variable between $+0.05$ and -1% of sidereal rate. Also, it is provided with crystal oscillators whose frequencies are available in -1.5% , -2.5% , -3.5% , and -6% of sidereal rate.

b) Speed of quick drive: $90^\circ/\text{min}$ for both polar and declination axis.

c) Speed of slow drive: $1''/\text{sec}$ for both polar and declination axis.

d) Speed of fine drive: $1.5''/\text{sec}$ for polar axis.

$2''/\text{sec}$ for declination axis.

6. Control desk

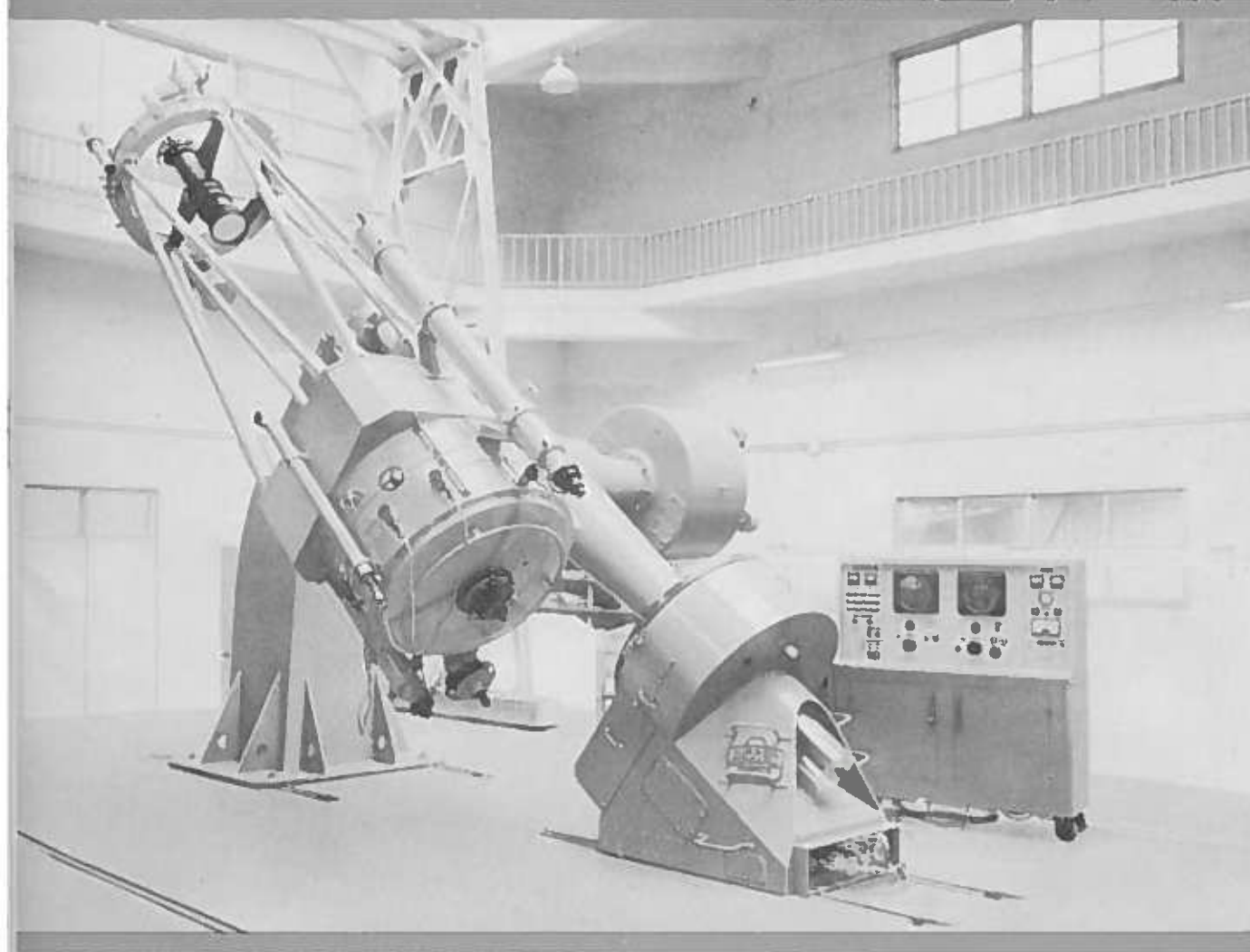
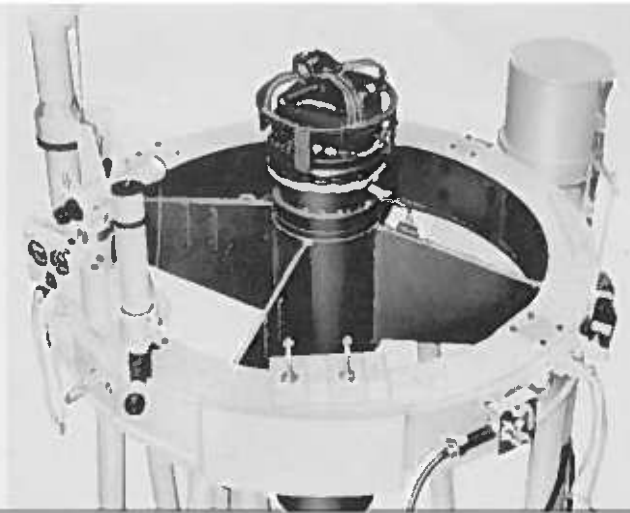
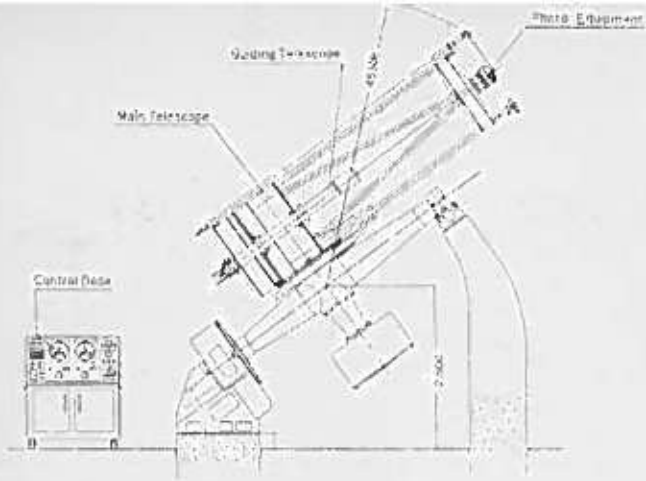
It contains automatic setting device (with quick drive) and manual adjustment device (with slow and fine drive) for declination and right ascension, crystal oscillators for sidereal drive, several power supplies and relays. Safety device prevents dangerous positioning.

7. Size and weight

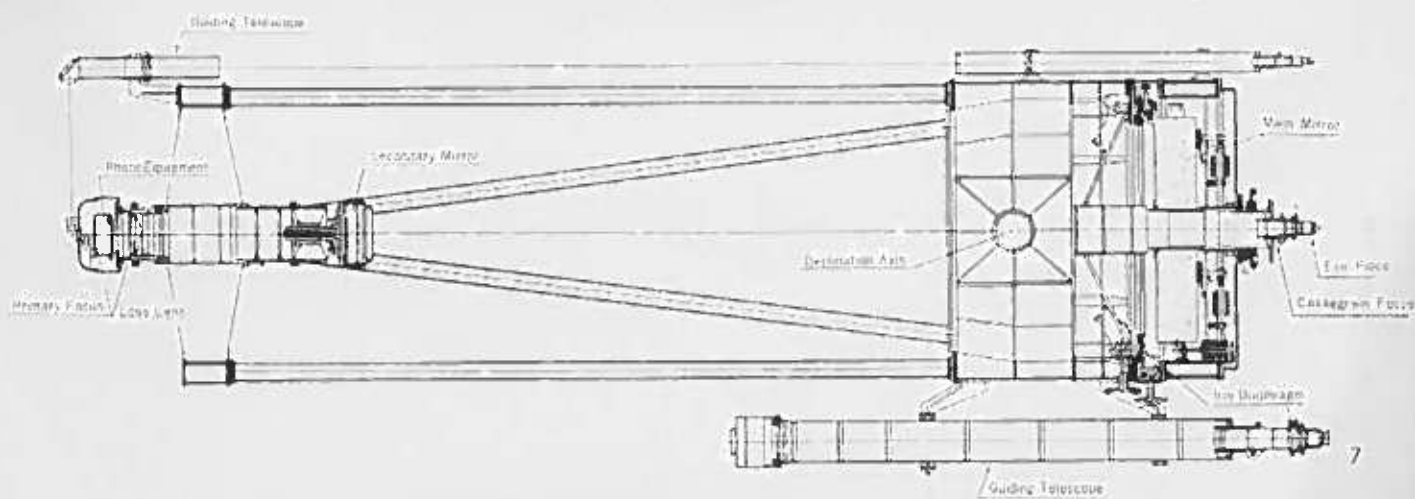
Length of main telescope: 5.6m

Maximum height: 7.0m

Approximate weight: 10 ton



91cm
(36 inch)
Reflector





Dodaira Station of the Tokyo Astronomical Observatory

Globular Cluster in Canes Venatici, M-1

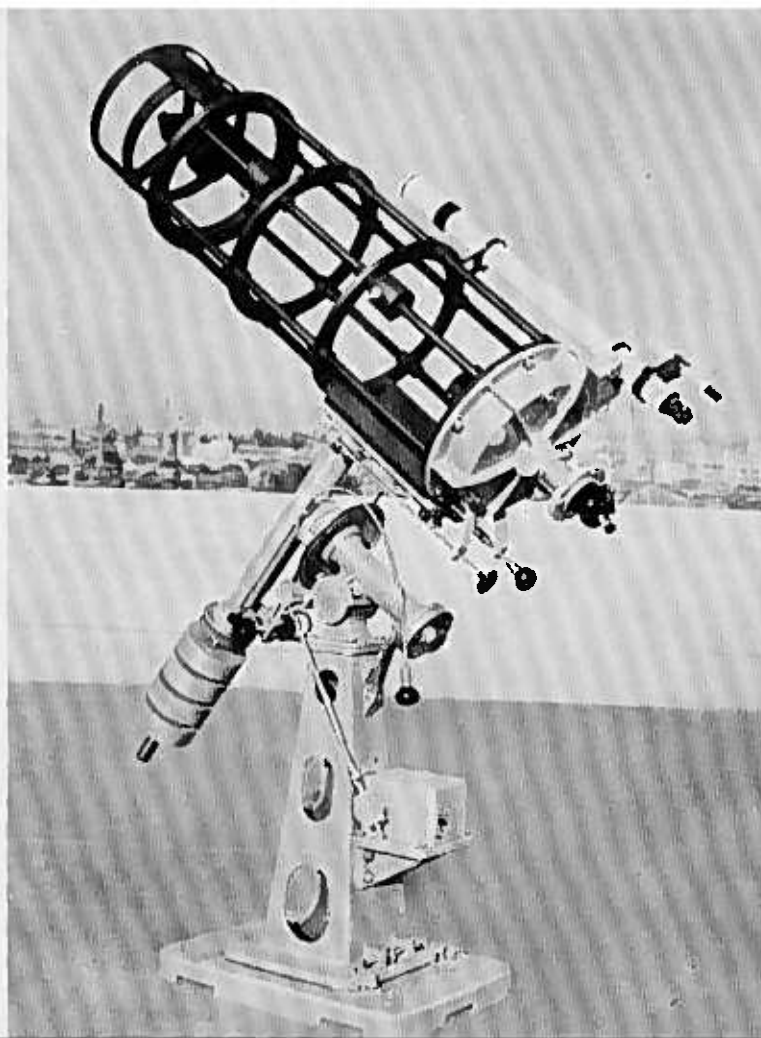


Spiral Nebulae in Ursa Major, M-81

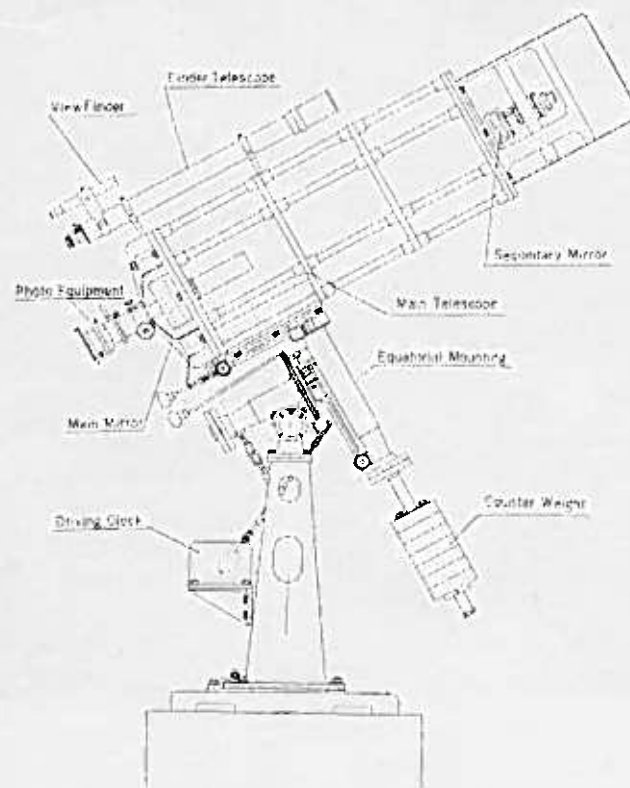




The Great Orion M-42



30cm (12 inch) Reflector



20cm (8 inch) Refractor

This refractor consists of a main telescope, German type equatorial mounting, clock device, finder telescope and other accessories.

For visual and photographic observation of celestial bodies.

1. Main telescope

- a) Objective (Apochromat)
Aperture: 200mm
Focal length: 3.6m
Resolving power: 0.57 second
- b) Eyepieces
Huygenian: 60, 40, 25 and 18mm
Orthoscopic: 12.5 and 9mm
Kellner: 25mm
- c) Magnification: 60—400x

2. Finder telescope

- Objective aperture: 50mm
- Focal length: 500mm
- Magnification: 20x
- Field of view: 2.5°

3. Equatorial mounting: German type

4. Clockwork is driven by weight

5. Accessories included

Sun glass, moon glass, star diagonal prism, sun prism, triple revolving nose-piece with bayonet mount.

6. Optional accessories supplied on order.

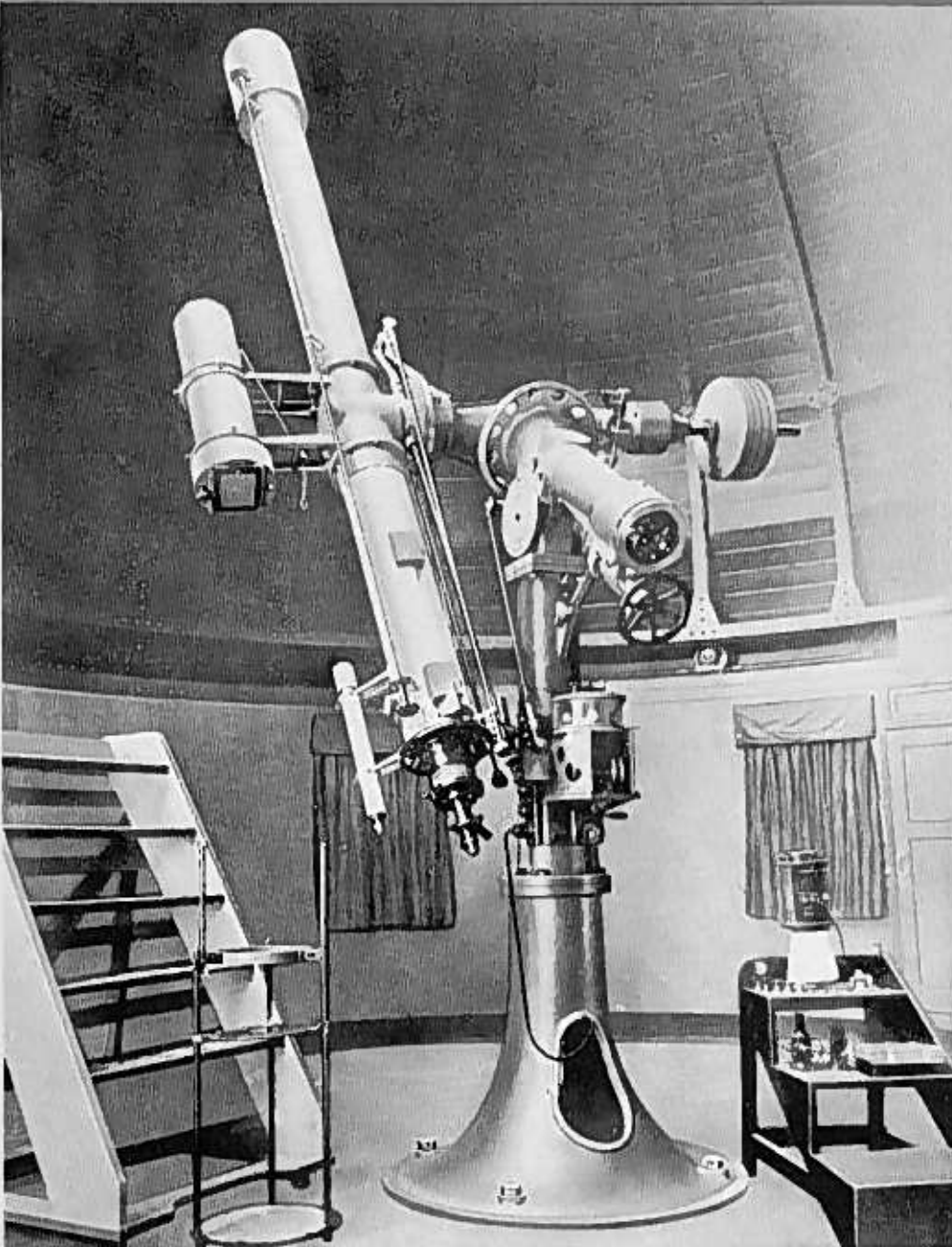
- a) Astro camera (Triplet)
Aperture: 125mm
Focal length: 600mm
Focal ratio: F/4.8
Plate size: 119 x 163mm
- b) Sun and moon camera
plate size: 119 x 163mm
Shutter: 1 to 1/125 sec., Time and Bulb.
Blue, red, yellow and neutral filters.
- c) Sun projection screen
Effective area: diameter 300mm
- d) Reading telemicroscope for declination angle
Aperture: 300mm
Magnification: 4x
- e) Centering telescope
Aperture: 150mm
Focal length: 15mm

7. Size

- Length of telescope: 4m
- Maximum height: 5m



Photo taken at National Science Museum



20cm (8 inch) Refractor

15cm (6 inch) Refractor

This refractor consists of a main telescope, German type equatorial mounting, clock device, finder telescope and other accessories.

For visual and photographic observation of celestial bodies.

1. Main telescope

- a) Objective (Achromat)
Aperture: 150mm
Focal length: 2250mm
Resolving power: 0.76 second
- b) Eyepieces
Huygenian: 40, 25 and 18mm
Orthoscopic: 9 and 7mm
- c) Magnification: 56 – 320x

2. Finder telescope

- Aperture: 50mm
- Focal length: 750mm
- Magnification: 27x
- Field of view: 1°50'

3. Equatorial mounting: German type

4. Clockwork is driven by weight

5. Accessories

Sun glasses, moon glasses, star diagonal prism, sun prism, sun projection screen and triple revolving nose-piece with bayonet mount.

6. Optional accessories supplied on order.

- a) Astro camera (Triplet)
Aperture: 125mm
Focal length: 600mm
Focal ratio: F/4.8
Plate size: 119×163mm
- b) Sun and moon camera
Plate size: 88×133mm
Blue, red, yellow and neutral filters are provided
- c) 6x finder
Aperture: 30mm
Field of view: 6°20'
- d) Position micrometer
12.5mm orthoscopic eyepiece and illuminating device for bright and dark field are provided.
Measuring range: ± 3 mm
Minimum reading: 0.01mm
Circular graduation: 1 div. 1°
- e) Eyepieces
Huygenian: 12.5 and 60mm
Orthoscopic: 5mm

7. Size

- Length of telescope: 2.7m
- Maximum height: 3.8m



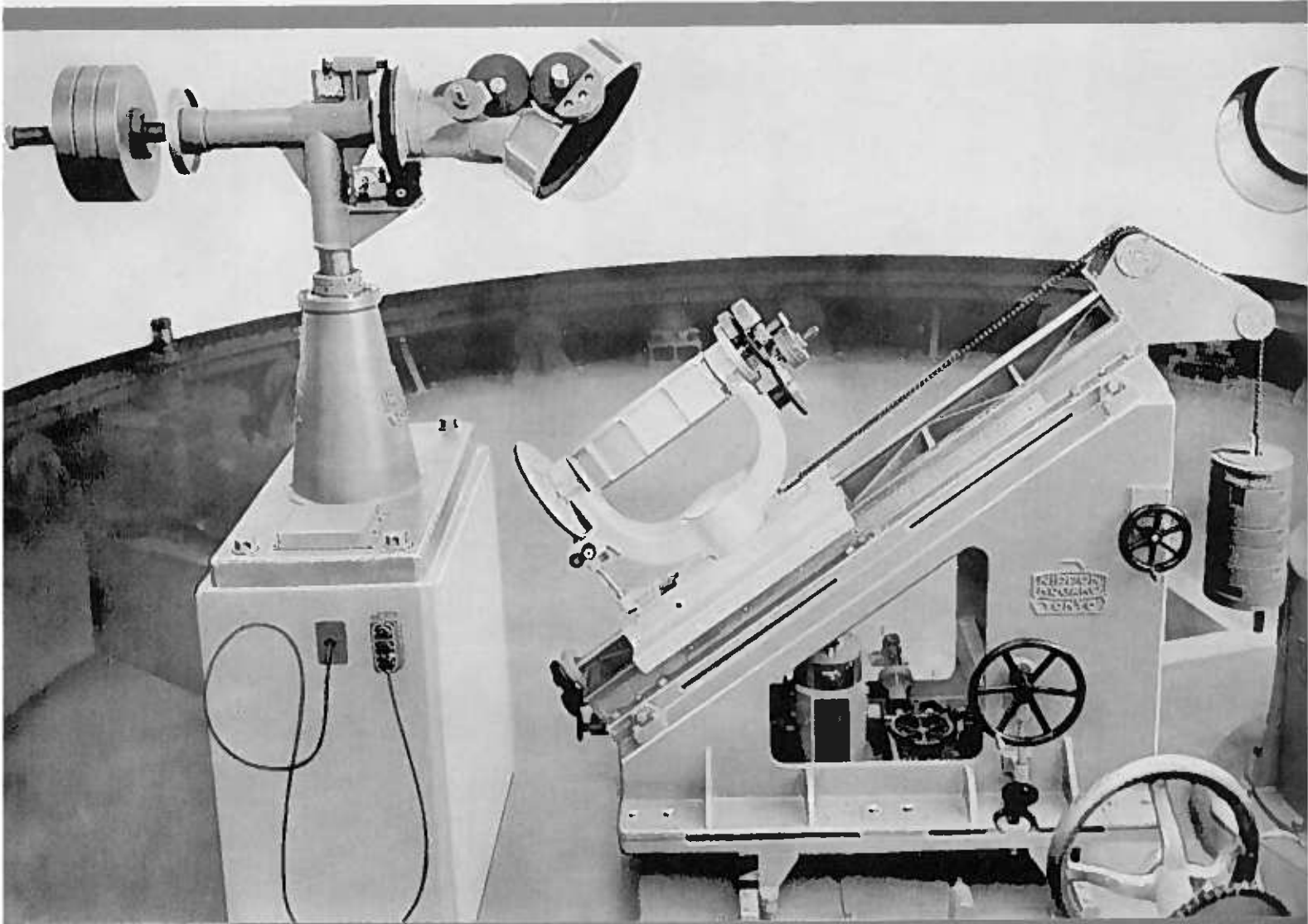
15cm (6 inch) Refractor

Solar Tower Telescope

For observation by the general public.

Solar light is fed to the vertical telescope by the coelostat and projected on an $800 \times 800\text{mm}$ screen to form a solar image.

This image is kept automatically on the screen by a photoelectric tracking device.



Solar Tower Telescope

1. Coelostat of fused quartz (1st and 2nd mirrors)
Aperture: 300mm
2. Auxiliary mirror of fused quartz
Aperture: 300mm
3. Telescope
 - a) Objective (Achromat)
Aperture: 150mm
Focal length: 2.7m

- b) Projection screen size: $800 \times 800\text{mm}$
4. Long distance projector
Distance: 6m
Screen size: $1.1 \times 1.1\text{m}$
Solar image size: diameter 800mm
5. Finder
Magnification: 10x
Field of view: 5°

Floating Zenith Telescope

A telescope tube floating in a mercury vessel.
Used for photographic observation of the latitude by
Talcott's method, without a level.

1. Objective

Triplet type lens

Aperture: 178mm

Focal length: 1.78m

Focal ratio: F/10

2. Vessel of mercury

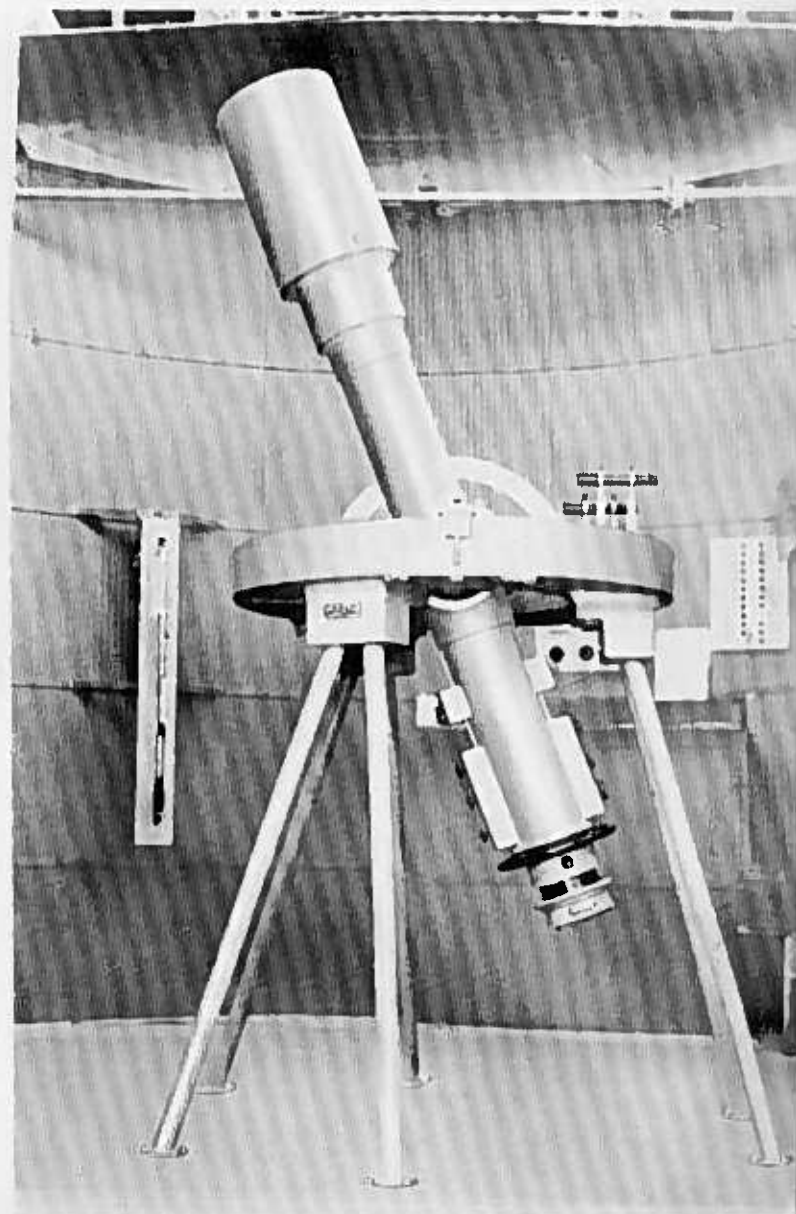
Outer diameter: 1.05 m

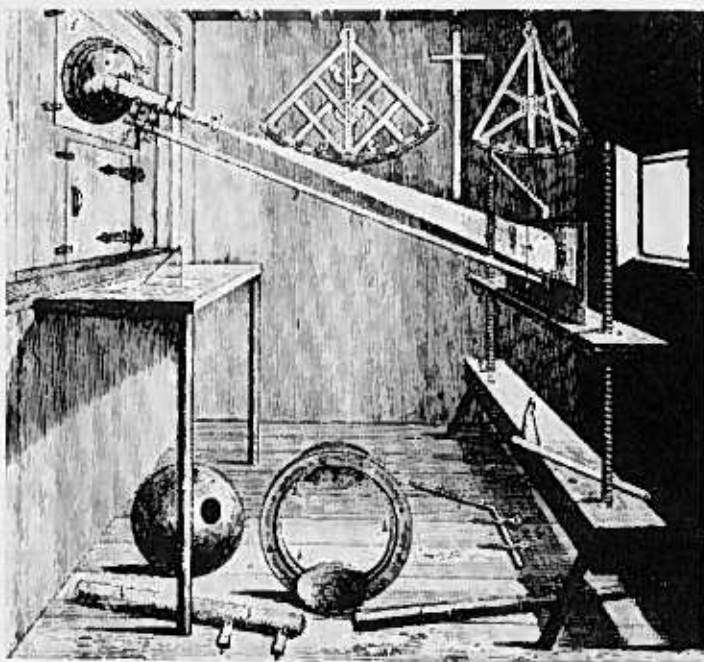
Inner diameter: 0.56 m

Weight of mercury: 90 kg



Floating Zenith Telescope





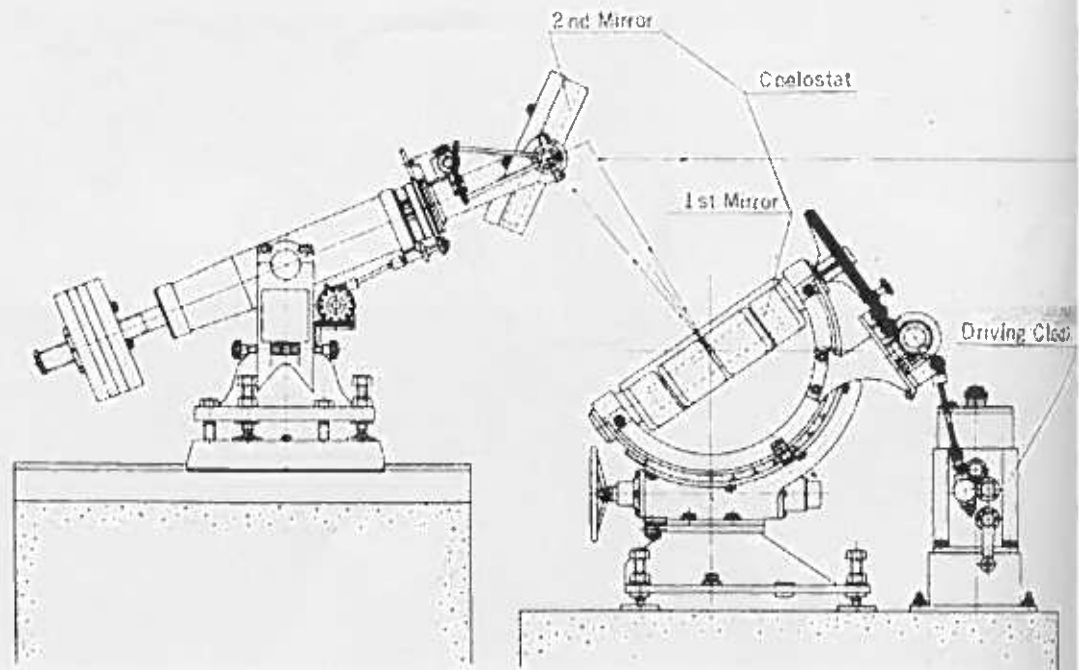
2. SPECTROGRAPHS
AND
OTHERS

Spectroheliograph

For visual observation of the solar prominence, flare and other phenomena.

Solar light is introduced to the instrument by a coelostat. A monochromatic solar image is reproduced by means of a spectroscopic.

Spectroheliograph



1. Collimator of fused quartz (1st and 2nd mirrors)

Aperture: 300 mm

2. Objective single lens

Aperture: 130 mm

Focal length: 5 m

3. Dispersion system

a) Collimating mirror

Aperture: 90 mm

Focal length: 5 m

1st slit: length: 30 mm, width: 0-3 mm

Roseau glass is inserted in front of the 1st slit.

b) Grating

Reflection type made by Bausch & Lomb

Grooves/mm: 600

Ruled area: 102 x 128 mm

c) Objective mirror

Aperture: 90 mm

Focal length: 5 m

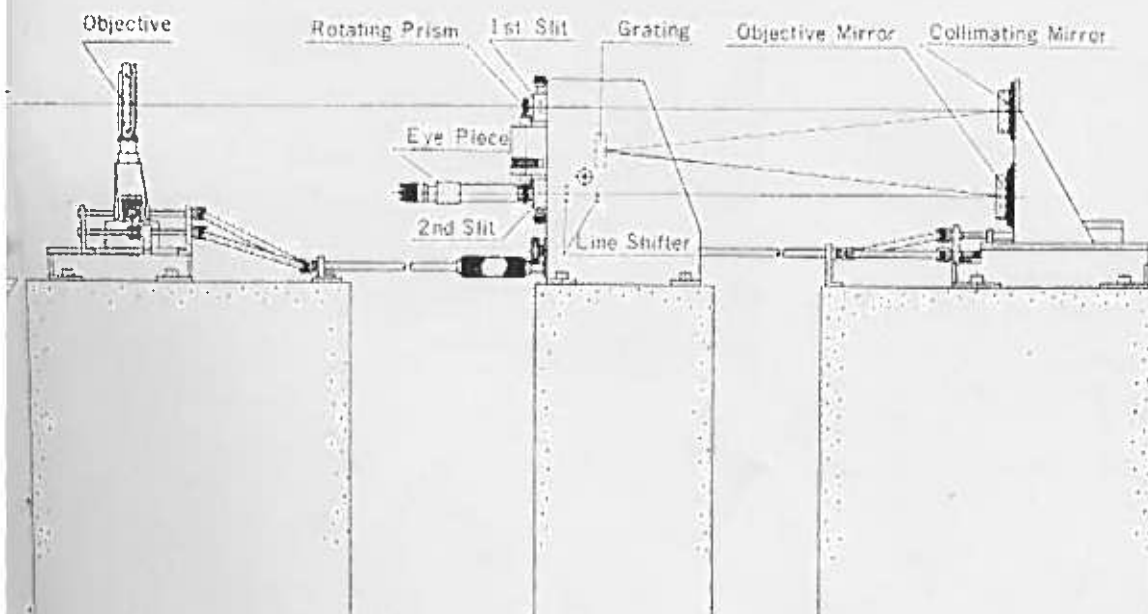
2nd slit: length: 30 mm, width: 0-3 mm

4. Size of image covered by rotating prism: 30 x 30 mm

5. Observing unit

Eye piece, Magnification 4x and 1.6x

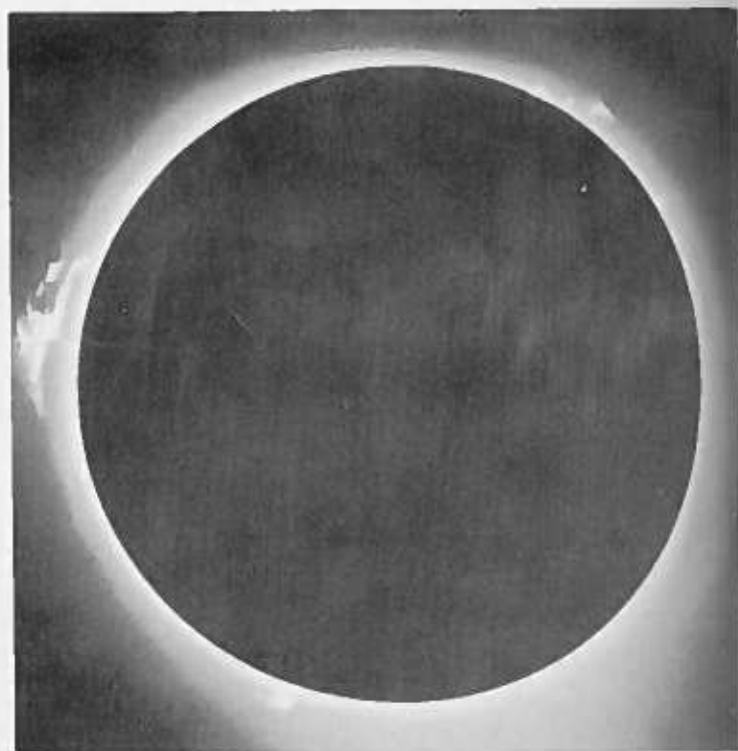
6. Photographic unit with Nikon F 35mm camera

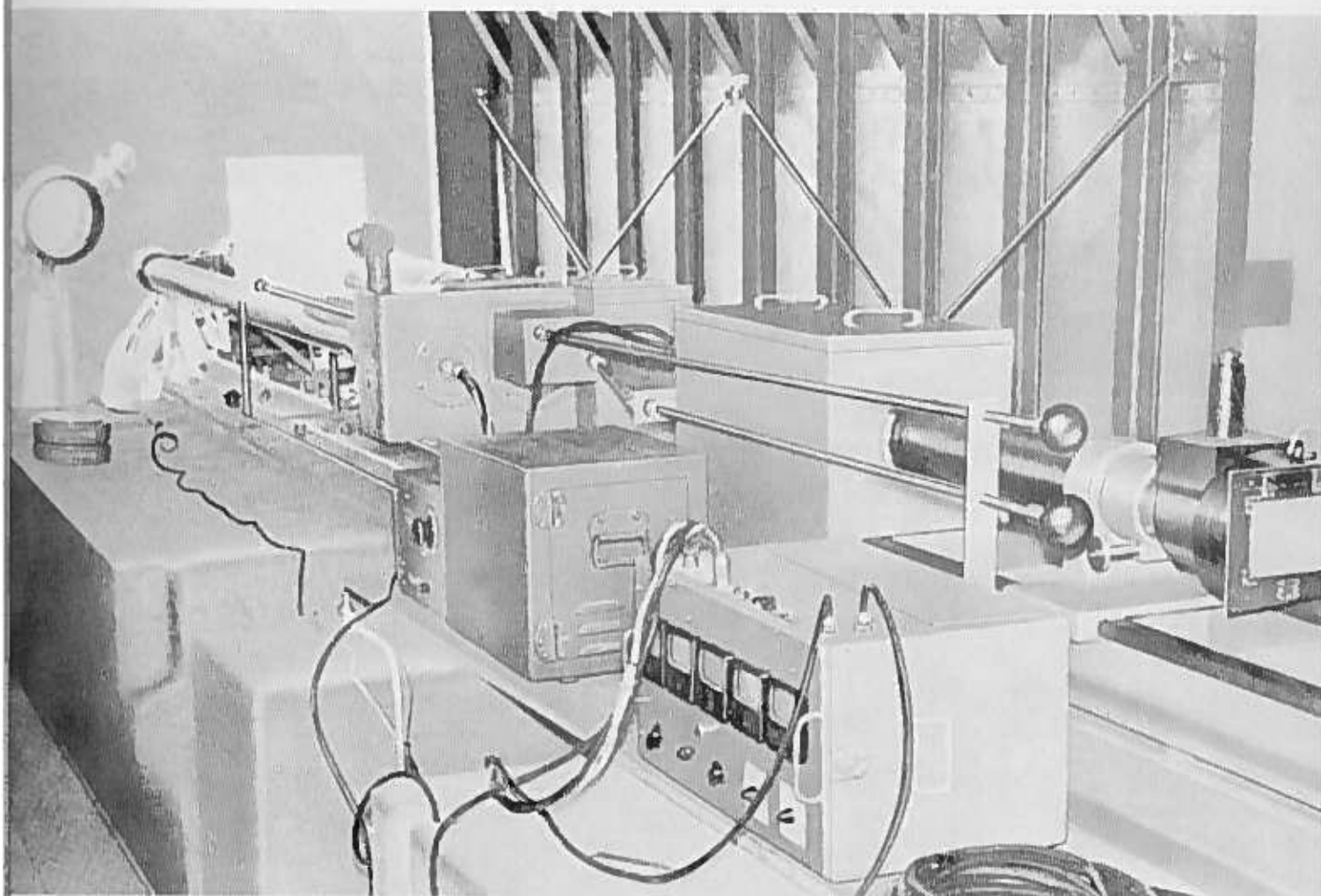


Monochromatic Heliograph

For monochromatic observation and photography of the solar prominence, flare and other phenomena. Monochromatic light ($H\alpha$ -6563A) is selected with a birefringent filter. It consists of a coelostat controlled automatically by a photoelectric guiding device, horizontal telescope, cine camera and box camera.

1. Coelostat of low-expansion glass (1st and 2nd mirrors)
Aperture: 300 mm
2. Objective
Aperture: 130 mm
Focal length: 2.5 m
Size of the solar image: Diameter 22 mm
3. Birefringent filter for $H\alpha$ (6563A)
4. Camera lens
Magnification: $\times 2$, $1\times$ or $1/2\times$ (size of the solar image is 44mm, 22mm or 11mm respectively)
5. Cine camera body
35 mm cine camera with reflex finder
6. Box camera body
Plate size 82×107 mm
7. Guiding device
Photoelectric automatic guiding device to control the 1st mirror of the coelostat.
Aperture of objective: 50 mm
Focal length of objective: 2.5 m
Magnified image size: 115mm
8. Size
Length of the instrument: 9.4 m
Maximum height: 1.8 m





Monochromatic Heliograph

Coronagraph

Consists of a main telescope, fork type equatorial mounting, clock device, and finder telescope.

It is designed on Lyot's principle.

The solar image produced by the objective is masked by a circular disc. Only peripheral light is admitted to visual, photographic, spectroscopic and photoelectric observation.

1. Objective (single lens)

Finely annealed material is specially selected, free of bubble and striae.

Aperture: 110 mm

Focal length: 1.5 m

2. Circular disc (interchangeable)

14.3–15.4 mm at intervals of 0.1 mm in diameter

3. Relay lens

Focal length: 205 mm

Magnification: 1x–1.5x

4. Direct-vision spectroscope for coronal observation

a) 3 Amici prisms for 5303A. Difference between dispersion angle of H_{α} and H_{β} : $13^{\circ}16'$

b) 1 Amici prism for 5303A. Difference between dispersion angle of H_{α} and H_{β} : $4^{\circ}27'$

c) 3 Amici prisms for 6374A. Difference between dispersion angle of H_{α} and H_{β} : $14^{\circ}43'$

5. Spectrograph

a) Collimator lens

Aperture: 53 mm

Focal length: 600 mm

b) Plane grating

c) Camera lens

Focal length: 600 mm and 210 mm

Focal ratio: 1:11 and 1:4.5

6. Cine camera

Focal length: 121 mm

Film size: 18 x 24 mm (35 mm film)

Magnification: 1, 2, or 3x

7. Camera with a Lyot filter to photograph the monochromatic image of the corona.

8. Guiding telescope

Aperture: 80 mm

Focal length: 960 mm

Field of view: $22.5'$

Magnification: 107x

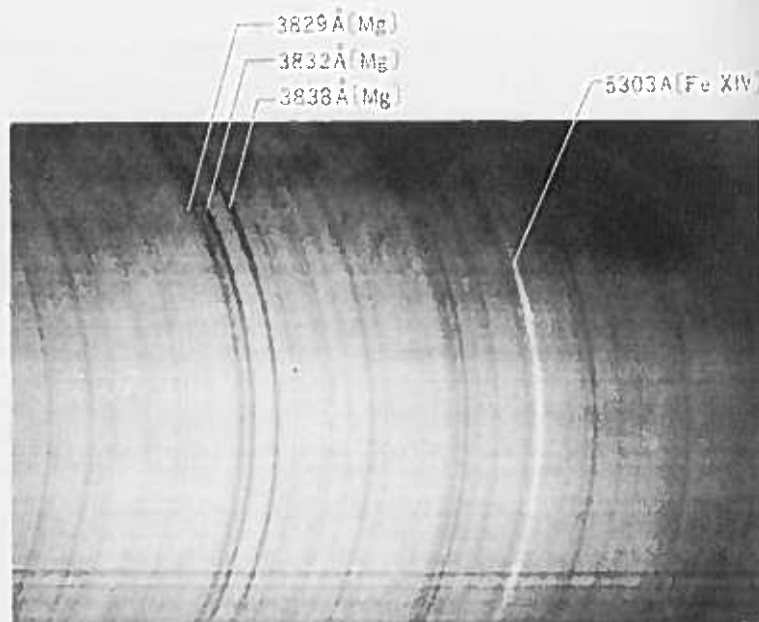
9. Mounting

Fork type equatorial mounting

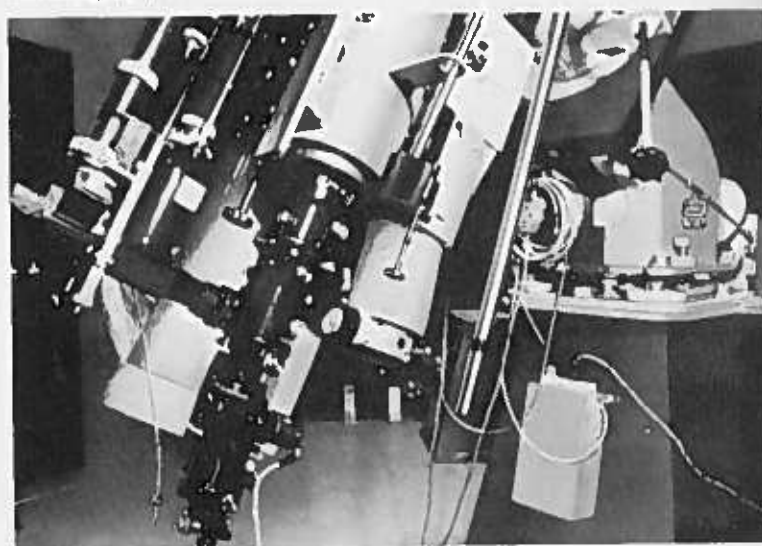
10. Clockwork is driven by weight

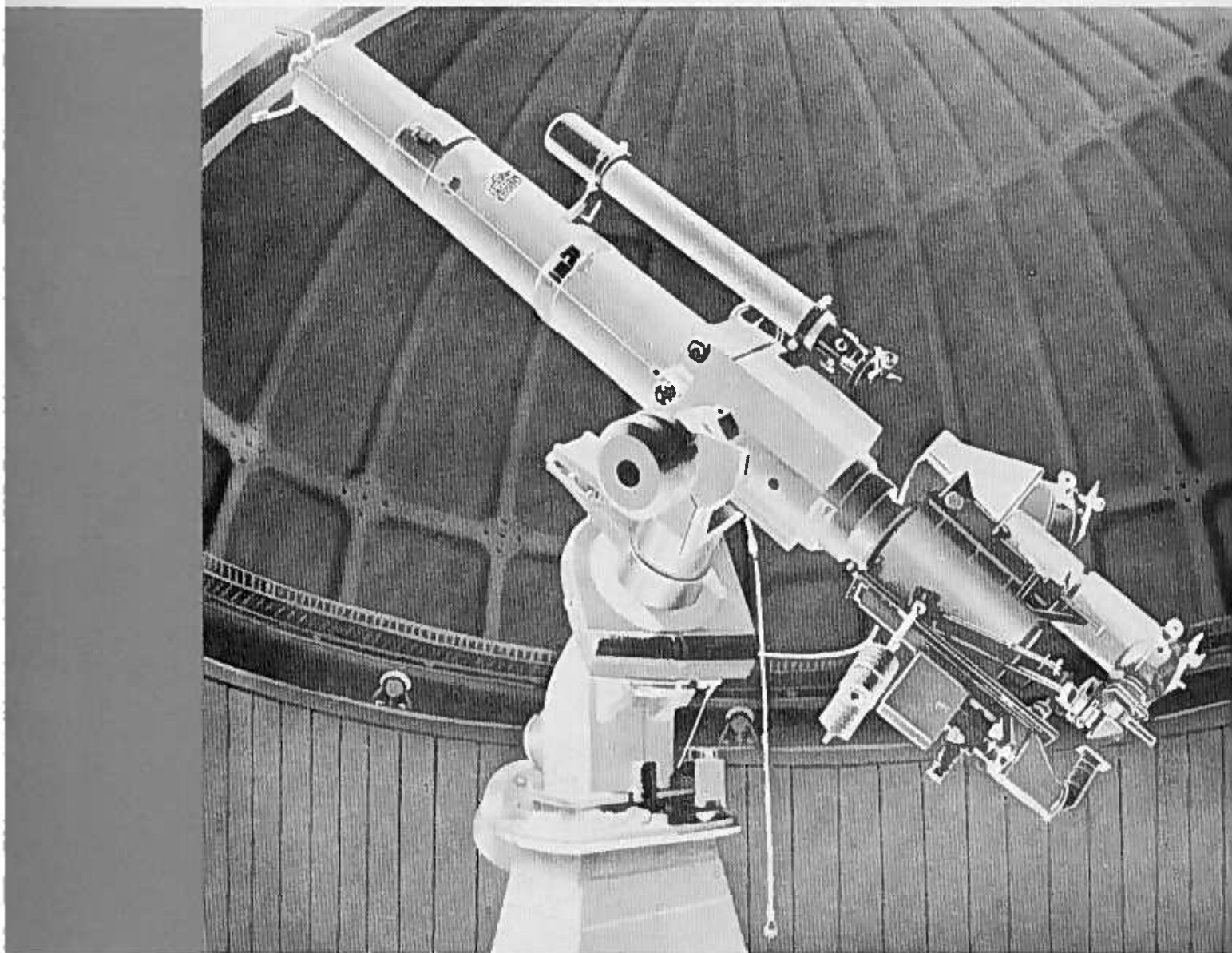
11. Size

Length of main telescope: 2.9 mm



Coronagraph

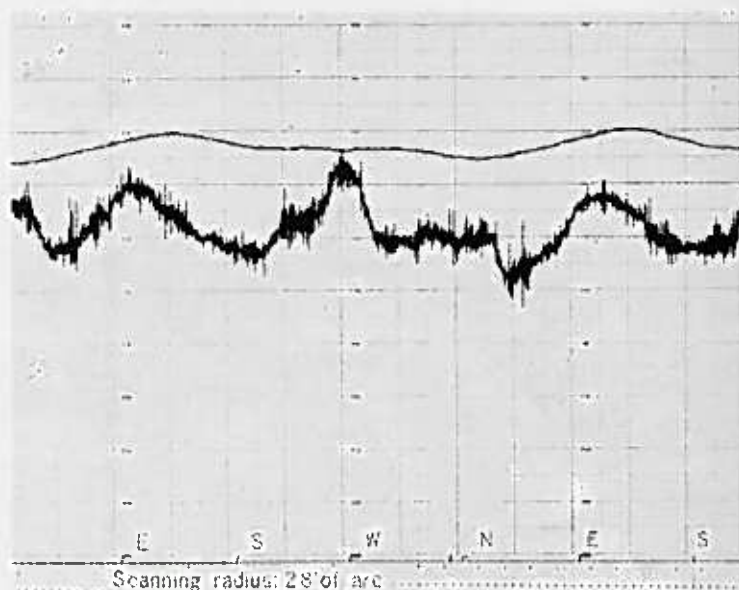


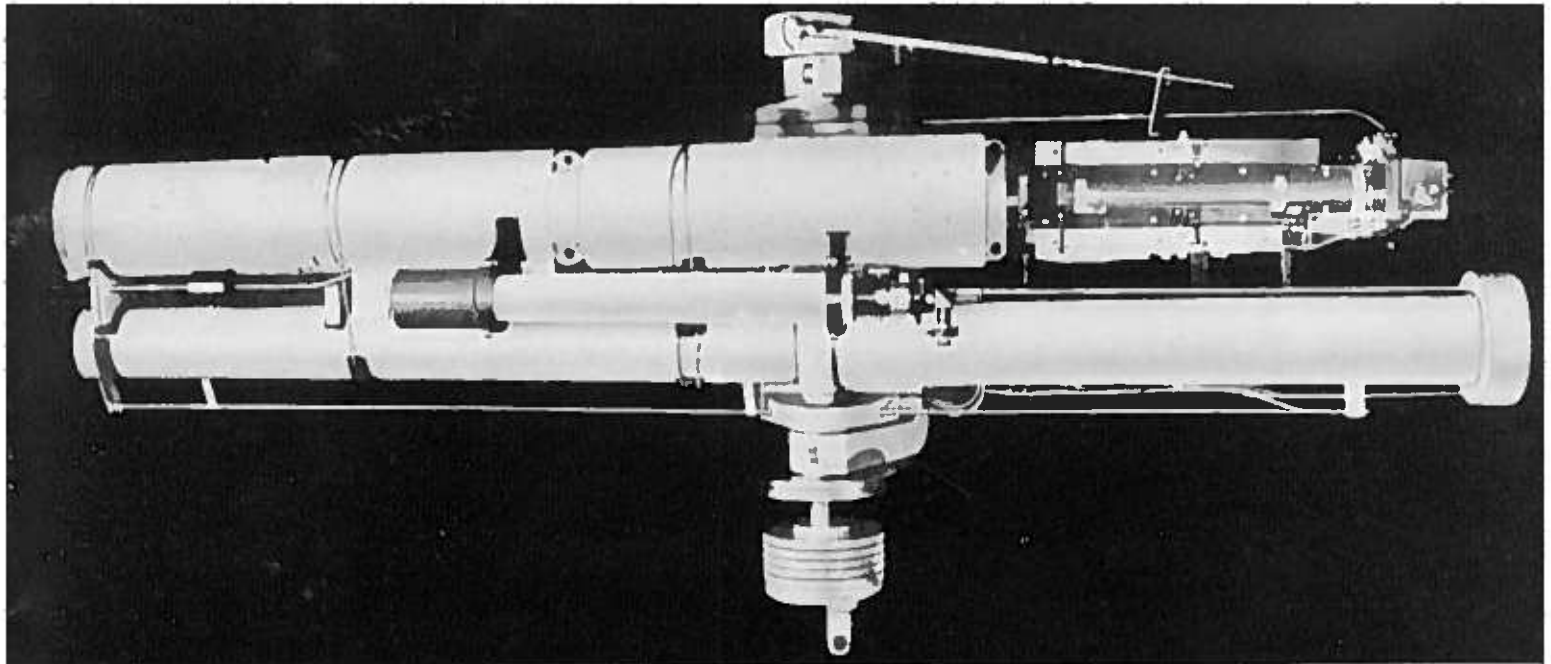


K-Coronameter

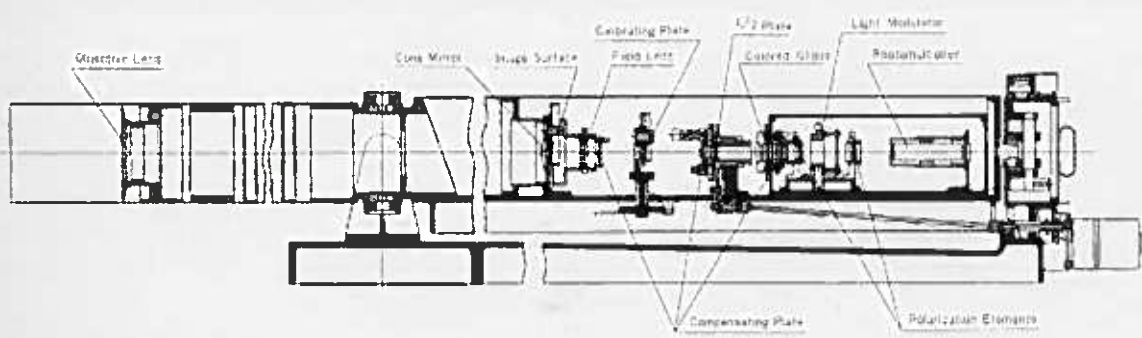
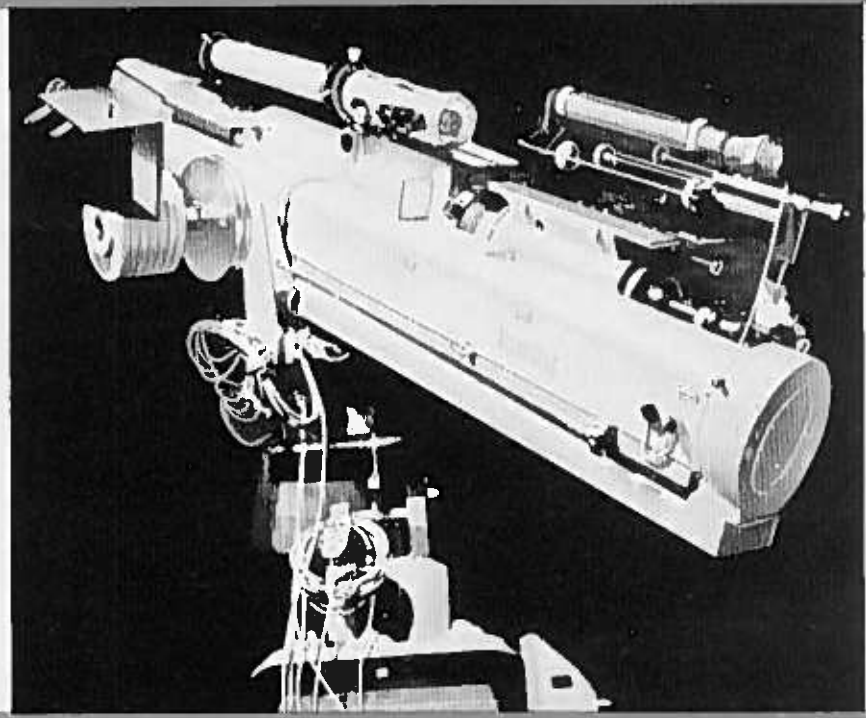
A coronagraph type telescope, with a high-precision polarimeter incorporating an ADP light modulator. This polarimeter accurately measures polarization (down to the order of 10^{-5}) of skylight near sun. It can be used to measure the white corona (K-corona) of a total solar eclipse up to a distance of twice the solar radius. The K-Coronameter is set parallel to the coronagraph on the same mounting.

1. Range of effective wavelength: 4300Å-6700Å
2. Maximum range of measurement: To the distance of twice the solar radius
3. Scanning time
One scan around the sun requires 4 minutes
4. Precision of the polarimeter
Detects partial polarized light to the order of 10^{-5}
5. Objective (single lens)
Finely annealed material is specially selected, free of bubble and striae.
Aperture: 80mm
Focal length: 2m
6. Light modulator
Applying AC 5KV (70 c/s) to an ADP cell, we have $\pm \lambda/4$ retardation alternately
7. Polarization elements
 - a) $\lambda/2$ plate diameter 30mm
 - b) $\lambda/4$ plate diameter 30mm
 - c) Polarizer diameter 30mm
8. Calibrating plate (ND filter)
Density: 3 and 4 Density for 4300-6700Å
Inclining range: $\pm 10^\circ$
The angle of inclination can be read to the order of 0.01°
9. Detector
EMI 9524 Photomultiplier
10. Size
Length of main telescope: 3.1m





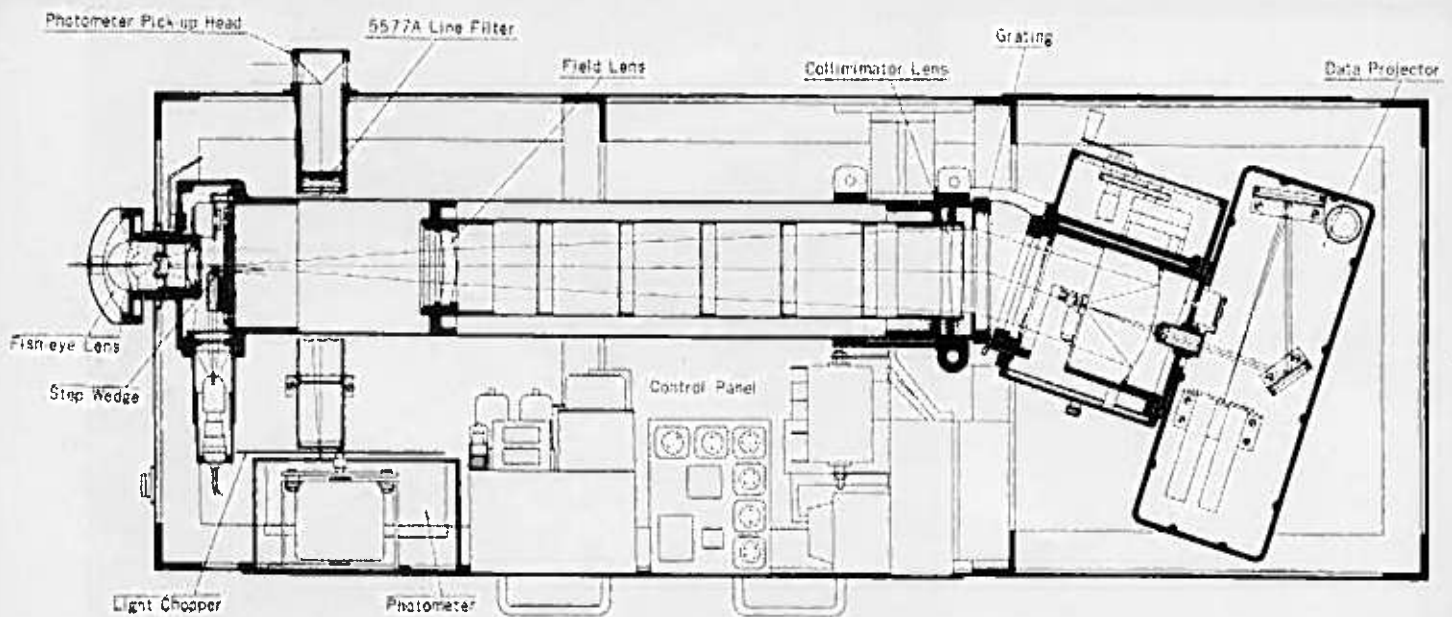
Coronagraph and K-Coronameter



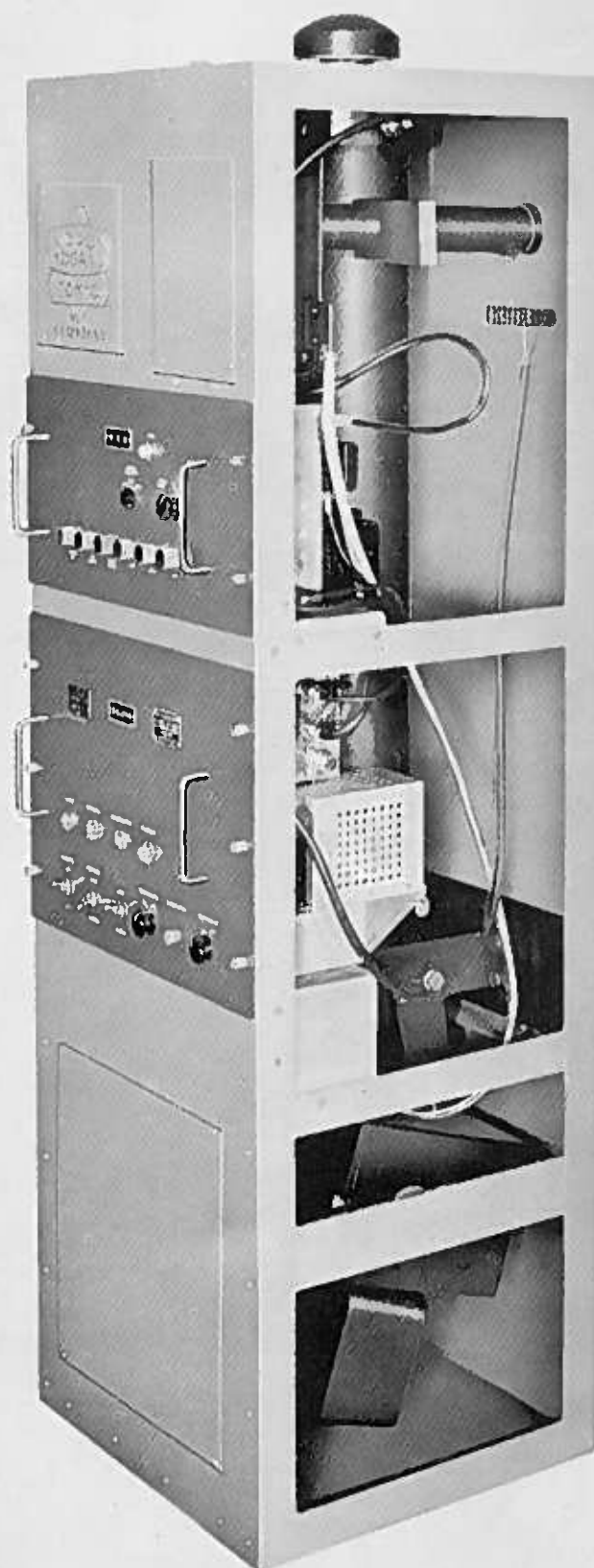
Auroral Spectrograph

Permits continuous automatic or manual photography of the auroral spectrum within a zone of $180^\circ \times 2''$ along a magnetic meridian.

It has a semi-solid Schmidt camera with focal ratio of 1:0.65. Time, film number, number of photons and spectral step wedge are simultaneously recorded on the film. The Auroral Spectrograph shown was designed for the Japanese Antarctic Research Expedition during the International Geophysical Year, 1957-58.



1. Range of wavelength: 3400A—8800A
2. Condenser
Fisheye type
Field of view: $180^{\circ} \times 2^{\circ}$
Focal ratio: 1:7.6
3. Collimator
Aperture: 80mm
Focal length: 510mm
Slit length: 30mm
4. Grating
Transmission type made by Bausch & Lomb.
Grooves/nm: 600m
Ruled area: 75×75 mm
Blaze wavelength: 5000A
Linear dispersion: 330A/mm at 5130A
Resolving power: 45000
5. Camera
Semi-solid Schmidt type
Focal length: 49mm
Focal ratio: 1:0.65
Field of view: 12°
Film: 16mm cine film
100 feet bulk magazine is provided
6. Step wedge for calibration
0—2.1 density (8 steps)
7. Photometer
Number of photons transmitted through 5577A interference filter, is counted and recorded for automatic determination of exposure time. Time and film no. are simultaneously recorded.
a) Interference filter for 5577A
b) Detector: RCA 931-A Photomultiplier
8. Height of this instrument: 1.3m



Auroral Spectrograph

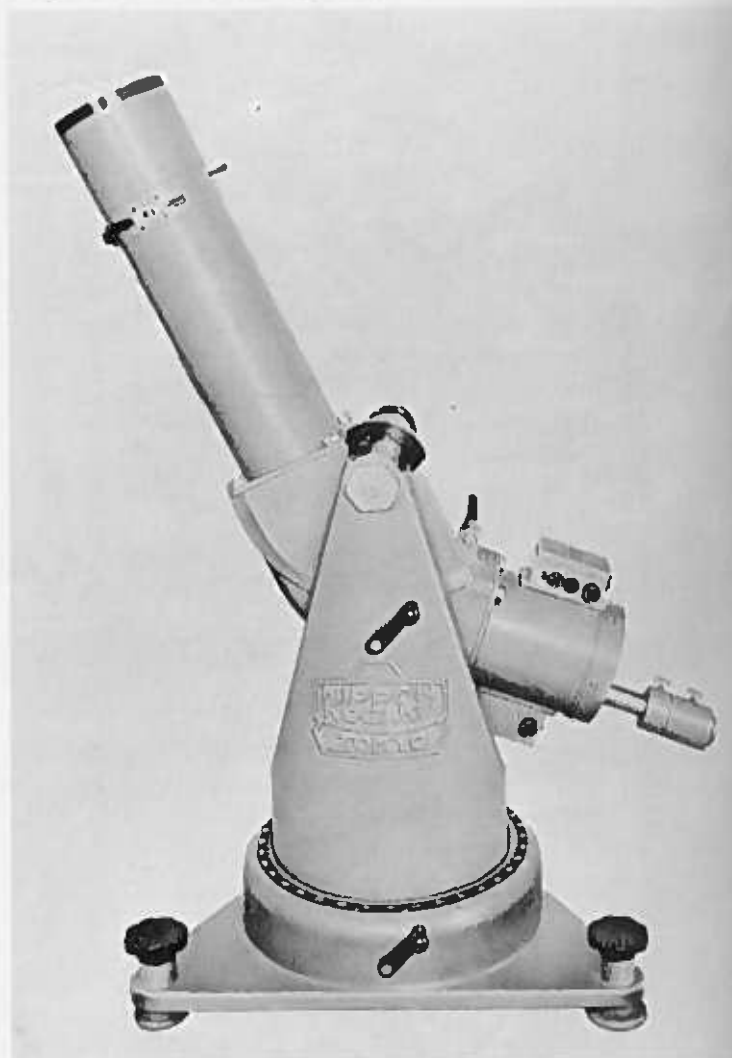
Airglow Spectrograph Type 1

Provided with an altazimuthal mounting and a Schmidt type camera with focal ratio of 1:0.7, permitting extremely short exposure time. Two collimators are provided to change field of view.

1. Range of wave length: 3500A—8000A
2. Collimators
 - a) Long focal length collimator
Aperture: 100mm
Focal length: 1.5m
Curved slit
with prism for comparison spectra
Length: 51mm
Field of view: 3°50'
 - b) Short focal length collimator
Aperture: 100mm
Focal length: 400mm
Curved slit
with prism for comparison spectra
Length: 14mm
Field of view: 14°30'
3. Dispersion prism
Two 30° prisms
Size: 110×55mm
Height: 80mm
Glass material: BaF3 (Schott type)
Linear dispersion: 500A/mm at 5000A
Resolving power: 27000
4. Camera
Schmidt type
Focal ratio: 1:0.7
Focal length: 70mm
Field of view: 4°
Film: 16mm cine film

5. Finder
Magnification: 5×
Field of view: 5°
6. Mounting
Vertical movement: 0°—90°
Horizontal movement: 0°—360°
7. Height: 2.3m for long focus collimator
1.2m for short focus collimator

Airglow Spectrograph Type 1



Airglow Spectrograph Type 2

For continuous photography of airglow spectrum. It has a fisheye lens-condenser permitting photography of the spectrum within a zone of $180^\circ \times 2^\circ$... and a Schmidt type camera with focal ratio of 1:0.7 for extremely shortened exposure time.

1. Range of wave length: 3400A—6800A

2. Condenser

Fisheye type

Field of view: $180^\circ \times 2^\circ$

Focal ratio: 1:7.6

3. Collimator

Aperture: 80mm

Focal length: 610mm

Slit length: 30mm, width: 0—3.6mm

4. Grating

Transmission type made by Basuch & Lomb

Grooves/mm: 600

Ruled area: 75×75mm

Blaze wave length: 5000A

Linear dispersion: 330A/mm at 5130A

Resolving power: 45000

5. Camera

Schmidt type

Focal length: 70mm

Focal ratio: 1:0.7

Size of image: 5×15mm

Film: 16mm cine film

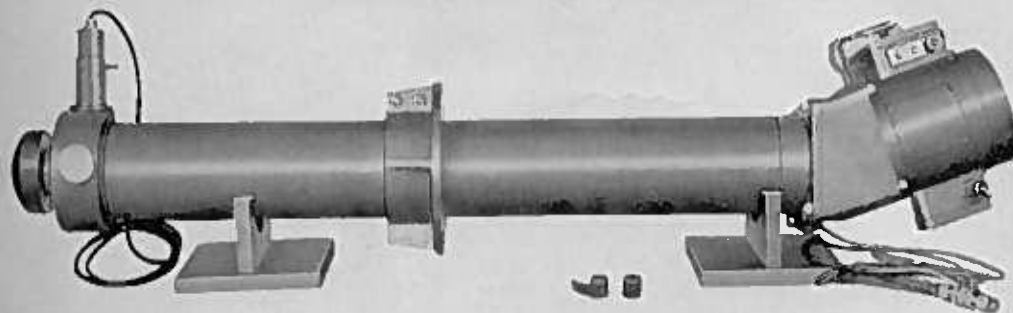
6. Step wedge for calibration

0—2.1 density (8 steps)

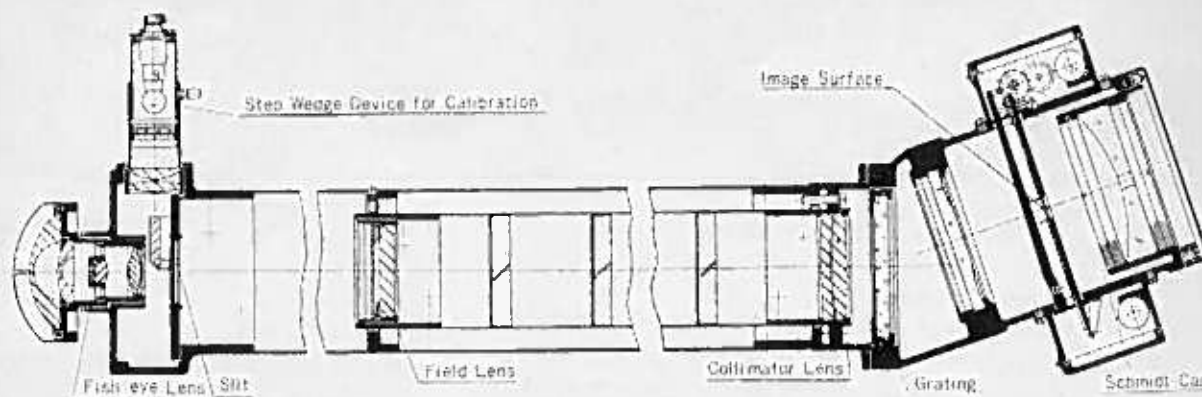
7. Film drive

Interval of automatic film drive: 10—30min

8. Length of instrument: 1.3m



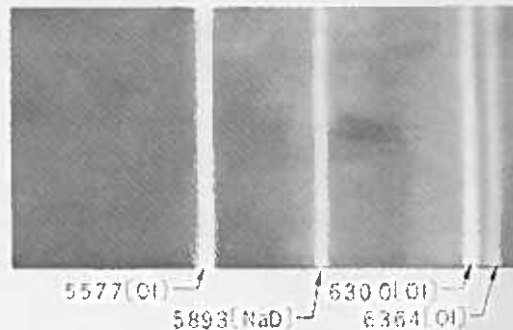
Airglow Spectrograph Type 2



South
horizon

Zenith

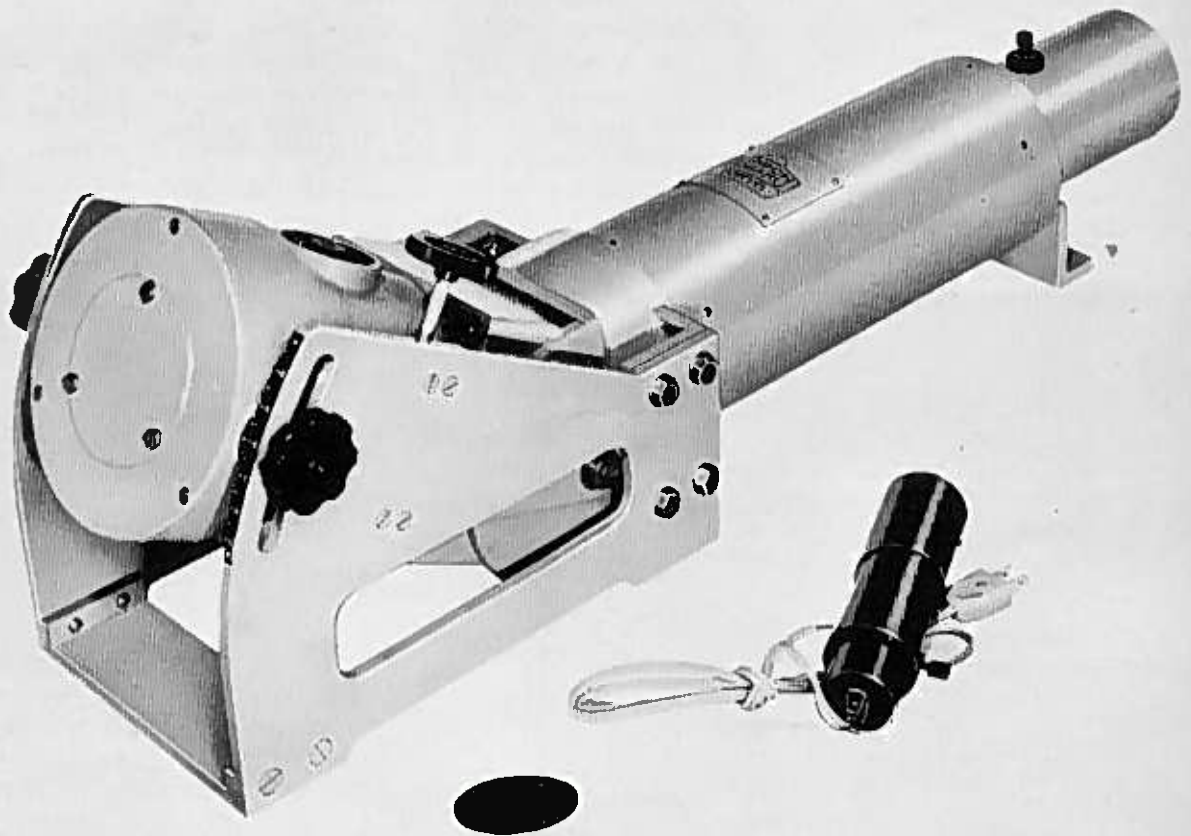
North
horizon



Airglow Spectrograph Type 3

Projects an image of the airglow spectrum on the image converter tube.

It has a Schmidt type camera with focal ratio of 1:0.7, permitting extremely short exposure time.



1. Wavelength range: 5000A—10500A

2. Slit

Length: 20mm

Width: 0—2.0mm Variable

3. Collimator lens

Achromat-doublet

Aperture: 100mm

Focal length: 450mm

4. Grating

Reflection type made by Bausch & Lomb

Ruled area: 75×75mm

Grooves/mm: 600

Blaze wavelength: 5000A

Linear dispersion: 330A/mm at 5130A

Resolving power: 45000

5. Camera lens

Schmidt type

Aperture: 100mm

Focal length: 70mm

Focal ratio: 1:0.7

Effective film area: 15×5mm (16mm film)

Image surface: Cylindrical

Field of view: 12°

6. Step wedge for calibration

0—2.1 density (8 steps)

7. Size

Height: 0.8m

Airglow Spectrograph Type 3

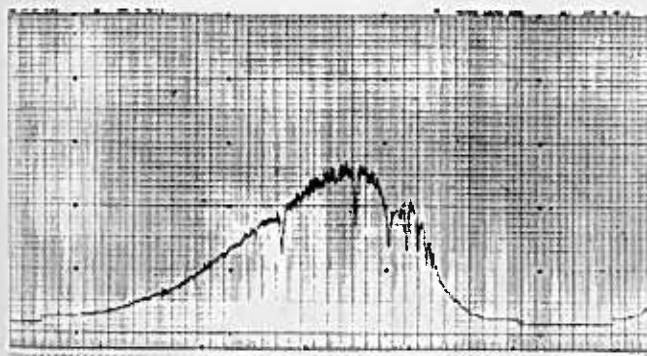
Photoelectric Photometer

May be installed at the focus of any astronomical telescope.

It is used for introducing stellar light to a photoelectric auto-recording unit. If necessary, a Spectro Scanning Photoelectric Photometer is provided.



Photoelectric Photometer



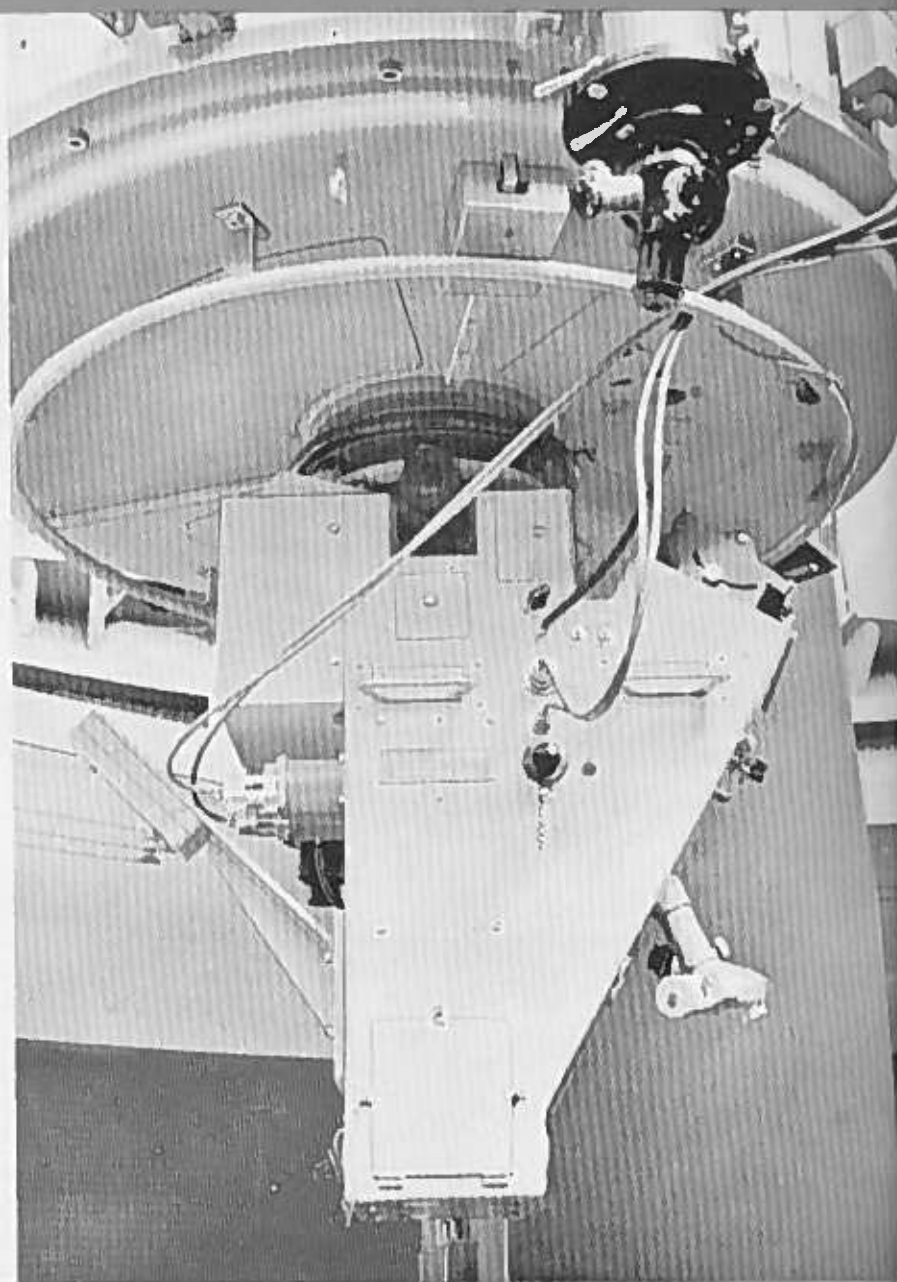
1. Eyepiece (diagonal system)
Focal length: 60mm
Field of view: 30mm diameter
2. Optical system for guiding with reticle
Magnification: 10 \times , 20 \times
Field of view: 9mm
diameter of hole: 0.5, 1.0, 2.0mm
3. Condenser lens of fused quartz
Diameter: 15mm
Focal length: 80mm
4. Filters: U, B, V, filter system
Filters for three or multicolor photometry.

Grating Spectrograph

For taking spectrograms of celestial bodies at the focus of a telescope. For example, as installed in the Cassegrain focus of the 91cm (36 inch) Reflector at Dodaira Station of the Tokyo Astronomical Observatory.

Its grating is interchangeable with other gratings or with Littrow type prism.

The entire spectrograph is hermetically sealed and temperature controlled.



Grating Spectrograph

1. Range of wave length: 3500Å—8000Å

2. Inverted Cassegrain type collimator

Focal length: 850mm

Focal ratio: 1:15

Slit length: 10mm (max.)

Slit width: 0.01—1mm

3. Dispersion system

Grating

a) Reflection type made by Bausch & Lomb

Grooves/mm: 600

Blaze wave length: 5000Å

Ruled area: 65×76mm

Linear dispersion: 45Å/mm at 4340Å

Resolving power: 30000

b) Littrow type 30° prism

Glass material: BaF₃ (Schott type)

Linear dispersion: 60Å/mm at 4340Å

Resolving power: 13000

4. Camera

Focal length: 350mm

Focal ratio: 1:3.5

Field of view: 6°30'

Plate size: 82×107mm

5. Comparison spectra

Light source: Iron arc and Neon discharge tube
Optical elements are made of fused quartz

6. Viewfinder

Eyepiece focal length: 80mm

Field of view: 10°

7. Optical system for guiding with reticle

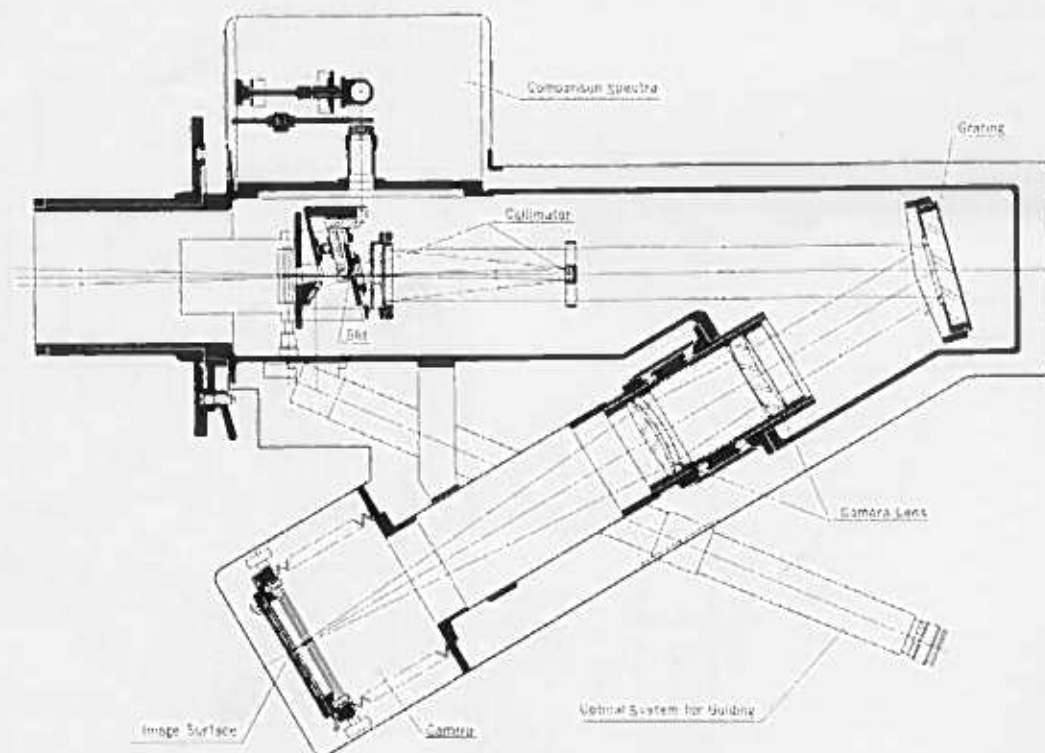
Magnification: 10×

Field of view: 10mm on the slit

8. Size and weight

Length: 1m

Approximate weight: 60kg



Nebular Spectrograph

For taking spectrograms of nebulae at the focus of a telescope.

It has a Schmidt type camera lens with focal ratio of 1:0.62 and a 20mm slit that make photography of the weakest nebular light possible.

1. Wavelength range: 3000A–8000A

2. Collimating mirror

Aperture: 80mm

Focal length: 290mm

Slit length: 20mm

Slit width: 0.01–2mm

3. Grating

Reflection type made by Bausch & Lomb

Ruled area: 102×102mm

Grooves/mm: 600

Blaze wavelength: 5000A

Linear dispersion: 290A/mm at 4000A

Resolving power: 44000

4. Camera (Schmidt type)

Aperture: 85mm

Focal length: 52.5mm

Focal ratio: F/0.62

Field of view: 12°

Film size: 11×8mm, total length 1.5m

Image surface: cylindrical

5. Comparison spectra

All optical elements are made of fused quartz

Light source: Iron-arc, Neon and Argon discharge lamp

6. Viewfinder (diagonal system)

Eyepiece focal length: 80mm

Field of view: 20°

7. Optical system for guiding

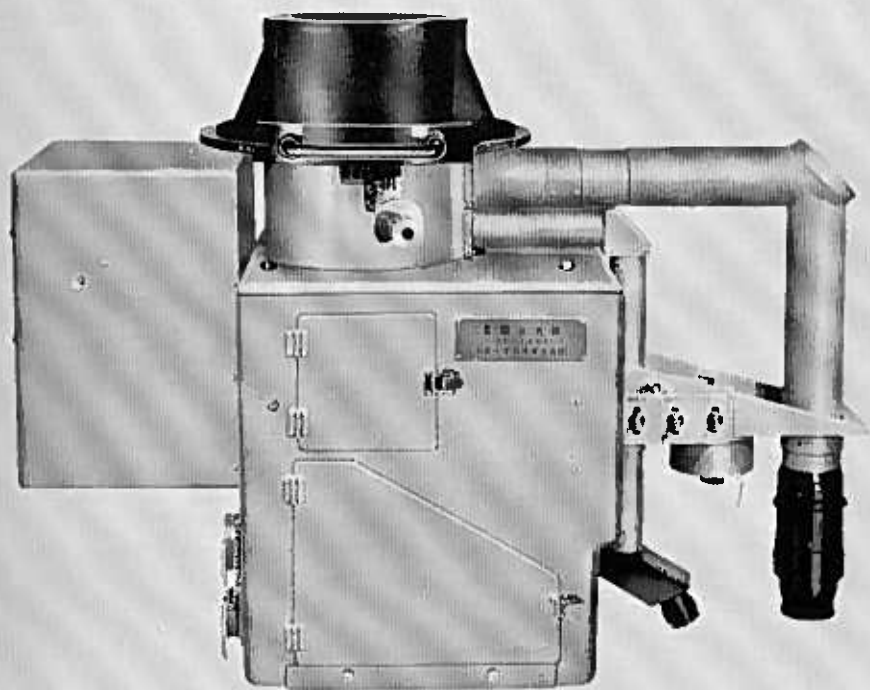
Magnification: 10×

Field of view: 20° with reticle

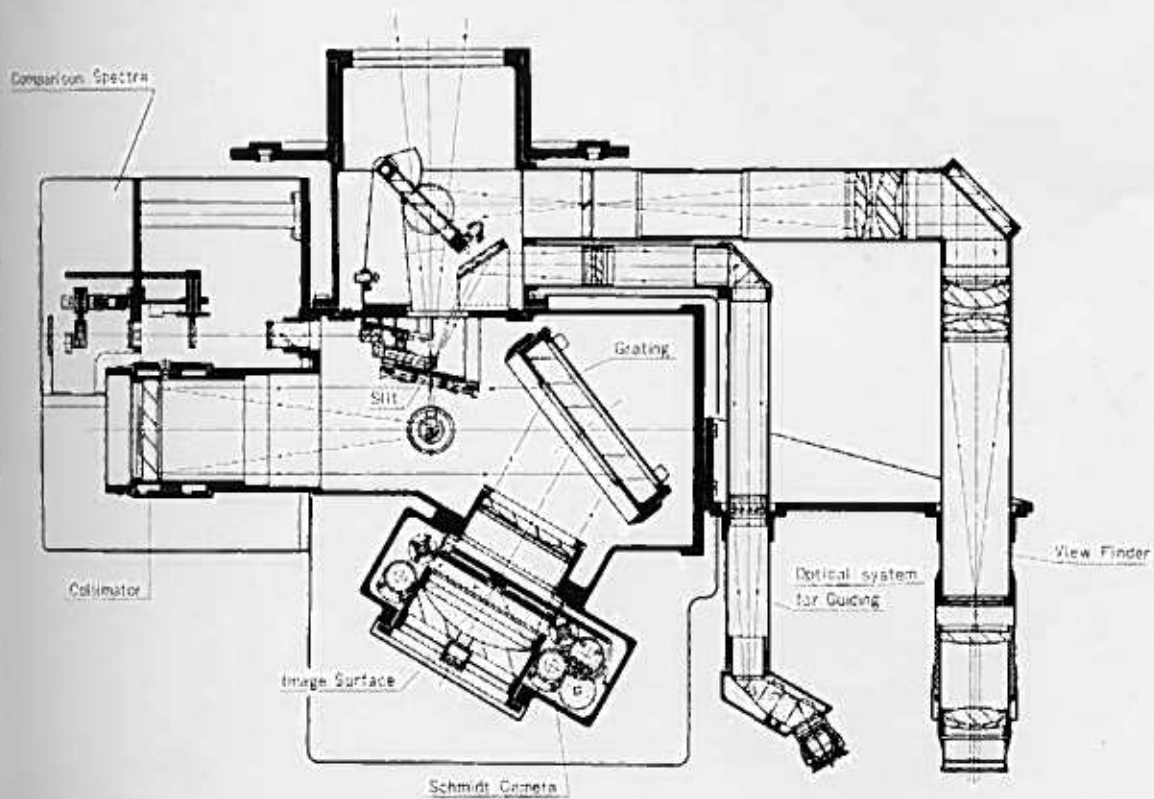
8. Size and weight

Length: 0.7m

Weight: 60kg



Nebular Spectrograph

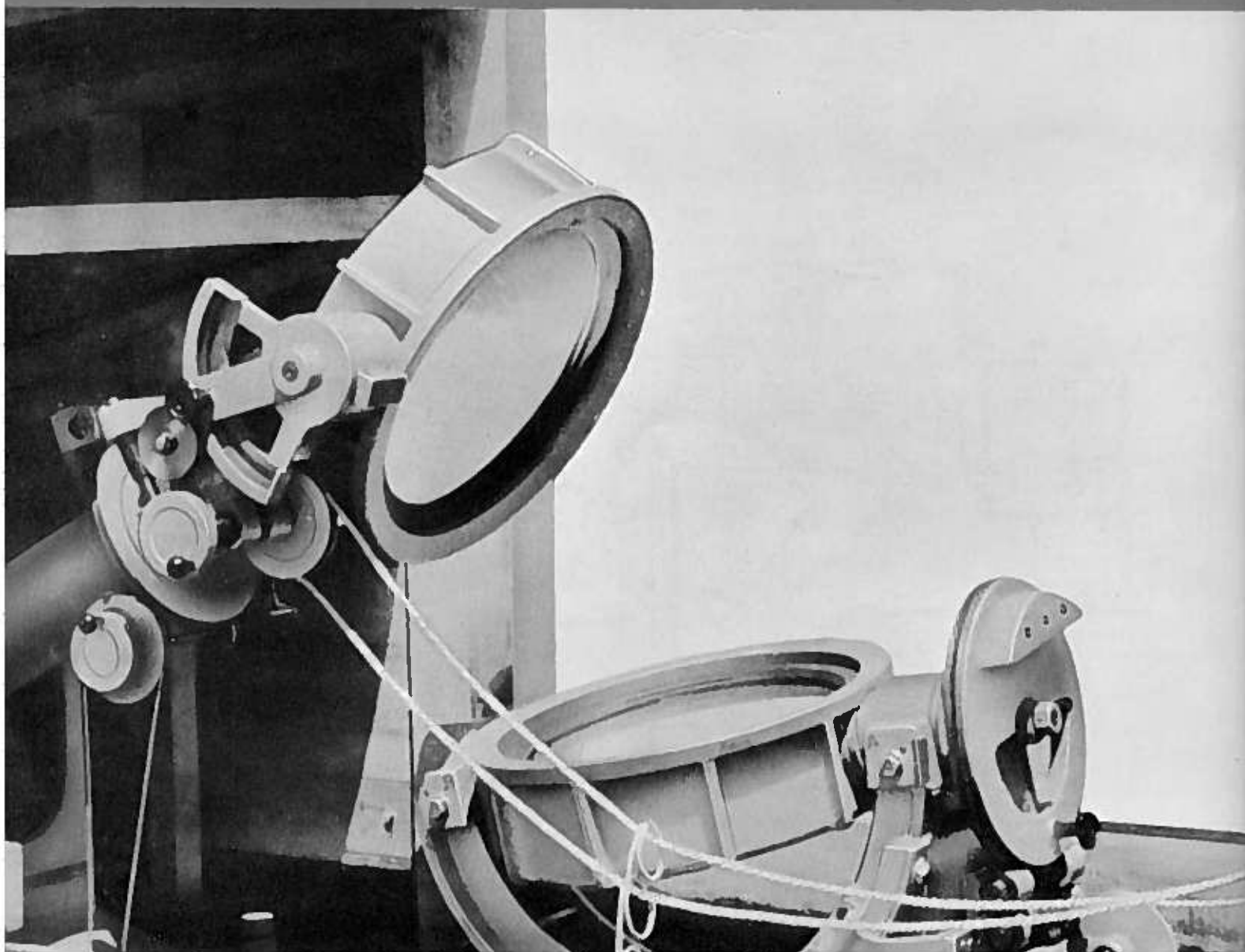


30cm (12 inch) Coelostat

Consists of 300mm primary mirror with a clock driven by weight and a 300mm secondary. It is usually used for solar observation.

1. Primary mirror: Aperture 300mm
2. Secondary mirror: Aperture 300mm
3. Polar axis of primary mirror is adjustable for the latitude $0^{\circ} - 60^{\circ}$
4. Glass material: Low expansion glass ($\alpha = 300 \times 10^{-6}$) or fused quartz supplied on order.
5. Clockwork is driven by weight.

30cm (12 inch) Coelostat



Fisheye Lens Camera for Photographing the Sun

Permits photography of the sun from an airplane. The photographs are used in determining the direction of geomagnetic lines, by measuring the position of the sun and relating this to time and other data.

1. Sun camera

Lens: Fisheye lens

Focal length: 8mm

Focal ratio: F/8

Field of view: 180°

Built-in filter: 6 sorts

Camera: NIKON F with Motor Drive

2. Camera for chronometer and coast line

a) For chronometer

Focal length: 35mm

Focal ratio: F/2.8

Field of view: 62°

Nikon F with Motor Drive

b) For coastline

Focal length: 58mm

Focal ratio: F/1.4

Field of view: 41°

NIKON F with Motor Drive

c) Accessories: Filters

3. Remote control equipment for Motor Drive

4. Regulative equipment

a) Leveling device: Consists of a circular and two tubular levels

b) Plane angle measuring telescope

Aperture: 15mm

Magnification: 5x

Field of view: $9-30^\circ$

5. Film reading device

a) Magnification: 10x

b) Screen size: diameter 270mm

c) Micrometer stage

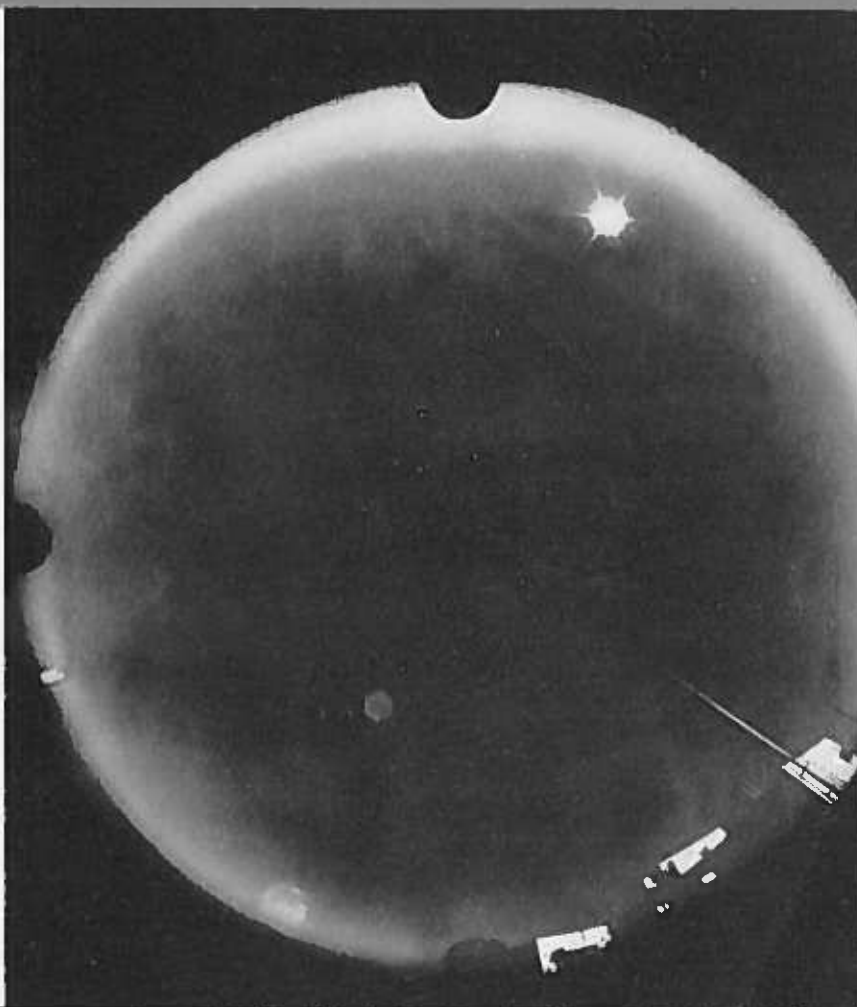
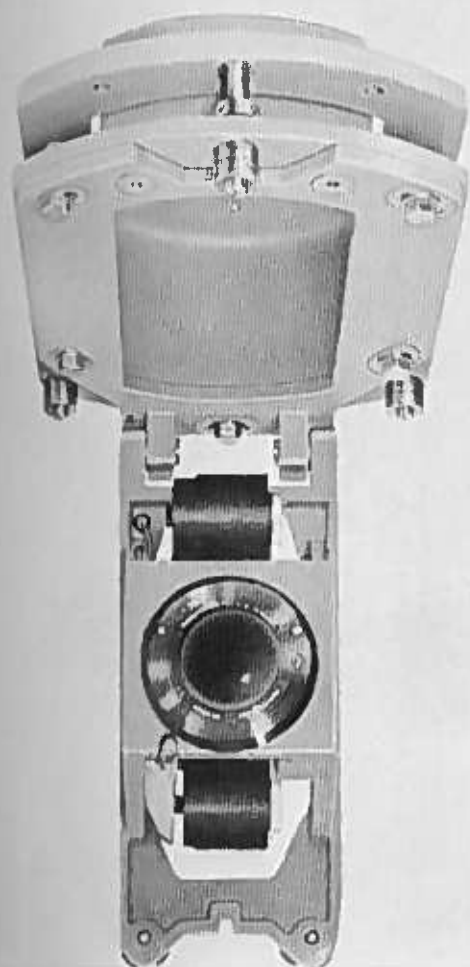
Traveling range: 50×25 mm, 1 div. 5 μ

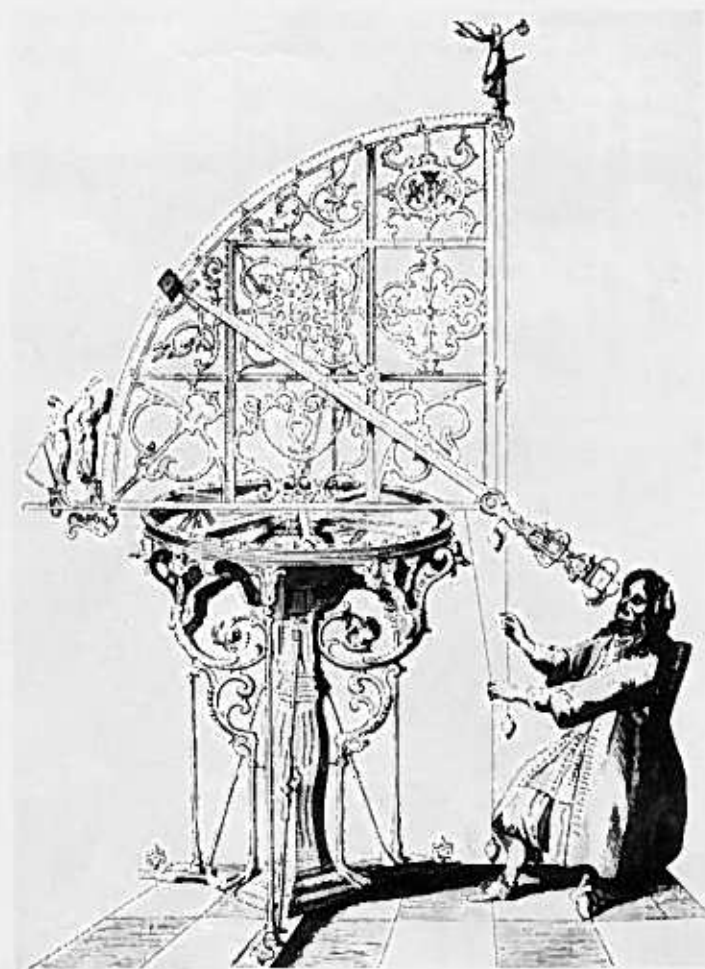
Rotation: 360° , 1 div. 1° , reading $2'$ by vernier

d) Film leader with a counter

6. Size: $500 \times 350 \times 250$ mm

Fisheye Lens Camera for Photographing the Sun





3. MEASURING APPARATUS

Self-Recording Microphotometer

Direct-intensity type used for accurate measurement of stellar spectrograms.

It records linear intensity curves or density curves, effecting automatic comparison of the stellar spectrograms with a standardized plate.

The automatic photometry is accomplished by the zero method with a split and chopped beam and servo-mechanism. Magnification of the motion in the direction of the dispersion is 1/500–500 times.

This microphotometer can also be used as an ordinary densitometer by employing a standard wedge in place of the standardized plate.

1. Range of measurement: 0–3 Density for 3500Å–7000Å

2. Plate stage

Traveling range of measuring plate: 110mm (manual and automatic)

Traveling speed of measuring plate: 0.2mm/min. – 100mm/min. (9 steps)

Traveling range of standardized plate: 110mm (manual and automatic by programming)

Adjustment mechanism to set for both plates

Plate size: 107×41mm (max.)

3. Slit

a) 1st slit: Width 0.005–1mm, length 0.005–1mm on the plate

b) 2nd slit: Width 0.005–1mm, length 0.005–1mm on the plate

4. Detector: EMI 9524 Photomultiplier

5. Pen recorder

a) Paper speed: 0.2mm/min. – 100mm/min. (9 steps)

b) Pen speed: 2–3 sec. for full scale

Recording with magnification $3\times$ is possible if the density range of measuring plate were narrow.

6. Accessory optical device

a) Spectrum observing device

b) Slit observing device

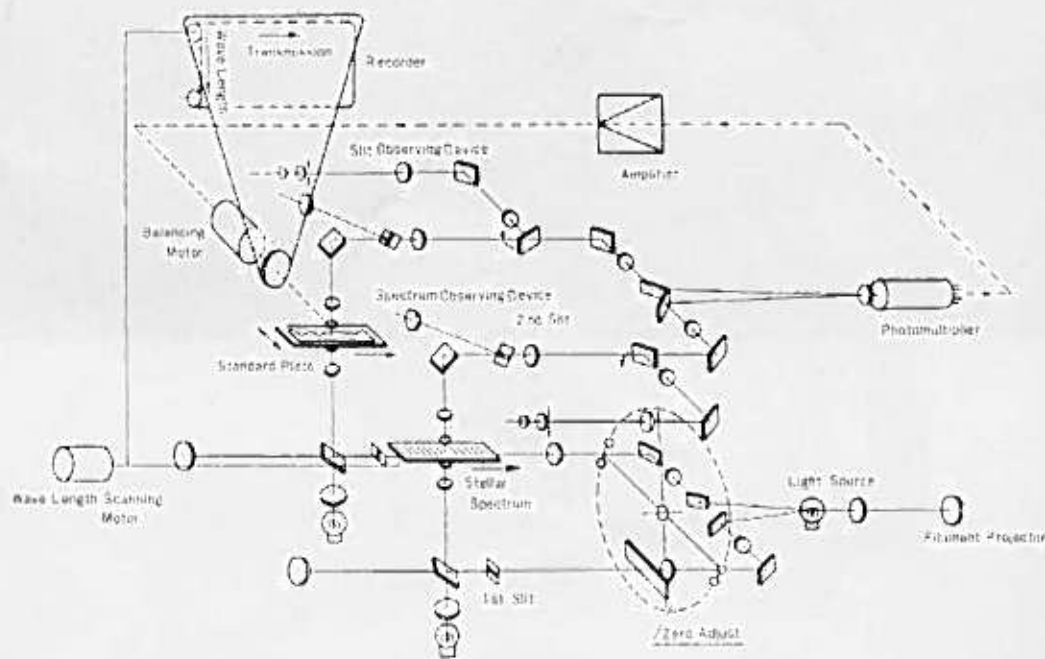
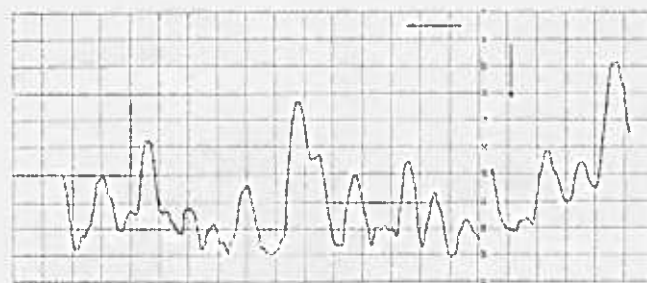
7. Light source: 10V, 50W Tungsten lamp with stabilizer

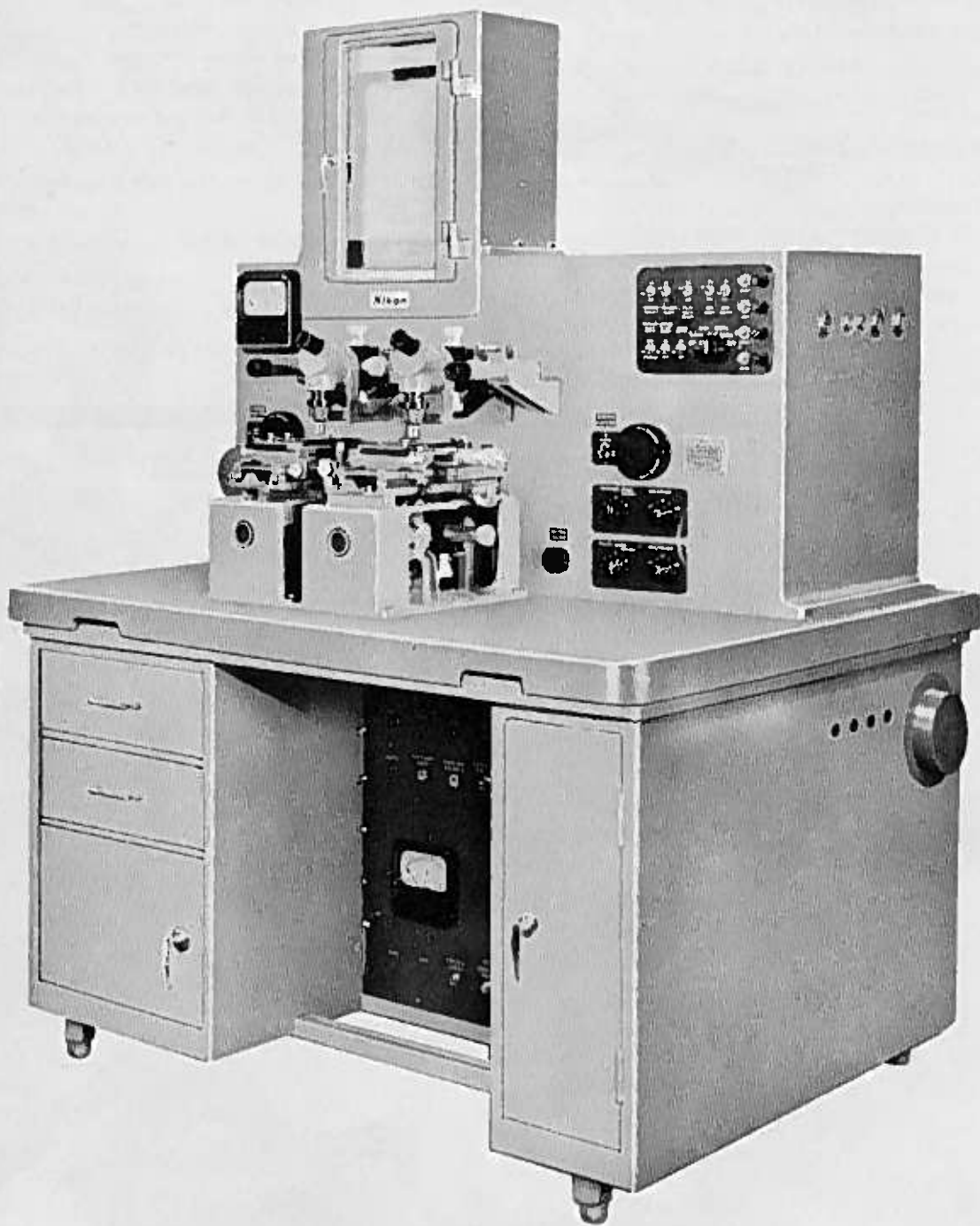
8. Bed is made of steel and cast iron.

9. Size and weight

Size: $1.2 \times 1.0 \times 1.6$ m

Approximate weight: 700kg





Self-Recording Microphotometer

Plate Standardizing Spectrograph for Self Recording Microphotometer

For standardizing the plate needed in photometry of stellar spectrograms.

Two types of standardized plates are obtained by changing the diaphragm in front of the collimator:

- a) Linear intensity scale
- b) Logarithmic intensity scale

1. Spectral range: 3500Å—7000Å
2. Size of spectrum: Dispersion way: 80—100mm
Density way: 15mm
3. Optical system
 - a) Slit: length: 15mm, Width: 0.1—3mm
 - b) Collimator lens:
 - Aperture: 50mm
 - Focal length: 450mm

c) Grating

Transmission type made by Bausch & Lomb
600 grooves/mm
Ruled area: 52×52mm
Linear dispersion: 370Å/mm at 5000Å
Resolving power: 31000

d) Camera lens

Aperture: 50mm
Focal length: 450mm

4. Light source: 8V, 50W lamp (with ribbon tungsten filament, with stabilizer and time switch)
5. Plate size: Maximum 117×41mm
6. Step wedge for exposure time adjustment: 0—2.0 Density (5 steps)
7. Bed is made of steel
8. Size
Length: 1.6m
Height: 1.3m

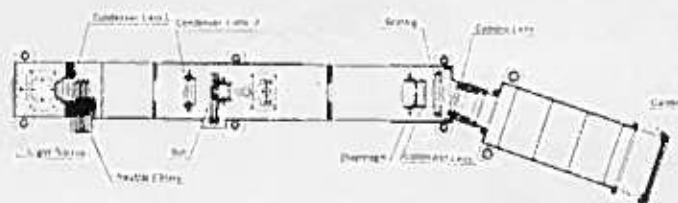
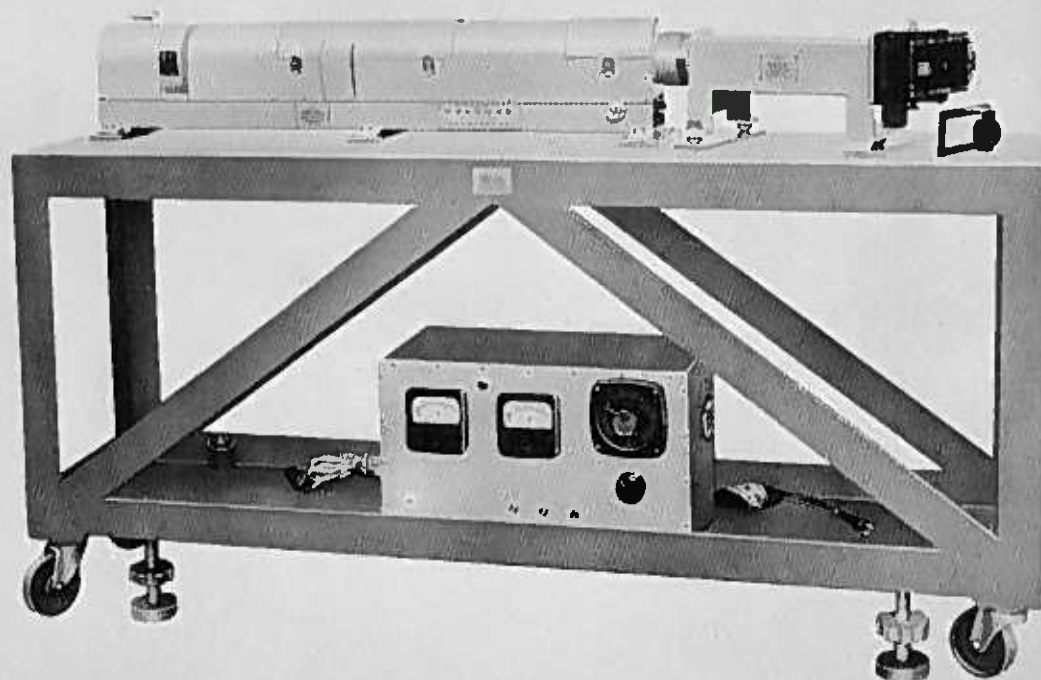


Plate Standardizing Spectrograph for Self-Recording Microphotometer

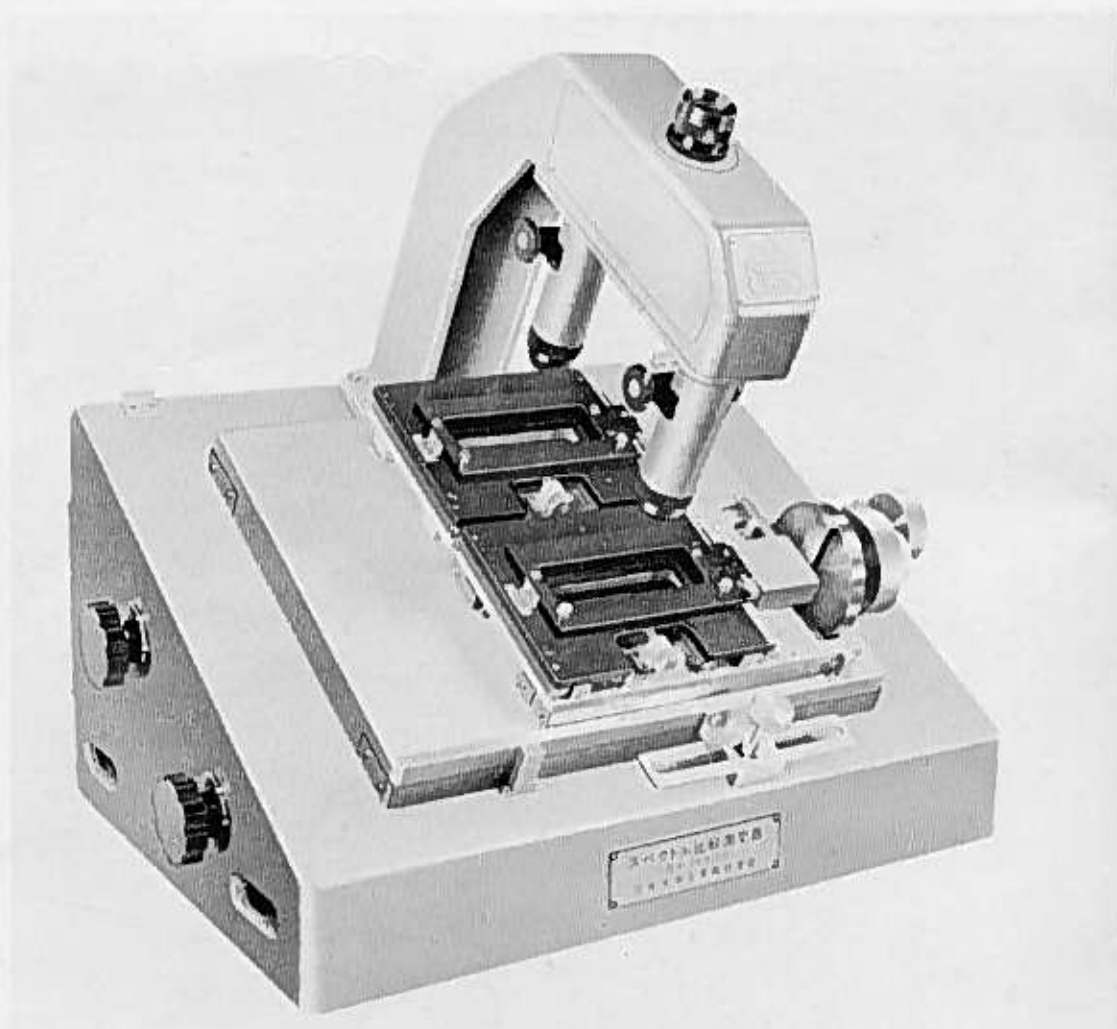


Spectro Comparator

A Hartmann type comparator to be used for comparing two stellar spectrograms.

It is mainly used for measurement of radial velocity, and is provided with a micrometer accurate to one micron.

1. Plate size : max. 41 × 107mm
2. Plate stage
Range of travel : 150mm, 1 div. 0.1mm
Adjustment device : Crosswise travel ± 5 mm and rotation $\pm 3^\circ$
3. Micrometer
Measuring Range : 15mm, 1 div. 1 μ
4. Optical System
Magnification : 25 \times and 37.5 \times
Field of view : diameter 7mm on the plate
Zooming system
Range : $\pm 25\%$ for standard and measuring plate side simultaneously
 $\pm 5\%$ for standard and measuring plate side independently
5. Illumination
2 fluorescent lamps : 100V 10W
6. Size and weight
Size : 570 × 460 × 550mm
Weight : 40kg



Spectro Comparator

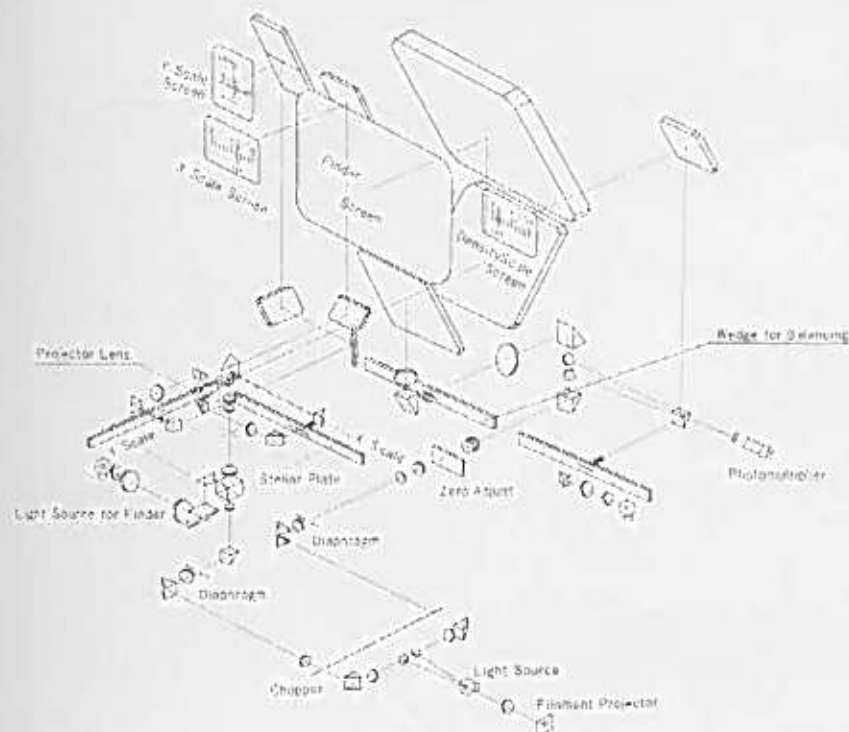
Densitometer for Astrographic Plate

For photographic photometry of stars. Measurement is made by the zero method with split and chopped beams, and servo-mechanism.

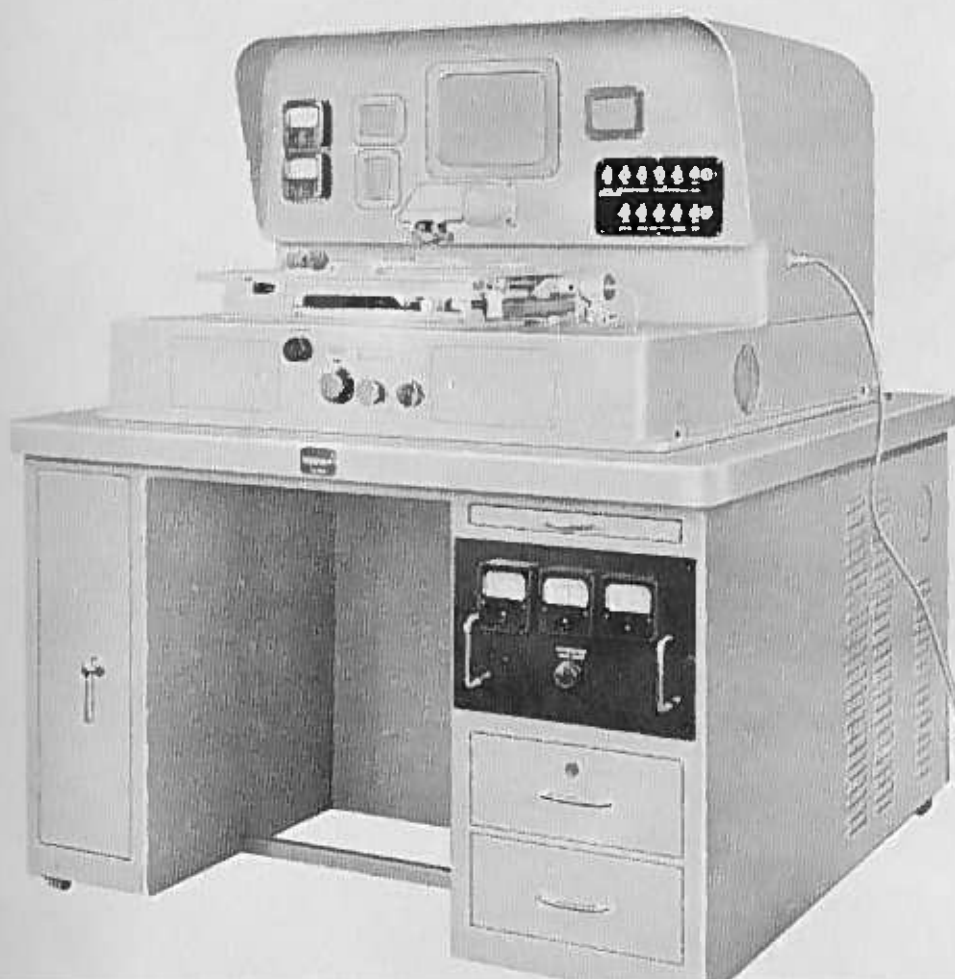
It is provided with a viewfinder for accurate setting and several diaphragms which are used in accordance with the sizes of the star images on the plate.

Density value and coordinates are easily read on the screen.

1. Measuring range: 0-3 Density
2. Plate size: max. 150×150mm
3. Plate stage
Traveling range: 160×160mm
Reading scale: Projection system 1 div. 0.1mm
Rotating: 360°, 1 div. 1°
4. Diaphragms: Diameter: 0.1-2mm (5 steps) on the plate
5. Viewfinder
Size of screen: 200×150mm
Magnification: 20x
6. Density measuring part
Wedge for balancing: Length: 150mm for 0-3 Density
Density scale: Projection system 1 div. 0.1mm (0.002 Density)
7. Measuring accuracy: 0.01 stellar magnitude
8. Zero adjusting device: Neutral density wedge and neutral density filters
9. Light source: 10V, 70W lamp (with tungsten filament) with stabilizer
10. Bed is made of steel and cast
11. Size and Weight
Size: 1.2×1.2×1.4m
Approximate weight: 600kg



Densitometer for Astrographic Plate



Blink Comparator

For detection of the movement of stars and discovery of new stars.

In operation, two photographic plates of the same star field are compared with each other by alternate illumination and monocular observation or by constant illumination and stereoscopic observation.

1. Plate size: max. 305 × 305mm

2. Plate stage

a) Range of crosswise travel: 300 × 300mm

b) Adjusting devices

One by crosswise travel: 160 × 160mm
and the other by rotation: 360°

3. Optical system

a) Eyepieces

For monocular and binocular

Magnification: 5×, 10×, 15× and 20×

Field of view: 20mm, 12mm and 8mm

b) Zooming system: Ratio 2

c) Filor micrometer

Measuring range: 10 × 10mm

4. Blink period: 0, 1/2, 1/5 and 1/10 second

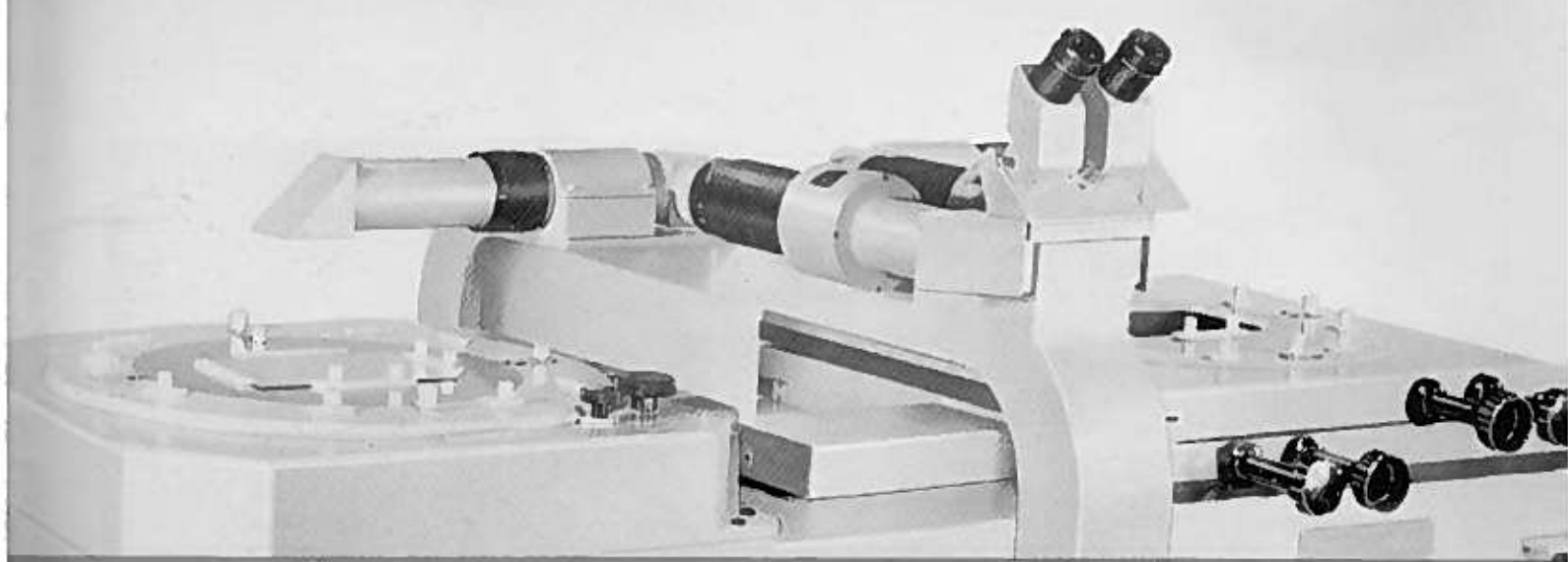
5. Image rotating prism is provided in both paths individually

6. Illumination

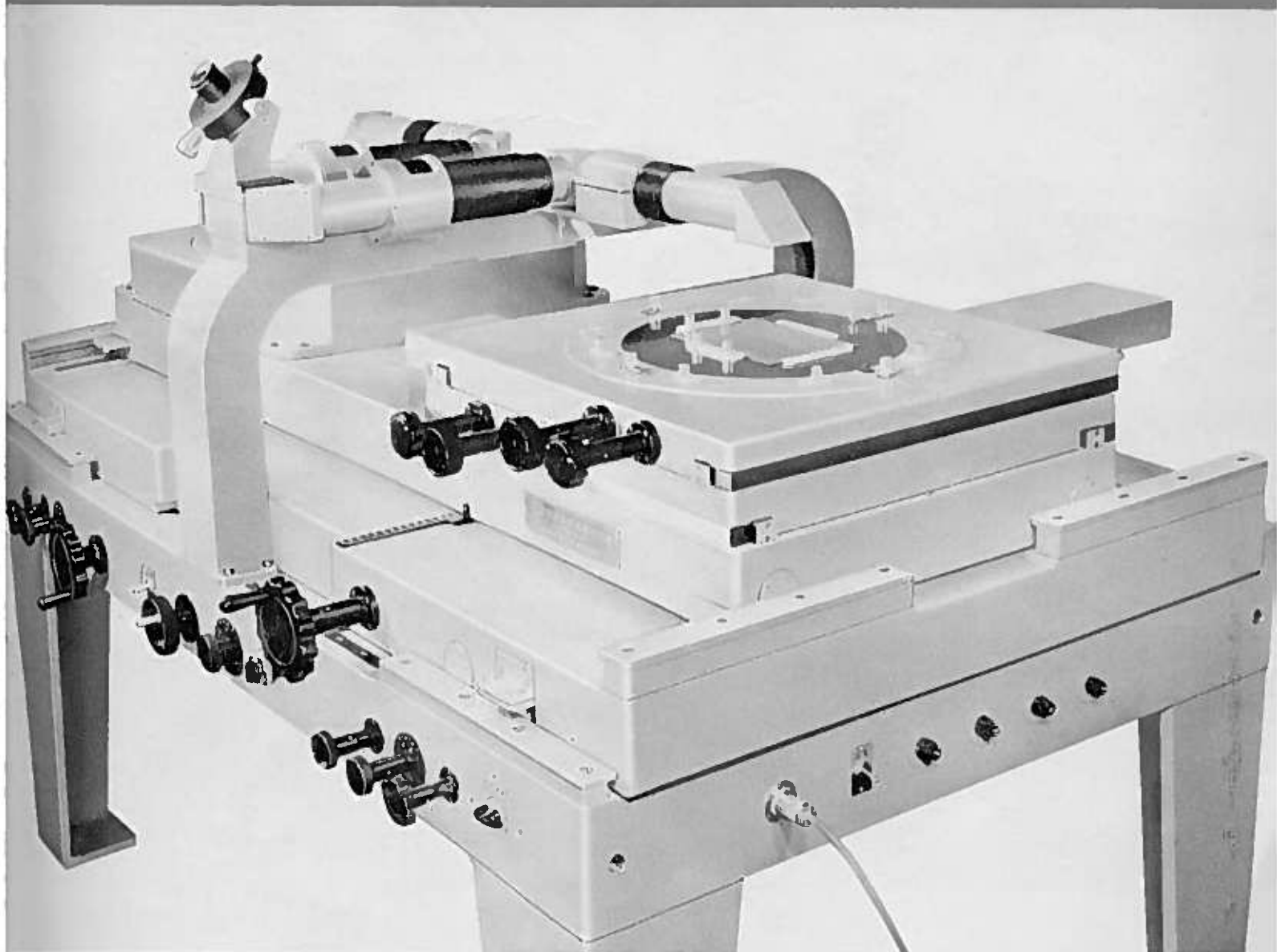
2 projector lamps: 100V, 100w

7. Bed is made of cast iron

8. Size: 1.5 × 1.0 × 1.2m



Blink Comparator



Electronic Isophotometer

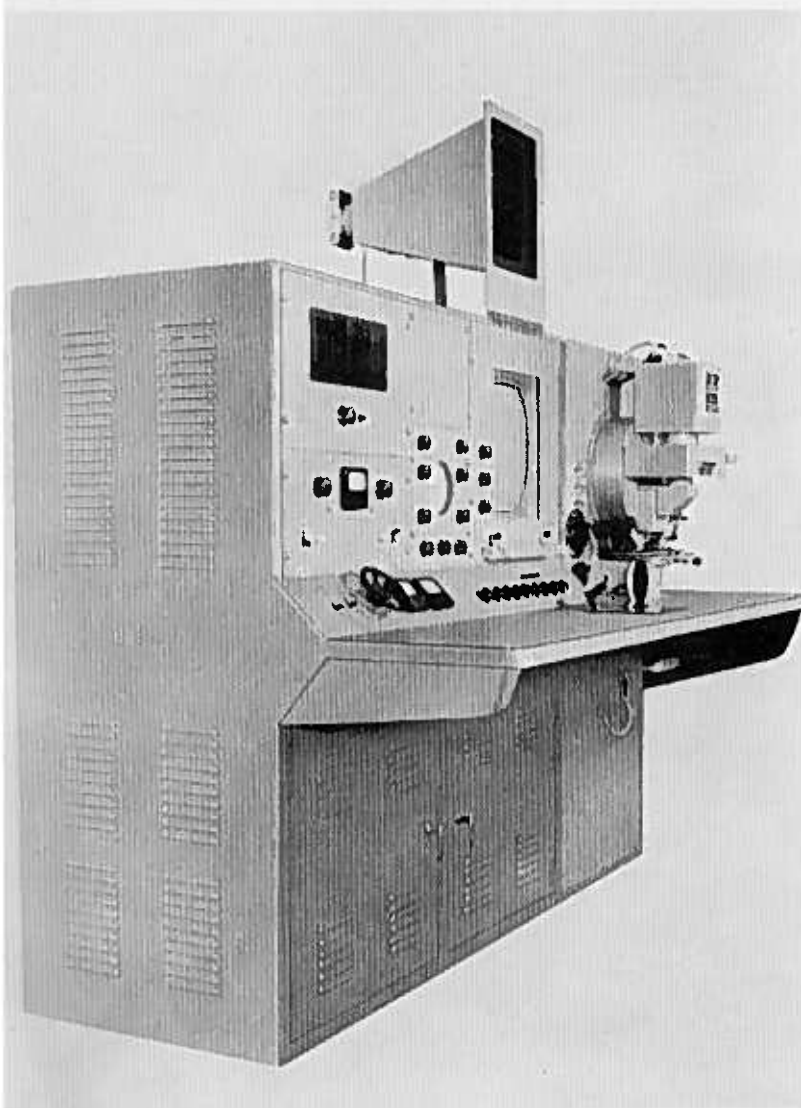
Provides an isophoto of solar flare in 0.1 minute by automatically measuring the photographic density of the solar image taken with the H α Monochromatic Heliograph. It consists of a flying-spot cathode ray tube as light source, an optical system, two photomultipliers, a pulse counter, a cathode ray measuring tube and a recording camera.



Sunspot



1. Accuracy
 - a) Density: ± 0.01 for the photographic density in the range from 0 to 1.0
 - b) Area: $\pm 3\%$
2. Measuring time: 0.1 sec. for 1 isophoto-curve
3. Flying-spot cathode ray tube: RCA 5ZP16
4. Wavelength of maximum brightness: 3700Å
5. Magnification of image: 1x, 3x, 6x
6. Detector: RCA 6217 Photomultiplier
7. Cathode ray tube for measuring: "National AW36-21" (14 type)
8. Counter
A pulse counter for the area measurement is provided.
9. Power supply
10. Size: 1.5x1.5x0.4m



Electronic Isophotometer

SHADOWGRAPHS

The Shadowgraph is an optical projector, originally designed for producing correctly enlarged images of a variety of minute objects, is efficiently used for astronomical purposes, for example, for observing and measuring photographic images of stars, sunspots, prominences, flares, stellar spectrograms, etc. On request of the user, the instrument may be subjected to accommodation of attachments such as a micrometer stage with minimum division $1/\mu$, a crosswise travelling stage with the range of $50\text{mm} \times 50\text{mm}$ for coordinate measurement in astronomy, etc.

Shadowgraph Model 5A

Floor type model designed for large capacity and heavy duty

1. Accuracy of magnification of projected image
 - a) Within $\pm 0.1\%$ in transmitting illumination
 - b) Within $\pm 0.15\%$ in reflecting illumination
2. Viewing screen

Size of ground glass: $450 \times 550\text{mm}$
Interchangeable with protractor or photographing screen
3. Projection lenses

Magnification:	10 \times	20 \times	25 \times	31.25 \times
Object field:	60mm	30mm	24mm	19.2mm

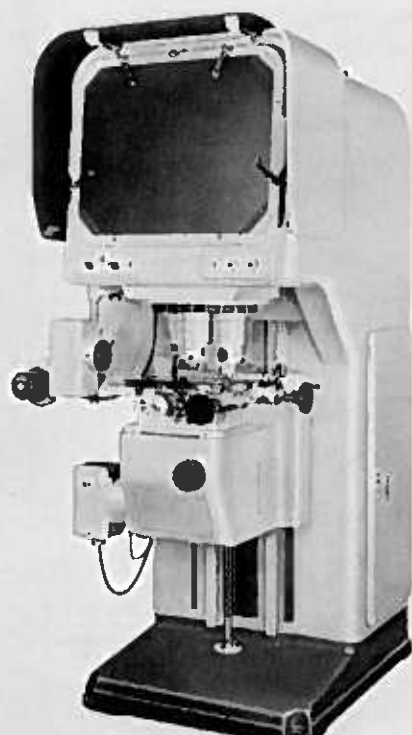
(With attachable half-reflecting mirror)

Magnification:	50 \times	62.5 \times	100 \times	200 \times
Object field:	12mm	9.6mm	6mm	3mm

(Built-in half-reflecting mirror)
4. Micrometer stage type P

Available in metric or inch system
Surface area: $360 \times 150\text{mm}$
Crosswise travel: $150 \times 50\text{mm}$
Minimum micrometer division: 0.005mm
Travel range over 25mm is obtained by use of block gages which are supplied with the stage.
5. Size and weight

Size: $1.8 \times 0.9 \times 1.1\text{m}$
Approximate weight: 680kg



Shadowgraph Model 6C

Bench type design makes this model particularly comfortable for continuous seated operation.

1. Accuracy of magnification of projected image
 - a) Within $\pm 0.1\%$ in transmitting illumination
 - b) Within $\pm 0.15\%$ in reflecting illumination
2. Viewing screen

Diameter of ground glass: 300mm
Interchangeable with protractor or photographing screen
3. Projector lens

Magnification:	10 \times	20 \times
Object field:	30mm	15mm

(With attachable half-reflecting mirror)

Magnification:	50 \times	75 \times	100 \times
Object field:	6mm	4mm	3mm

(Built-in half-reflecting mirror)
4. Stage
 - a. Crosswise traveling stage

Surface area: $200 \times 150\text{mm}$
Stage glass: $80 \times 120\text{mm}$
Crosswise travel: $25 \times 40\text{mm}$
 - b. Micrometer stage

Available in metric or inch system

	Type A	Type O	Type E
Surface area:			
160mm in dia.	$150 \times 280\text{mm}$	150mm in dia.	
Stage glass:			
90mm in dia.	$120 \times 140\text{mm}$		
Crosswise travel:			
50 \times 25mm	$100 \times 50\text{mm}$		$25 \times 25\text{mm}$
Minimum micrometer division:			
0.005mm	0.005mm		0.01mm
Angular graduation:	One division		
1' (2' with vernier)	1' (2' with vernier)		
Travel range over 25mm is obtained by block gages supplied with the stage.			
5. Size and weight

Size: $0.9 \times 0.5 \times 0.7\text{m}$
Approximate weight: 60kg



SUPPLY LIST

1. TELESCOPES

91 cm (36 inch) Reflector for
Photoelectric Photometer

91 cm (36 inch) Reflector

30 cm (12 inch) Reflector

20 cm (8 inch) Refractor

15 cm (6 inch) Refractor

Solar Tower Telescope

Floating Zenith Telescope

2. SPECTROGRAPHS AND OTHERS

Spectroheliograph

Monochromatic Heliograph

Coronagraph

K-Coronameter

Auroral Spectrograph

Airglow Spectrograph Type 1

Airglow Spectrograph Type 2

Airglow Spectrograph Type 3

Photoelectric Photometer

Grating Spectrograph

Nebular Spectrograph

30 cm (12 inch) Coelostat

Fisheye Lens Camera for

Photographing the Sun

50cm Schmidt Telescope

3. MEASURING APPARATUSES

Self-Recording Microphotometer

Plate Standardizing Spectrograph

for Self-Recording Microphotometer

Spectro Comparator

Densitometer for Astrographic Plate

Blink Comparator

Electronic Isophotometer

Okayama Astrophysical Observatory of the Tokyo Astronomical Observatory

1960

Dodaira Station of the Tokyo Astronomical Observatory

1962

Tokyo Astronomical Observatory

1953

Okayama Astrophysical Observatory of the Tokyo Astronomical Observatory

1964

Tohoku University (Sendai)

1964

Konan High School (Ashiya) and others

1964

National Science Museum (Tokyo) and others

1931

Akashi Astronomical Museum

1960

Nagoya Astronomical Observatory

1951

The Defence Academy (Yokosuka) and others

1956

Gotoh Planetarium & Astronomical Museum (Tokyo)

1956

Latitude Observatory (Mizusawa)

1939

Tokyo Astronomical Observatory

1948

Magnetic Observatory (Kakioka)

1949

Norikura Corona Station of the Tokyo Astronomical Observatory

1955

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1950

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1961

Tokyo Astronomical Observatory

1957

Niigata University

1957

University of Tokyo (Kakioka)

1957

Tokyo Astronomical Observatory

1960

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1960

Dodaira Station of the Tokyo Astronomical Observatory

1963

Okayama Astrophysical Observatory of the Tokyo Astronomical Observatory

1963

Tokyo Astronomical Observatory

1955

The Maritime Safety Agency Hydrographical Department

1961

Dodaira Station of the Tokyo Astronomical Observatory

1964

Okayama Astrophysical Observatory of the Tokyo Astronomical Observatory

1963

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1961

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1961

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1963

Tokyo Astronomical Observatory

1963

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1957



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NIKON PRODUCTS

Cameras & Lenses	Fully Automatic Single Lens Reflex. Nikon F Standard Nikon F Photomic (with built-in exposure meter) Nikkorex F Nikkorex Zoom 35 All Weather Camera : Nikonos 8mm Cine Cameras : Nikkorex Zoom 8, Nikkorex SF Photographing Lenses : Nikkor Interchangeable Lenses Cine Lenses : Cine Nikkor & Cine Zoom Nikkor for 16mm Cine Camera
Microscopes	Nikon Biological Microscopes Nikon Hand Microscope Nikon School Microscopes Nikon Stereoscopic Microscopes Nikon Inverted Microscope (for metallographic & biological microscopy)
Shadowgraphs	Nikon Shadowgraphs (Optical Comparators) Circular screen 300mm bench type 356mm floor type 400mm floor type Rectangular screen 450mm x 550mm floor, heavy duty type
Measuring Instruments	Nikon Autocollimators Nikon Measurescope (Tool-maker's Microscope) Microtester (Optical thickness measurer) Optical Flat, Optical Parallel Glass scales Nikon Dioptrometer (Vertexometer)
Special Purpose Lenses	APO-Nikkor (photo-engraving lenses) Fax-Nikkor (Electro-fan lenses) Pro-Nikkor (35mm film projector lenses) TV-Nikkor (Television camera lenses) Nikon Video Remote Control Fundus Camera
Surveying Instruments	Nikon Transit Nikon Theodolite Nikon Tilting Levels Nikon Auto Level
Binoculars	Nikon Binoculars 5 x 15, 7 x 15, 7 x 35, 8 x 30, 7 x 50, 9 x 35 Nikon Sports Glass Nikon Binocular Telescopes
Spectacles	Nikon Spectacle Lenses Optical Glasses & Radiation Shielding Glasses Radiation Periscopes & Hot Cell Microscope



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