Astronomy
University of Michigan

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To: Optical manufacturers.

Ref: Request for quote, MIRC spectrograph Optical Fabrication.

This is a request for a quotation on the fabrication of custom lenses for an infrared spectrograph, which we are currently building for the 6 telescope CHARA interferometer on Mount Wilson, California. This infrared spectrograph, called the Michigan Infra-Red Combiner (MIRC), is a fiber based instrument optimized to work in the H spectral band. Funds for completion are available immediately.

The combiner includes two air spaced achromat, each composed of a biconvex CaF2 and a Fused Silica negative meniscus. Included with this letter are drawings of each element and specifications for their fabrication. The lenses are 25mm in diameter. Because the optical quality of the lenses will be critical to the performance of the instrument, we will require a report of he final testing and measurements of the lenses, including interferograms or other data characterizing the finished elements.

We designed these lenses using Zemax and did a test-plate fitting based on the ISP test-plate list available on ISP's website. We would like to make sure that the test-plates for the radii we have chosen are available. Additionally, we would like to have the measured glass parameters in order to update our zemax lens design.

We are particularly interested in the following issues: (1) the fabrication method you will use to generate, grind and polish the elements; (2) the surface figure accuracy and finish quality which you can confidently deliver; and (3) the testing methods and equipment available in-house to document the characteristics on the finished elements. Please note that we expect all the elements to be coated in the same batch.

Please feel free to comment on any aspects of our specifications which appear particularly difficult or costly to achieve, or which would drive up the cost without contributing significantly to the optical performance. We particularly would like to know if any of our specifications will require the use of manufacturing techniques which will significantly increase the cost. We will expect the fabricated element to adhere to agreed-upon specifications on a best-effort basis. If you intend to subcontract any aspects of the production, please state so explicitly.

Element	Material	Diameter mm	R1 mm	R2 mm	Quantity
1	CaF2	25	57.687	46.244	3
2	Fused Silica	25	37.667	91.204	3
1-2.4µm AR coating that withstands cryogenic temperatures, with spectral performances @ 1-2.4µm *Transmission:* 98% average; *Reflection:* 1.0% average per surface					

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Please comment on the fabrication time needed and provide a fixed price quote on all the costs related to the production and delivery. We expect the quote to include separate prices for:

- the glass blanks,
- the manufacturing of the lenses,
- the coating,
- shipping and handling.

We would appreciate receiving the quote within a week time due to a tight schedule on our project. Please do not hesitate to contact me for clarification of the above request or if anything mentioned requires discussion. I look forward to hearing from you.

Best regards,

Nathalie Thureau.

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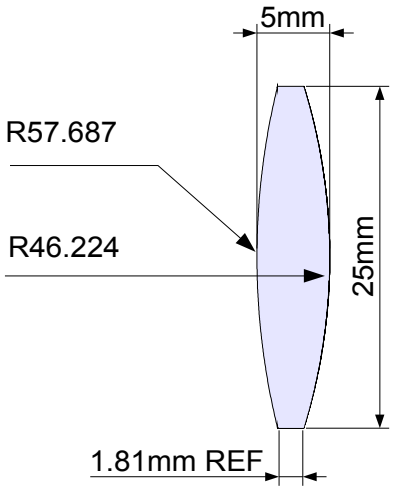
LENS 1



Central thickness	5mm
Radius 1	57.687mm
Radius 2	46.244mm
Diameter	25mm

1. Material:	IR grade CaF2
2. Surface Figure:	λ/20 at 633nm – Document and report final figure.
3. Radius Tolerance	± 0.06%
4. Surface Quality:	60-40
5. Surface finish:	micro ripple 1nm RMS or better. Document and report measured values.
6. Diameter Tolerance:	+0/- 0.1mm
7. Thickness Tolerance:	± 0.075mm. Report to ±0.010mm
8. Concentricity:	± 0.013mm maximum runout. Report measured value.
9. Bevel:	0.25mm at 45°
10.Clear Aperture	Exceeds central 90% of dimension
11.Coating:	AR 1-2.4μm coating

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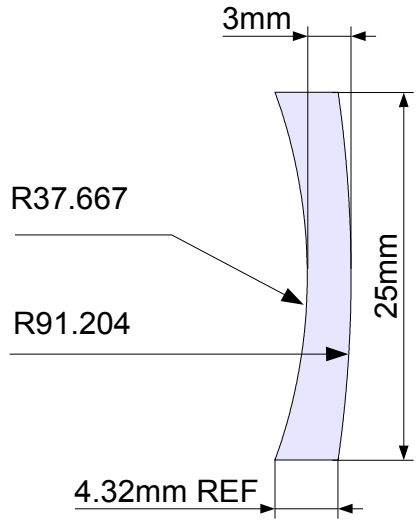
LENS 2



Central thickness	3mm
Radius 1	37.667mm
Radius 2	91.204mm
Diameter	25mm

1. Material:	IR grade Fused Silica
2. Surface Figure:	λ/20 at 633nm – Document and report final figure.
3. Radius Tolerance	± 0.06%
4. Surface Quality:	60-40
5. Surface finish:	micro ripple 1nm RMS or better. Document and report measured values.
6. Diameter Tolerance:	+0/- 0.1mm
7. Thickness Tolerance:	± 0.075mm. Report to ±0.010mm
8. Concentricity:	± 0.013mm maximum runout. Report measured value.
9. Bevel:	0.25mm at 45°
10.Clear Aperture	Exceeds central 90% of dimension
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Regarding glass properties:

- Striae grade A. per Mil-G-174A. Report bubble quality group.
- Index homogeneity (n) = $\pm 2 \times 10^{-5}$ or better.
- Refractive index measurements (to the 6^{th} decimal place) within 0.8-2.4µm wavelength range. Record temperature with index measurements.
- Duplicate blanks from the same melt and anneal.
- Fine anneal. Maximum birefringence 10nm/cm.
- Internal transmission data within 0.8-2.4µm wavelength range.

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