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An Interferometric Instrument for the Determination of Spectral and Angular Dependence of Back-reflected Light from Smooth Optical Surfaces

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Here we present the experimental results obtained for backscattered and retro-reflected light from optical components, including uncoated and anti-reflective coated windows and mirrors, using the BARRITON (BAck-scattering and Retro-Reflection by InterferomeTry with lOw cohereNce) instrument. BARRITON is an interferometric set-up based on the Fourier transform spectrometry technique, where the use of balanced optical detection suppresses the relative intensity noise of the input light source, thus improving the signal-to-noise ratio and allowing the measurement of the angular dependence of the back reflection on the order of 10-10 (10-4 sr-1 in terms of ARS measurement). In addition, the low coherence nature of the broadband light source allows accurate identification of the different optical interfaces and their respective back reflection and back scattering contributions. Finally, we demonstrate the recording of the spectral dependence of the reflection coefficient of anti-reflective coated windows with tunable spectral resolution from 0.2 nm to a few nanometers, with the lowest recorded value for an AR-coated interface between 80 ppb and 1.6 ppm. This work is performed in the context of the Stray Light Working Group of the LISA Consortium.

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