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THORLABS

AX2520-UV - January 27, 2015

Item # AX2520-UV was discontinued on January 27, 2015. For informational purposes, this is a copy of the website content at that time and is valid only for the stated product.

AXICONS

- **Transforms a Collimated Beam into a Ring**
- **High-Precision Conical Surface**
- **Four Broadband AR Coatings**

Application Idea
AX2520-B Prism in a CP06

Hide Overview

OVERVIEW

Features

- 1" Diameter
- Six Angles Available: 0.5°, 1.0°, 2.0°, 5.0°, 10.0°, and 20.0°
- AR Coated for Maximum Transmission

Applications

- Laser Drilling/Optical Trepanning
- Optical Trapping
- Optical Coherence Tomography (OCT)
- Corneal Surgery
- Telescopes

Common Specifications	
Substrate Material	UV Fused Silica[a]
Diameter	1" (25.4 mm)
Surface Quality	40-20 Scratch-Dig
Clear Aperture	>90% of Diameter
Edge Thickness	5.0 mm
Edge Thickness Tolerance	±0.1/-0.0 mm
Center Thickness Tolerance	+0.1/-0.0 mm
Angular Tolerance	±0.01°
Surface Deviation (RMS)	<0.07 µm

- Click Link for Detailed Specifications on the Substrate Glass

Axicons, also commonly referred to as rotationally symmetric prisms, are lenses that feature one conical surface and one plano surface. They are commonly used to create a beam with a Bessel intensity profile or a conical, non-diverging beam. When converting a collimated beam into a ring, the plano side should face the collimated source. For more information, please see the *Beam Shape* tab above.

Zemax Files

Click on the red Document icon next to the item numbers below to access the Zemax file download. Our entire Zemax Catalog is also available.

These Ø1" precision-polished axicons are offered with base angles from 0.5° to 20°. These axicons are made by Asphericon from high-quality UV Fused Silica using computer-numerical-controlled (CNC) grinding and polishing machines. This provides a high-quality surface, making them ideally suited for high-power laser applications. Our axicons have an antireflection coating deposited on both sides for one of four wavelength ranges: -UV (290 - 370 nm), -A (350 - 700 nm), -B (650 - 1050 nm), or -C (1050 -1700 nm). These coatings reduce surface reflections from the lens to maximize transmission (R_{avg} < 0.5%). For an uncoated axicon or a custom coating, please contact Tech Support for a quote.

Hide Beam Shape

BEAM SHAPE

Axicon Beams

- Bessel Beam: Non-Diffracting
- Ring-Shaped Beam: Ideal for Laser Drilling

A Bessel beam is a non-diffracting beam of concentric rings, each having the same power as the central ring. Technically, a bessel beam cannot be created as it requires infinite energy. By using an axicon with a collimated Gaussian beam, a beam closely resembling a bessel distribution is possible. To accomplish this, the projected beam must be close to the conical surface of an axicon. The absolute value of a 0^{th} order Bessel function of the first kind is shown in Fig 1 (below).

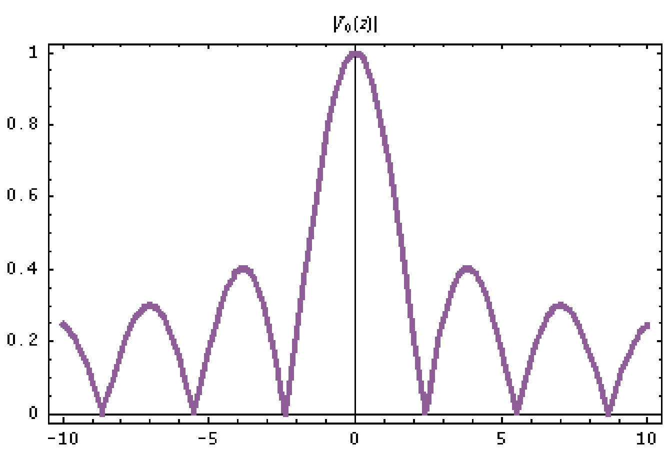


Fig 1: The absolute value of a 0^{th} order Bessel function. A true Bessel Beam requires each ring to have the same energy as the central peak, thus an infinite amount of energy is needed.

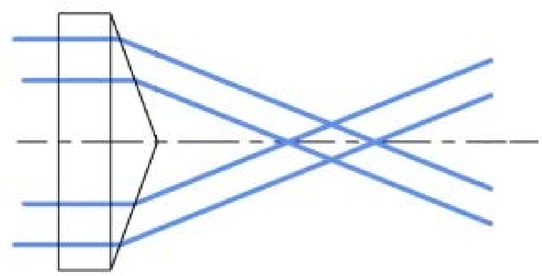


Fig 3: Axicon ray tracing diagram.

Fig 4: The photograph above shows the beam of a collimated laser beam after it is transmitted by an axicon.

Fig 5: The photograph above shows the beam from Fig 1 if a plano-convex lens is placed after the axicon.

When the beam is projected further from the lens, a ring-shaped beam is formed as seen in Fig

4. The beam is actually conical (i.e., diameter increases with distance), but the rays are non-diverging so that the thickness of the ring remains constant (see Fig 3). The ring's thickness will be half of the input laser beam's diameter. This beam is commonly used in laser-drilling applications.

The photograph below shows a HeNe laser, BE10M-A beam expander, AX255-A axicon, and a DG100X100-600 ground glass diffuser. Although the laser beam's diameter is roughly Ø1 mm, a beam expander increases the beam diameter to Ø10 mm before the axicon. The beam shape is then projected onto a ground glass diffuser. This setup forms a ring, which is shown in Fig 4. When a plano-convex lens is placed after the axicon, the resulting beam will be more focused, and thus a more intense ring will be formed, which can be seen in Fig 5.

Fig 2: A setup including a HeNe laser, beam expander, axicon, and diffuser.

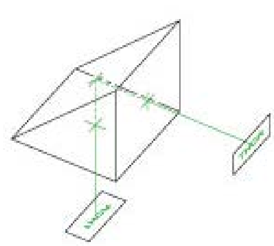
Hide Prism Guide

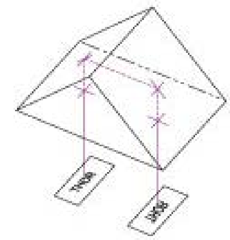
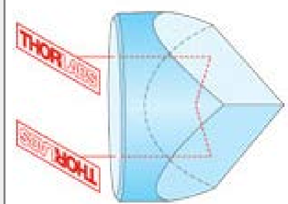
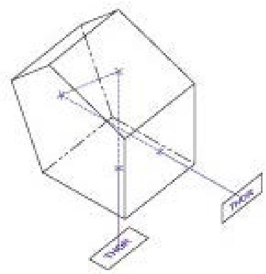
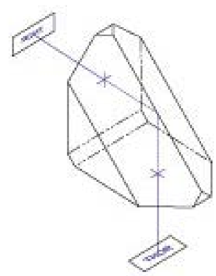
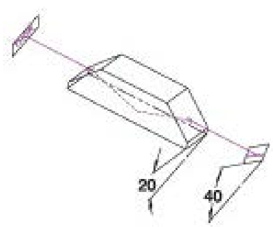
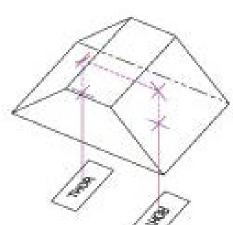
PRISM GUIDE

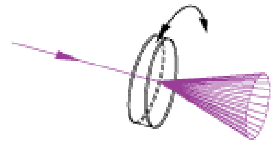
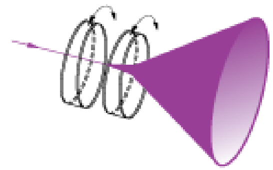
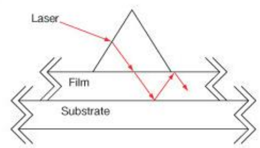
Selection Guide for Prisms

Thorlabs offers a wide variety of prisms, which can be used to reflect, invert, rotate, disperse, steer, and collimate light. Prisms are available in N-BK7, UV Fused Silica, F2, N-SF11, α-BBO, N-KZFS8, Ge, and CaF_2. For prisms and substrates not listed below, please contact tech support.

Beam Steering Prisms

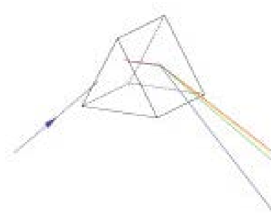
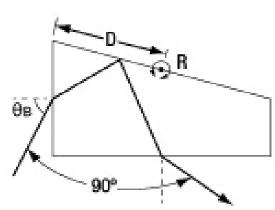
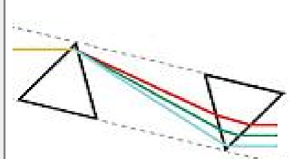
Prism	Material	Deviation	Invert	Reverse or Rotate	Illustration	Applications
Right Angle Prisms	N-BK7, UV Fused Silica, Germanium, or Calcium Fluoride	90°	90°	No		90° reflector, independent of entrance beam angle. Used in optical systems such as telescopes and periscopes.
		180°	180°	No		180° reflector, independent of entrance beam angle. Acts as a non-reversing mirror and can be used in binocular configurations.

						
Retroreflectors	N-BK7	180°	180°	No		180° reflector, independent of entrance beam angle. Beam alignment and beam delivery. Substitute for mirror in applications where orientation is difficult to control.
Penta Prisms and Mounted Penta Prisms	N-BK7	90°	No	No		90° reflector, without inversion or reversal of the beam profile. Can be used for alignment and optical tooling.
Roof Prisms	N-BK7	90°	90°	180^o Rotation		90° reflector, inverted and rotated (deflected left to right and top to bottom). Can be used for alignment and optical tooling.
Unmounted Dove Prisms and Mounted Dove Prisms	N-BK7	No	180°	2x Prism Rotation		Dove prisms may invert, reverse, or rotate an image based on which face the light is incident on. Prism in a beam rotator orientation.
		180°	180°	No		Prism acts as a non-reversing mirror. Same properties as a retro-reflector or right angle (180° orientation) prism in an optical setup.
						Beam steering applications.

Wedge Prisms	N-BK7	Models Available from 2° to 10°	No	No		By rotating one wedged prism, light can be steered to trace the circle defined by 2 times the specified deviation angle.
			No	No		Variable beam steering applications. When both wedges are rotated, the beam can be moved anywhere within the circle defined by 4 times the specified deviation angle.
Coupling Prisms	Rutile (TiO_2) or GGG	Variable*	No	No		High index of refraction substrate used to couple light into films. Rutile used for $n_{film} > 1.8$ GGG used for $n_{film} < 1.8$

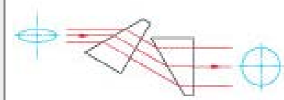
* Depends on angle of incidence and index of refraction

Dispersive Prisms

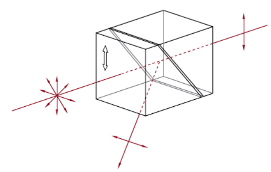
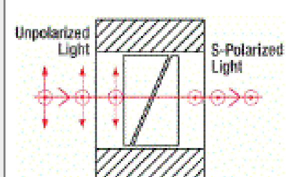
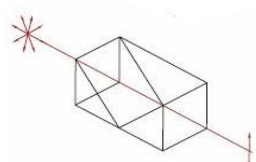
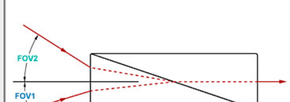
Prism	Material	Deviation	Invert	Reverse or Rotate	Illustration	Applications
Equilateral Prisms	F2, N-SF11, Germanium, or Calcium Fluoride	Variable*	No	No		Dispersion prisms are a substitute for diffraction gratings. Use to separate white light into visible spectrum.
Pellin Broca Prisms	N-BK7, UV Fused Silica, or CaF_2	90°	90°	No		Ideal for wavelength separation of a beam of light, output at 90°. Used to separate harmonics of a laser or compensate for group velocity dispersion.
Dispersion Compensating Prism Pairs	Fused Silica, CaF_2, SF10, or N-SF14	Variable Vertical Offset	No	No		Compensate for pulse broadening effects in ultrafast laser systems. Can be used as an optical filter, for wavelength tuning, or dispersion compensation.

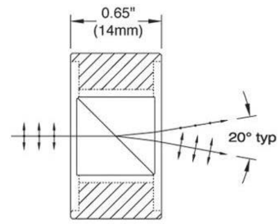
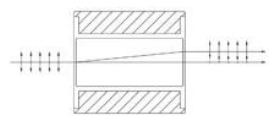
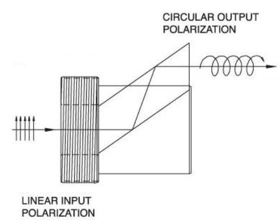
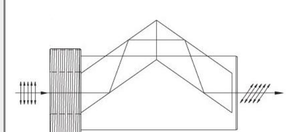
* Depends on angle of incidence and index of refraction

Beam Manipulating Prisms

Prism	Material	Deviation	Invert	Reverse or Rotate	Illustration	Applications
Anamorphic Prism Pairs	N-KZFS8 or N-SF11	Variable Vertical Offset	No	No		Variable magnification along one axis. Collimating elliptical beams (e.g., laser diodes) Converts an elliptical beam into a circular beam by magnifying or contracting the input beam in one axis.

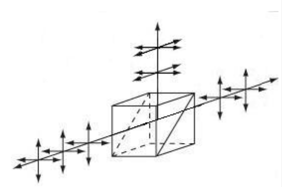
Polarization Altering Prisms

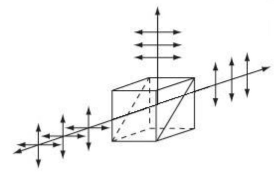
Prism	Material	Deviation	Invert	Reverse or Rotate	Illustration	Applications
Glan-Taylor, Glan-Laser, and α-BBO Glan-Laser Polarizers	Glan-Taylor: Calcite Glan-Laser: α-BBO or Calcite	*p*-pol. - 0° *s*-pol. - 112°*	No	No		Double prism configuration and birefringent calcite produce extremely pure linearly polarized light. Total Internal Reflection of *s*-pol. at the gap between the prism while *p*-pol. is transmitted.
Rutile Polarizers	Rutile (TiO_2)	s-pol. - 0° p-pol. absorbed by housing	No	No		Double prism configuration and birefringent rutile (TiO_2) produce extremely pure linearly polarized light. Total Internal Reflection of *p*-pol. at the gap between the prisms while *s*-pol. is transmitted.
Double Glan-Taylor Polarizers	Calcite	*p*-pol. - 0° *s*-pol. absorbed by housing	No	No		Triple prism configuration and birefringent calcite produce maximum polarized field over a large half angle. Total Internal Reflection of *s*-pol. at the gap between the prism while *p*-pol. is transmitted.
Glan Thompson Polarizers	Calcite	*p*-pol. - 0° *s*-pol. absorbed by housing	No	No		Double prism configuration and birefringent calcite produce a polarizer with the widest field of view while maintaining a high extinction ratio. Total Internal Reflection of *s*-pol. at the gap between the

						prism while *p*-pol. is transmitted.
Wollaston Prisms Wollaston Polarizers	Calcite	Symmetric *p*-pol. and *s*-pol. deviation angle	No	No		Double prism configuration and birefringent calcite produce the widest deviation angle of beam displacing polarizers. *s*-pol. and *p*-pol. deviate symmetrically from the prism. Wollaston prisms are used in spectrometers and polarization analyzers.
Beam Displacing Prisms	Calcite	2.7 or 4.0 mm Beam Displacement	No	No		Single prism configuration and birefringent calcite separate an input beam into two orthogonally polarized output beams. *s*-pol. and *p*-pol. are displaced by 2.7 or 4.0 mm. Beam displacing prisms can be used as polarizing beamsplitters where 90^{o} separation is not possible.
Fresnel Rhomb Retarders	N-BK7	Linear to circularly polarization Vertical Offset	No	No		λ/4 Fresnel Rhomb Retarder turns a linear input into circularly polarized output. Uniform λ/4 retardance over a wider wavelength range compared to birefringent wave plates.
		Rotates linearly polarized light 90°	No	No		λ/2 Fresnel Rhomb Retarder rotates linearly polarized light 90°. Uniform λ/2 retardance over a wider wavelength range compared to birefringent wave plates.

* s-polarized light is not pure and contains some p-polarized reflections.

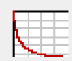
Beamsplitter Prisms

Prism	Material	Deviation	Invert	Reverse or Rotate	Illustration	Applications
Beamsplitter Cube and Mounted Beamsplitter Cube	N-BK7 - Grade A 400-700 nm 700-1100 nm 1100-1600 nm	50:50 splitting ratio, 0° and 90° *s*- and *p*- pol. within 10% of each other	No	No		Double prism configuration and dielectric coating provide 50:50 beamsplitting nearly independent of polarization. Non-polarizing beamsplitter over the specified wavelength range.

Polarizing Beamsplitter Cube and Mounted Polarizing Beamsplitter Cube	SF2 420-680 nm 620-1000 nm 900-1300 nm 1200-1600 nm	*p*-pol. - 0° *s*-pol. - 90°	No	No		Double prism configuration and dielectric coating transmit *p*-pol. light and reflect *s*-pol. light. For highest polarization use the transmitted beam.

Hide Axicons (AR Coated: 290 - 370 nm)

Axicons (AR Coated: 290 - 370 nm)

Item #	Angle (α)	Center Thickness	AR Coating	AR Coating Plot	Reference Drawing
AX251-UV	1.0°	5.2 mm	290 - 370 nm R_{avg}<0.5%	 Raw Data	
AX252-UV	2.0°	5.4 mm			
AX2520-UV	20.0°	9.6 mm			

These axicons are AR coated for the 290 - 370 nm range. They are designed to offer high transmission in the UV range, making them ideal for many ultraviolet applications. Furthermore, the substrate being used (UV fused Silica) offers excellent UV transmission.

Part Number	Description	Price	Availability
AX251-UV	**1.0°, 290 - 370 nm AR Coated UVFS, Ø25.4 mm (Ø1") Axicon**	**$1,392.20**	**Today**
AX252-UV	**2.0°, 290-370 nm AR Coated UVFS, Ø25.4 mm (Ø1") Axicon**	**$1,392.20**	**Lead Time**
AX2520-UV	**20.0°, 290 - 370 nm AR Coated UVFS, Ø25.4 mm (Ø1") Axicon**	**$1,392.20**	**Lead Time**