2F spectral reflectance measurement of spherical mirrors

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Abstract: We present a novel method for spectral reflectance of spherical mirrors based on 2F measurement setup. The method is similar to spectral transmission measurement ISO 8478:1996 Measurement of ISO spectral transmittance. The method is redesigned to measure the surface reflectance of spherical mirrors in 2F distance. The result gives the real overview of the mirrors spectral properties within the telescope.

OCIS codes: (300.6490, 220.4840).

References and links

1. Perkin Elmer, "LAMBDA 850 UV/Vis Spectrophotometer," `http://www.perkinelmer.com/catalog/product/id/l850`.
2. K. Gallo and G. Assanto, "All-optical diode based on second-harmonic generation in an asymmetric waveguide," J. Opt. Soc. Am. B **16**(2), 267–269 (1999).

1. Introduction

The most experiment designed for detection of light generated by particles passing a matter are using mirror telescopes to collect the signal light. The cheapest and simplest design of the telescopes uses spherical mirrors. One of the most important parameters of the telescope performance is the mirror reflectance, especially spectral reflectivity. By knowing the spectral reflectance of the mirrors the collected signal could be corrected. The most common method of reflectance measurement is the local contact/noncontact reflectance measurement. The tested mirror sample or segment is measured inside the spectrophotometer (e.q. Perkin Elmer Lambda series [1]) or the spectrophotometer (special head) is placed on the surface of the measured sample/segment (e.q. Ocean Optics Jaz spectrophotometer). In addition, those methods measure a small area of the surface defined by a diameter of incidence light beam. A number of measurements have to be done to obtain a more realistic view of the whole surface reflectance. Most of the devices provide a measurement of a specular reflectivity and collect a fraction of diffused reflected light from the surface. However, the real telescopes collect the light defined by the field of view of the detector/camera. This issue could be solved by knowing of roughness or BRDF of the surface. The encircled energy as a function of the angle of reflectance could be calculated and the result from spectrophotometer could be corrected. The other option is a new method that eliminates the scattered light and measure the light defined by the field of view of the detector only. This article presents such a new 2F spectral reflectance method of spherical mirrors. The method measures the whole surface at once and gives an integral reflectance of the surface.

1.1. Reflectance of a surface

Collective optics concentrates the light signal to a detector, the most important parameter of the optical setup is total reflectance for given working spectral interval. The goal is to maximize the reflectance for given spectral interval. The loses of the signal could be caused by absorption of the light within the reflective surface and roughness of the surface. The maximum reflectance of the surface depends on the deposition technique and used material. In real situation the final value is lower (due to layer quality and scattering properties) and changes in time. The knowledge of the real value of the reflectance for the signal analysis is very important.

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\begin{figure}[htbp]
%\centering\includegraphics[width=7cm]{opexfig1}
\caption{Sample caption (Ref. \cite{Oron03}, Fig. 2).}
\end{figure}

\begin{equation}
H = \frac{1}{2m}(p_x^2 + p_y^2) + \frac{1}{2} M{\Omega}^2
     (x^2 + y^2) + \omega (x p_y - y p_x).
\end{equation}
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2. Conclusion

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