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Bouchat, Julien; Fagnart, Julien; Caudano, Yves

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# **Probing Goos-Hänchen shifts in surface nonlinear optics by quantum weak measurements**

Julien Bouchat, Julien Fagnart, and Yves Caudano

*Research Unit Lasers and Spectroscopies (UR-LLS), Department of Physics,  
Namur Institute for Complex Systems (naXys) and Namur Institute for Structured Matter (NISM),  
University of Namur, Rue de Bruxelles 61, 5000 Namur, Belgium*

The Goos-Hänchen shifts are tiny deviations, in the incidence plane, from the laws of geometrical optics, which are observed when applying these laws to the central axes of incident and reflected light beams. The axis of the reflected beam does not generally emanate from the surface at the incidence point of the impinging beam (spatial shift) and the angle of the axis of the reflected beam does not generally match exactly the incidence angle (angular shift). In this theoretical work, we show how to exploit pre- and post-selected weak measurements of the light polarization to probe the spatial and angular Goos-Hänchen shifts occurring for paraxial Gaussian beams emitted by a surface nonlinear optical process, such as second-harmonic (SHG) or sum-frequency generation (SFG). Pre- and post-selected weak measurements, which were initially developed to probe foundational issues in quantum mechanics, proved very useful to enhance the minute shifts in linear optics that were undetectable otherwise, through a process called weak-value amplification. We further reveal the usefulness of amplified weak measurements in the context of nonlinear optics.