



CHARA TECHNICAL REPORT

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Telescope Secondary Mirror Specifications and Requirements

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1. INTRODUCTION AND GENERAL INFORMATION

The CHARA Array will employ five 1m size, alt-azimuth style telescopes at a site on Mount Wilson in southern California. The telescopes will be housed separately and operated remotely from a central laboratory. Light from each telescope will be directed by subsequent flat mirrors through vacuum pipes to additional optics and instrumentation at the central laboratory.

This document describes specifications for manufacture of the secondary mirrors for the telescopes of the CHARA Array. The information and specifications provided herein are intended to enable prospective suppliers (hereafter called vendors) of polished mirrors to respond to a future ITB. It is expected that these specifications will become part of any contract for mirror blank purchase that may result from the future ITB.

2. THE REQUIRED OPTICS

Optical components are required to meet the specifications given in Sections 3 and 4 in the following quantities.

1. One (1) concave, parabolic test optic, with test documentation.
2. Five (5) convex, parabolic mirrors, with test documentation.

The acceptance testing of the test optic and first mirror must be completed prior to 30 June 1997. The additional four mirrors must be delivered within intervals of two (2) months following that date.

Quoted prices to be f.o.b. delivery point including shipment costs to the CHARA Array site in California, and the mirrors must be packed in containers suitable for protecting them from damage during shipment. Vendors are required to provide a firm completion date for the first mirror, assuming that an award will be made within 30 calendar days from the bid opening date.

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3. MIRROR BLANK MECHANICAL CHARACTERISTICS AND MATERIAL PROPERTIES

General specifications are given here for blanks required for the CHARA telescope secondary mirrors and test optic.

Vendors are required to procure mirror blanks that meet the requirements of Section 3 and are therefore required to include information with this quotation concerning the mirror blanks the vendor intends to provide.

3.1. Test Optic Blank Specifications

The finished optic shall have a concave optical surface meeting the specifications in Section 4 after polishing. The blank, ready for polishing, shall conform to the specifications given below. In addition, all unpolished exterior surfaces of the blank shall be ground with #80 grit or finer.

Coefficient of Thermal Expansion	$\leq 1.5 \times 10^{-7} \text{ } ^\circ\text{C}^{-1} (-10^\circ \text{ to } 25^\circ \text{ C})$
Stress Condition	$\leq 15 \text{ nm/cm}$
Scratch/Dig	60/40
Diameter	140 (-0,+10) mm
Thickness	25 (-5,+10) mm
Bevels	$\approx 45^\circ, 1.0 \pm 0.5 \text{ mm}$

3.2. Secondary Mirror Blank Specifications

The finished mirror shall have a convex optical surface meeting the specifications in Section 4 after polishing. The mirror blanks, ready for polishing, shall conform to the dimensions given below. In addition, all unpolished exterior surfaces of the blank shall be ground with #80 grit or finer.

Coefficient of Thermal Expansion	$\leq 1.5 \times 10^{-7} \text{ } ^\circ\text{C}^{-1} (-10^\circ \text{ to } 25^\circ \text{ C})$
Stress Condition	$\leq 15 \text{ nm/cm}$
Scratch/Dig	60/40
Outer diameter	$140 \pm 0.25 \text{ mm}$
Inner hole diameter	$13.46 \pm 0.10 \text{ mm}$
Inner and Outer edge concentricity	$\pm 0.1 \text{ mm}$
Thickness	$16 \pm 0.25 \text{ mm}$
Bevels	$\approx 45^\circ, 1.0 \pm 0.5 \text{ mm}$

SECONDARY MIRROR SPECIFICATIONS

4. TEST OPTIC SURFACE SPECIFICATIONS

The optical specifications will be satisfied over the clear aperture of the test optic (the clear aperture is 130 mm in diameter, concentric with the mechanical axis of the blank). The polished surface shall be a concave paraboloidal surface of revolution, conforming to the following requirements:

Outer diameter of figured surface	≥ 134 mm
Radius of curvature	625 ± 1 mm
Distance of optical vertex from blank axis of symmetry	≤ 1 mm
Surface error (at 632 nm) within clear aperture	≤ 0.02 waves RMS
	≤ 0.15 waves peak to valley

5. SECONDARY MIRROR SURFACE SPECIFICATIONS

The optical specifications will be satisfied over the clear aperture of the mirrors (the clear aperture is an annulus concentric with the mechanical axis of the blank, 128 mm in outer diameter, and 25 mm in inner diameter). The polished mirror surfaces shall be a convex paraboloidal surface of revolution, conforming to the following requirements:

Outer diameter of figured surface	≥ 134 mm
Inner diameter of figured surface	≤ 18 mm
Radius of curvature	-625 ± 1 mm
Distance of optical vertex from blank axis of symmetry	≤ 1 mm
Surface error (at 632 nm) within clear aperture	≤ 0.02 waves RMS
	≤ 0.15 waves peak to valley

5.1. Optical Testing

Optical surface testing for acceptance purposes shall be done with interferometric testing equipment, or equipment with similar performance approved by CHARA, capable of resolving errors at least 50% smaller than the surface deviation specification given above, and capable of resolving the surface to spatial scales of 2 mm.

Confirmation of the mirror surface figures will include documentation of interference fringes between each secondary mirror and the test optic.