LIGHT BUCKET ASTRONOMY

Silvering and Overcoating Experiments

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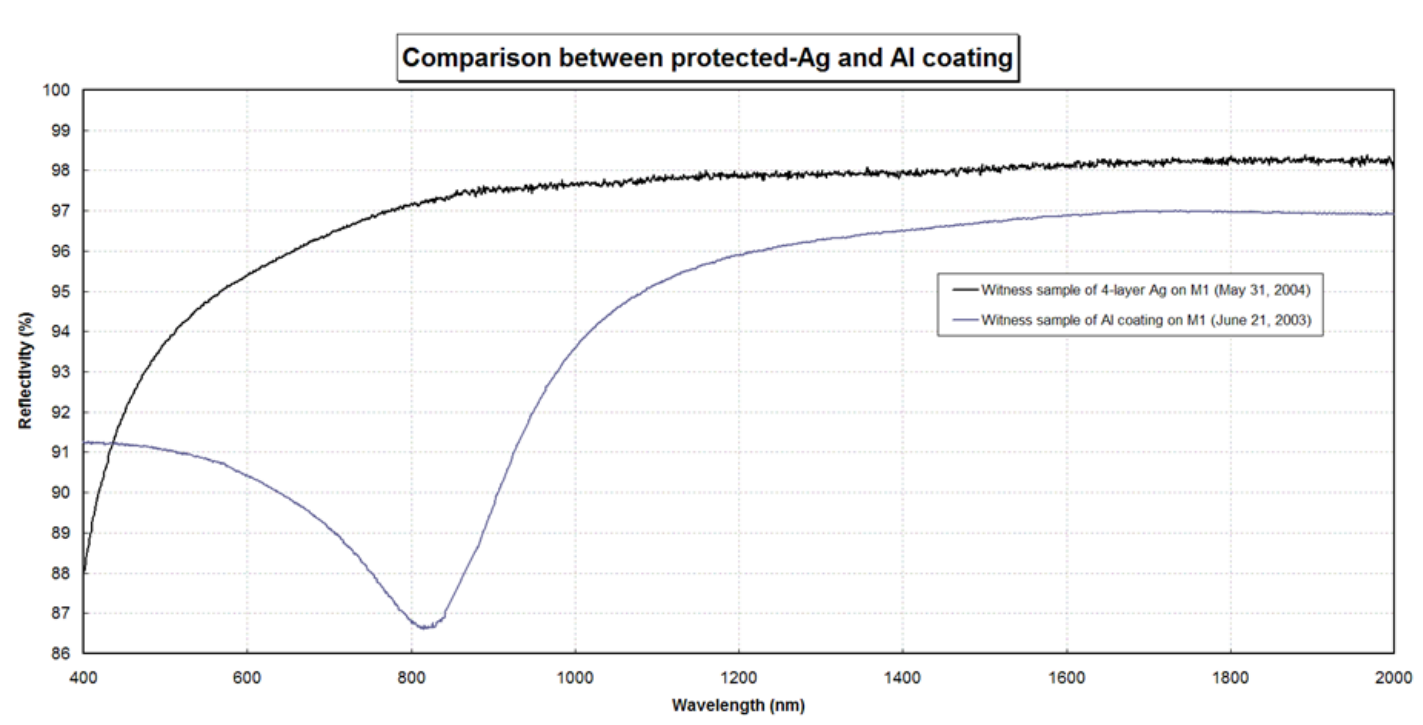
Agenda

- Overview
- Experimental Setup
  - Use Peacock Labs Cold Silvering and Overcoating
- Surface error tests
- Reflectivity tests
- Conclusions

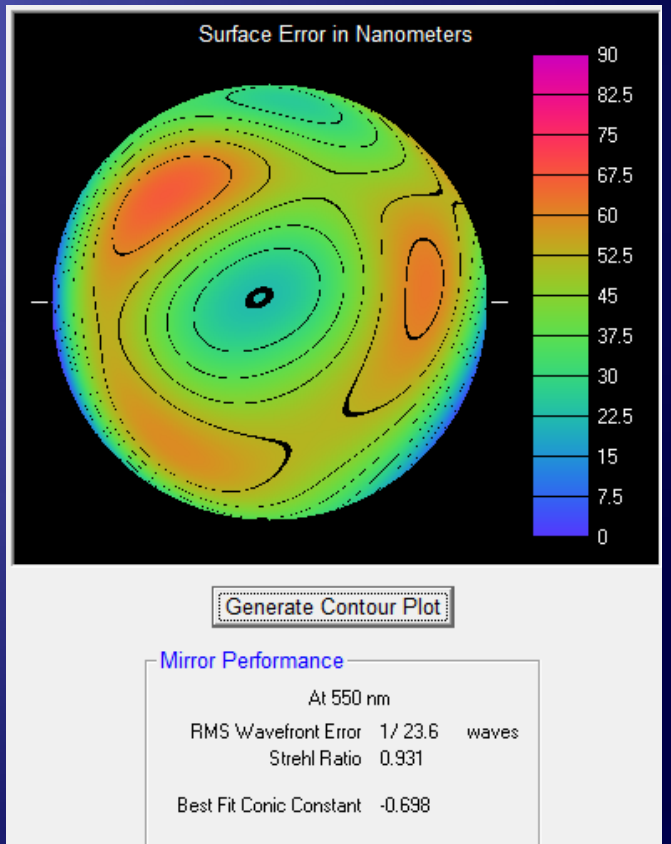
Overview

- Vacuum overcoating
  - Expensive, shipping risks and delays
- Silver is a traditional cold overcoating material
  - Reflectivity is very good out to NIR



Source: gemini.edu

Peacock Labs I



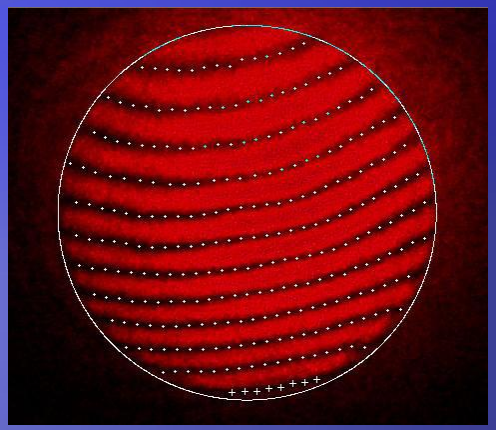
- Cold silvering processes
- Located in Philly
- Calibrated mirrors silvered and coated with their Permalac products

Phase I Tests

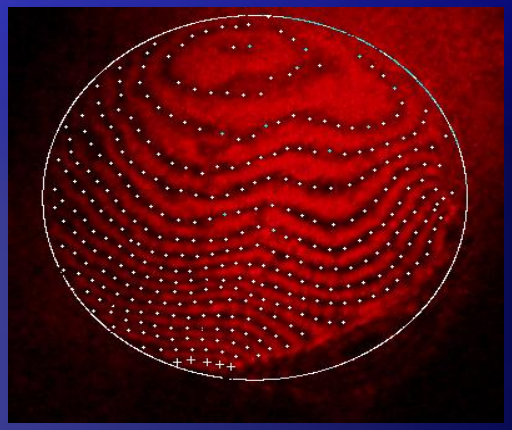
- Silvered (2)
- Thick 25-µm Permalac (2)
- Thin 5-µm Permalac (2)

Phase I Tests

- Thick produced no fringes
- Thin not thin enough
- Just silvered – very fine (must confirm)



Silvered



Thin Permalac

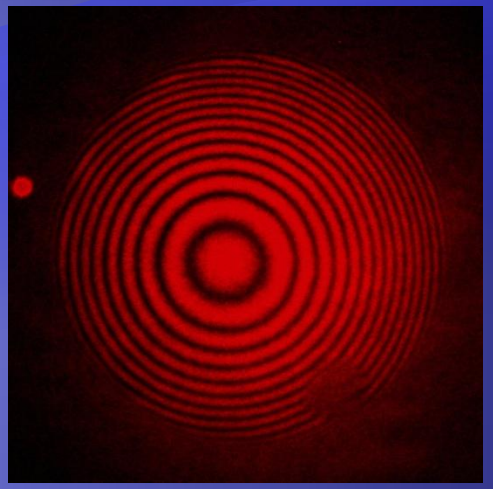
	Before Coating		After Coating	
Mirror #	Wavefront Error	Strehl Ratio	Wavefront Error	Strehl Ratio
Silvered				
2	1/8.4	0.571	1/20.1	0.907
4	1/12.0	0.762	1/27.9	0.951
Thin Permalac				
6	1/15.4	0.847	1/2.86	0.00791
7	1/15.9	0.855	1/2.1	0.000133

Phase II Tests

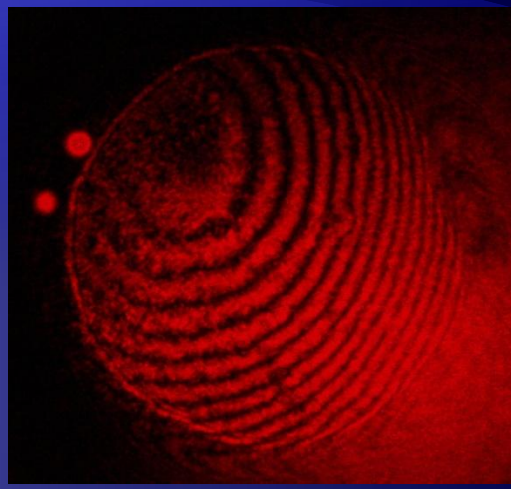
- Silvered (4) – verify Strehl
- Extra Thin Permalac (3)
- Flats (2 each) – test reflectivity

Phase II Tests

- Extra Thin still not thin enough
- Just silvered – very fine (confirmed)



Silvered

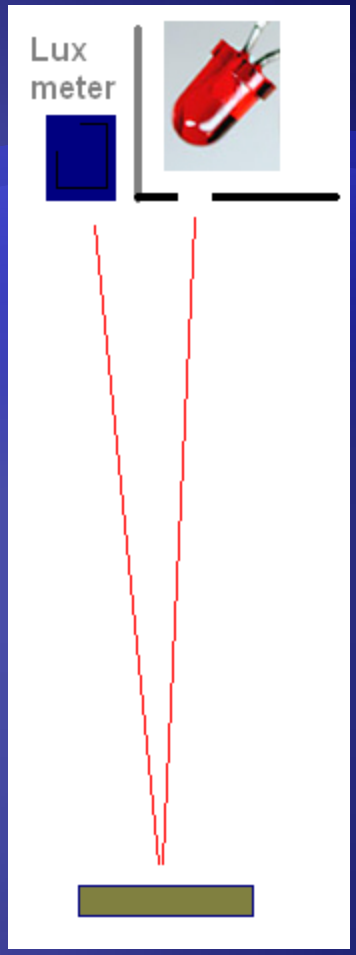


Extra Thin Permalac

Mirror #	BEFORE COATING			AFTER SILVERING	
	RMS Wavefront Error (waves @ 550nm)	Strehl Ratio		RMS Wavefront Error (waves @ 550nm)	Strehl Ratio
No overcoat					
20	0.031	0.963		0.001	0.962
22	0.120	0.567		0.071	0.821
24	0.073	0.812		0.065	0.847
26	0.080	0.778		0.099	0.680
Extra-thin overcoat					
5	0.042	0.933		0.088	0.735
21	0.085	0.753		0.199	0.211
36	0.083	0.760		0.285	0.040

Phase II Flats

- Normal incidence reflectivity
- Compared to Thorlabs SiO overcoated Ag flat ($35/sq in.)
- More tests needed



FLAT	GREEN LED	RED LED	WHITE LED
Silvered	92.0%	98.4%	98.3%
Silver + Overcoated	88.0%	93.5%	90.8%

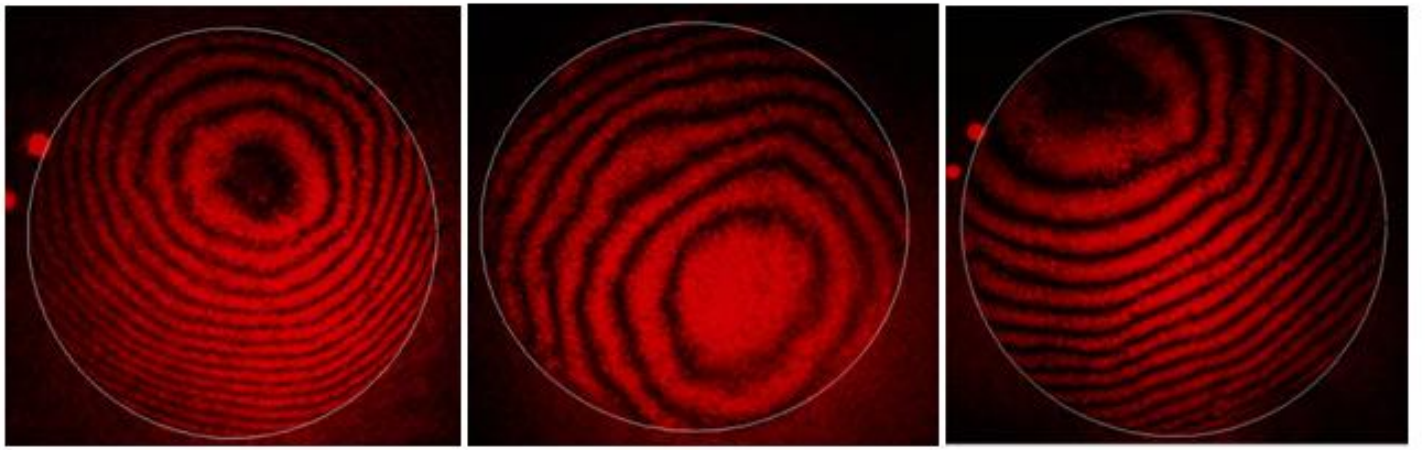
Phase IIA Tests

- Extra Extra Thin Permalac (3)

Phase IIA Tests

- Extra Extra Thin mirrors show improved Strehl and surface smoothness

Phase IIA Mirror Smoothness



Mirror #	BEFORE COATING			AFTER SILVERING	
	RMS Wavefront Error (waves @ 550nm)	Strehl Ratio		RMS Wavefront Error (waves @ 550nm)	Strehl Ratio
EET overcoat					
9	0.086	0.747		0.177	0.291
23	0.054	0.891		0.112	0.612
25	0.057	0.878		0.118	0.576

Conclusions and Pending Tests

- Peacock Labs Coatings
  - EET Permalac Suitable for LBTs,
  - Overcoat not yet ready for diffraction-limited scopes
- Test Long-Term Durability, Larger mirrors
- Test reflectivity into NIR

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