Antireflective coatings for the red camera of WEAVE

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INTRODUCTION

In this work we present the coatings of the spectrograph red camera of WEAVE - the new multi-object survey facility for the 4.2m William Herschel Telescope. The initial requirements of WEAVE red camera lenses, with reflectances as low as 0.4% through the wavelength interval from 590 nm to 959 nm at angles of incidence of 18° ± 17° represented a challenge for both design and production.

AR coating AOI specification

A detailed analysis was carried out regarding the AOI specification of the cameras coatings. Based in Zemax ray tracing, RAL Space provided histograms of the AOI of different rays at each interface air/glass for the spherical camera lenses.

DATA ANALYSIS

The coating evaporations were performed at CIO in the Integrity 39 Denton Vacuum Deposition System. In all the depositions at least a witness samples is included to evaluate the coating quality by measuring afterwards the transmittance of the sample(s).

To be able to calculate the reflectance at other AOI it is indispensable to find the design corresponding to the actual reflectance measured experimentally. A re-optimization through damped least squares of the design is done, using the experimental data as boundary to fit a theoretical model.

Figure 2. Top left: experimental data and theoretical reflectance, after removing Fresnel reflections from the second surface. Top right: Re-optimized design that fits the experimental data. Bottom: data extrapolation to non-normal AOI.

Repeatibility

Several designs were developed and the advantages of each were evaluated. The teams of INAOE and CIO collaborated very closely to achieve the best solutions.

Conclusions

Great amount of R&D has been done in the determination of the most suitable material combination and optimal optical properties of AR coatings for the specific case of WEAVE. The requirements are large AOI and a medium size spectral range. Red Camera coatings are soon to be finished and the Blue Camera along with its AR coatings are under development.