MEASURING QUALITY. SINCE 1796

Spectroscopes and Spectral Meters

Lab spectroscopes for measurement of emission and absorption spectra

ABSORPTION SPECTRA OF GEMSTONES

Characteristic absorption spectra of coloured stones can be generated using spectroscopes. These absorption spectra are almost like individual fingerprints which allow many stones to be determined or stones of the same colour to be separated quickly and reliably. Transparent or translucent stones in rough or polished condition are suitable for this type of analysis. It may also be possible to observe the spectra of opaque stones if the light reflected from the surface is used for this purpose. In the case gemstones of different colours, various absorptions take place, for which the respective individual chemical compositions and crystal structures are responsible. These absorptions determine the chromaticity of the stones at the same time. By nature, only clearly coloured stones produce an absorption spectrum, since no absorption takes place with colourless stones and pale coloured stones do not absorb sufficiently for a clearly visible spectrum.

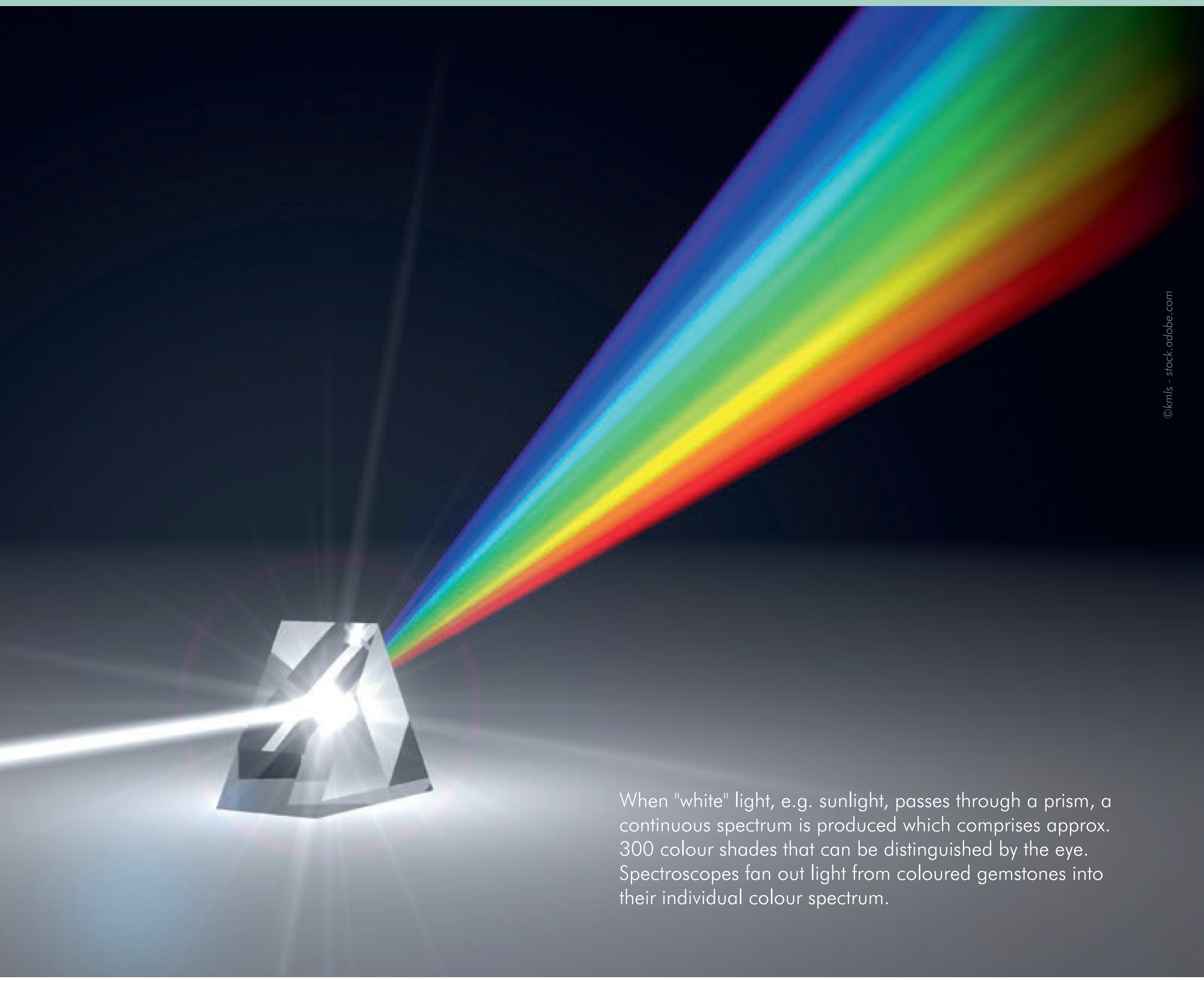


Fig.12: Spectral colours produced by refraction of white light in a glass prism.

SPECTROSCOPY

FUNCTIONALITY

The spectroscope has a narrow slit for for light entry or light incidence, in front of which a stone is placed. If the stone is illuminated by light, a certain part of the light is absorbed by the stone. The other part is broken down into its absorption spectrum inside the spectroscope and is visible to the observer in the eyepiece. Dark lines and stripes then appear where certain wavelengths are absorbed by the stone. The slit width can be varied with good spectroscopes. A fine slit and good lighting are required to obtain pure and clear absorption spectra.

The instruments are also equipped with a focusing device so that the spectrum, which is slightly curved for physical reasons, can be seen sharply everywhere.
Absorption lines can be measured directly by fading in the wavelength scale. However in most cases the appearance of the entire spectrum is observed and then compared with the reference spectra of other stones. Reference spectra for the most common gemstones are listed and illustrated in the gemmological literature, or see samples figure 15.

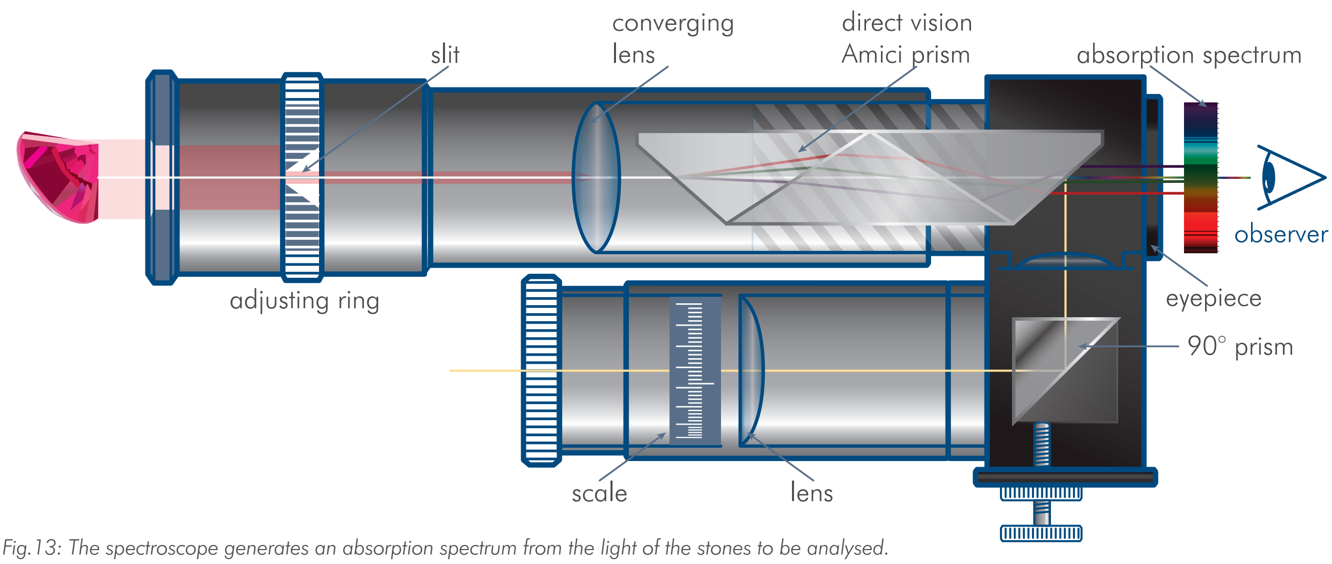


Fig. 13: The spectroscope generates an absorption spectrum from the light of the stones to be analysed.

ABSOPTION SPECTRA OF STONES

The spectra generated by the spectroscope, exhibit dark lines and bands of varying intensity, the so-called Fraunhofer lines and absorption bands, depending on which stones are observed. Figure 15 illustrates a compilation of absorption spectra of red gemstones. The different absorption lines and bands of the different stones are aparent. The spectra of precious gemstones, such as ruby and alexandrite, can be quickly identified using patterns of Fraunhofer lines and absorption bands. This makes it easy to distinguish them from other red gemstones such as tourmaline or red garnet.

The spectroscope can also be used to determine whether characteristic lines such as the absorption lines of chromium are present. The two corundum varieties of ruby and reddish sapphire are distinguished from each other by definition in that only the ruby contains chromium. It is not possible to detect syntheses with the spectroscope, however. Syntheses, such as synthetic rubies, created in the laboratory cannot be distinguished here from the natural gemstones.

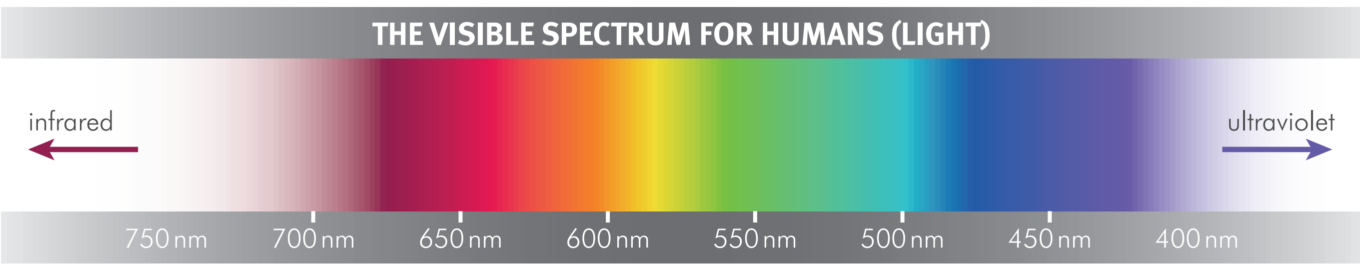


Fig. 14: The graphic illustrates the wavelengths of light (electromagnetic wave spectrum) and separately the parts that are visible to the human eye.

COMPARISON OF THE ABSORPTION SPECTRA OF RED GEMSTONES

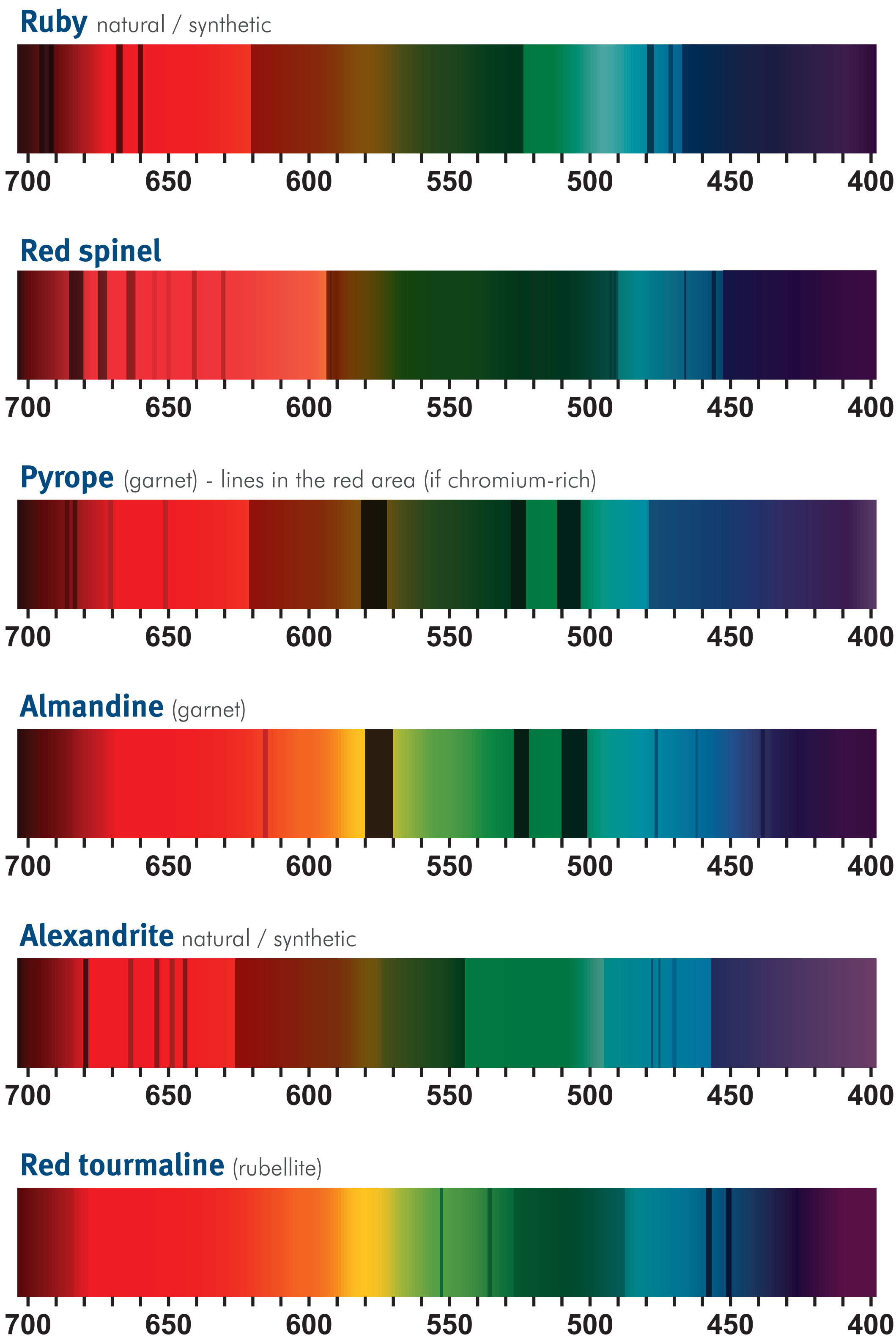


Fig. 15: Comparison of the absorption spectra of red gemstones.
(Graphic created based on "Gemstone Identification - Blue Chart" by H.N. Lazzarelli, 2018)

OUR SPECTROSCOPES

Hand-held spectroscope

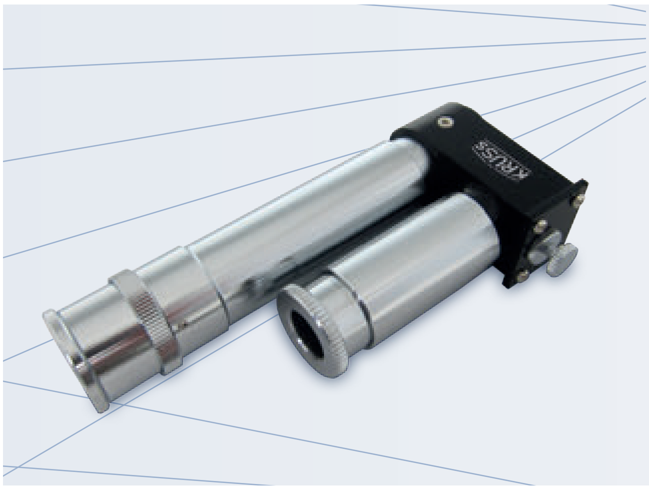
- Portable grid spectroscope
- Dimensions: (Ø×H) 10 mm x 55 mm
- Weight: 12 g

ORDER NUMBER **HS15001**

Hand-held spectroscope

- Portable hand-held spectroscope with adjustable optical slit
- Angular dispersion: C-F 7°
- Linear dispersion: 60 mm
- Dimensions: (Ø×H) 20 mm x 90 mm
- Weight: 96 g

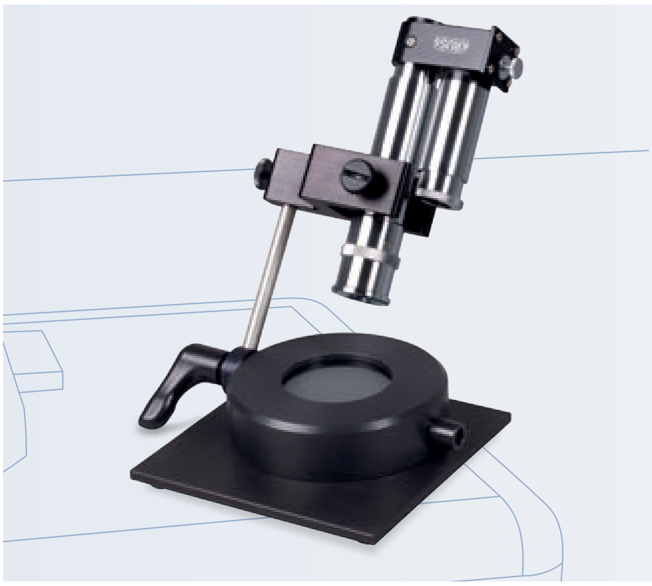
ORDER NUMBER **HS1501**



Hand-held spectroscope

- Portable hand-held spectroscope with adjustable optical slit and wavelength scale.
- High-intensity Amici prism (5 individual prisms) produces a very sharp spectrum
- Angular dispersion: C-F 7°
- Linear dispersion: 60 mm
- Measurement range wavelength scale 400 - 750 nm
- Scale division: 10 nm
- Dimensions (W×H×D): 42 mm x 115/65 mm x 20 mm
- Weight: 233 g

ORDER NUMBER **HS1504**



Spectroscope stand

- Spectroscope stand with adjustable holder
- Compatible with A.KRÜSS cold light sources
- Dimensions (W×H×D): 75 mm x 140/150 mm x 75 mm
- Weight: 219 g

Spectroscope is not included in the scope of delivery.

ORDER NUMBER **ST1512**

1701

Spectroscope 1701

The 1701 Spectroscope is a Kirchhoff-Bunsen Spectroscope, used for qualitative analysis and measurement of emission and absorption spectra. It can be calibrated easily, and both the observation tube and ocular is moveable.

Specifications

• Observation tube	moveable, with lock-screw
• Slit tube	fixed with variable slit objective
• Scale tube	fixed scale of 200 divisions can be calibrated in wavelengths
• Ocular	18 mm / 90 mm
• Objective	18 mm / 180 mm
• Flint prism	60°, dispersion C–F = 2°, base length 20 mm, height 30 mm

Accessories

• 1714	scale illumination for memory and wavelength scale
• 1717	wavelength scale
• 1718	spare prism
• GL1	spare lamp 12 V / 1 W

Handheld spectroscopes 1501 and 1504

The handheld spectroscopes 1501 and 1504 are portable precision spectroscopes. They meet most laboratory applications. They are ideal instruments for applications within schools and universities and for qualitative analysis and measurement of emission and absorption spectra, e.g. for checking the line spectrum of gas discharge lamps as well as individual and comparative observations and spectral examinations.

1501

1504

Specifications

1501

• Slit	variable
• Angle dispersion	C–F 7°
• Linear dispersion	60 mm

(direct vision prism of Amici type)

1504

• Slit	variable
• Angle dispersion	C–F 7°
• Linear dispersion	60 mm
• Wavelength scale	400–750 nm

(direct vision prism of Amici type)

Accessories

• 1510	Stand
• 15081	Scale illumination
• GL1	Spare lamp 12 V / 1 W

Spectrometer-Goniometer 1836

KRÜSS offers the model 1836 Spectrometer-Goniometer, for the exact measurement of optical data on prisms. It can also be used as a spectroscope, for qualitative examination and measurement of emission and absorption spectra.

1836

Specifications

Observation tube	infinitely variable
Ocular	crosshairs
Scale reading precision	1 angle min.
Objective	field number 18 160 mm focal distance
Prism	Flint glass (60°)
Dispersion angle	C–F = 2°
slit tube	symmetric precision slit of hardened steel

Accessories

1860	prism holder
1861	grill retainer for Rowland type grating
1862	Rowland type grating 590 lines / mm
1863	Rowland type grating 600 lines / mm
1865	spare prism
1866	crosshair's ocular
1874	scale illumination with transformer 100–240 V
1875	scale illumination without transformer
GL1	spare lamp 12 V / 1 W

How does a spectrometer work?

The spectrometer remains one of the easiest to understand, and yet among the most powerful of all scientific instruments. Its development has played a large part in the development of science itself. The basic laboratory spectrometer has changed little in its configuration since the early 19th century, and yet it remains indispensible for education as well as practical research.

The incoming or incident light ray is collimated – made into a parallel beam – either by passing through a narrow slit or by use of a collimating lens. It is then diffracted, using a prism or a diffraction grating, and the resulting spectrum can be observed. By careful measurement of the position of the receiving optics, an accurate measure of wavelength can be made and, using the considerable spectral knowledge that has been collected over two centuries, identification of materials can be made.

Elements have unique spectra, which can be thought of as their fingerprints, generating bands of specific colour in the receiving optics. Perhaps the best-known of these is sodium, which generates a distinctive pair of closely-spaced spectral lines at a wavelength of about 589 nanometres. These lines are just 0.6 nanometres apart, and their resolution as a pair of lines – rather than a single line – is an age-old test of the optical quality of a simple spectrometer.

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