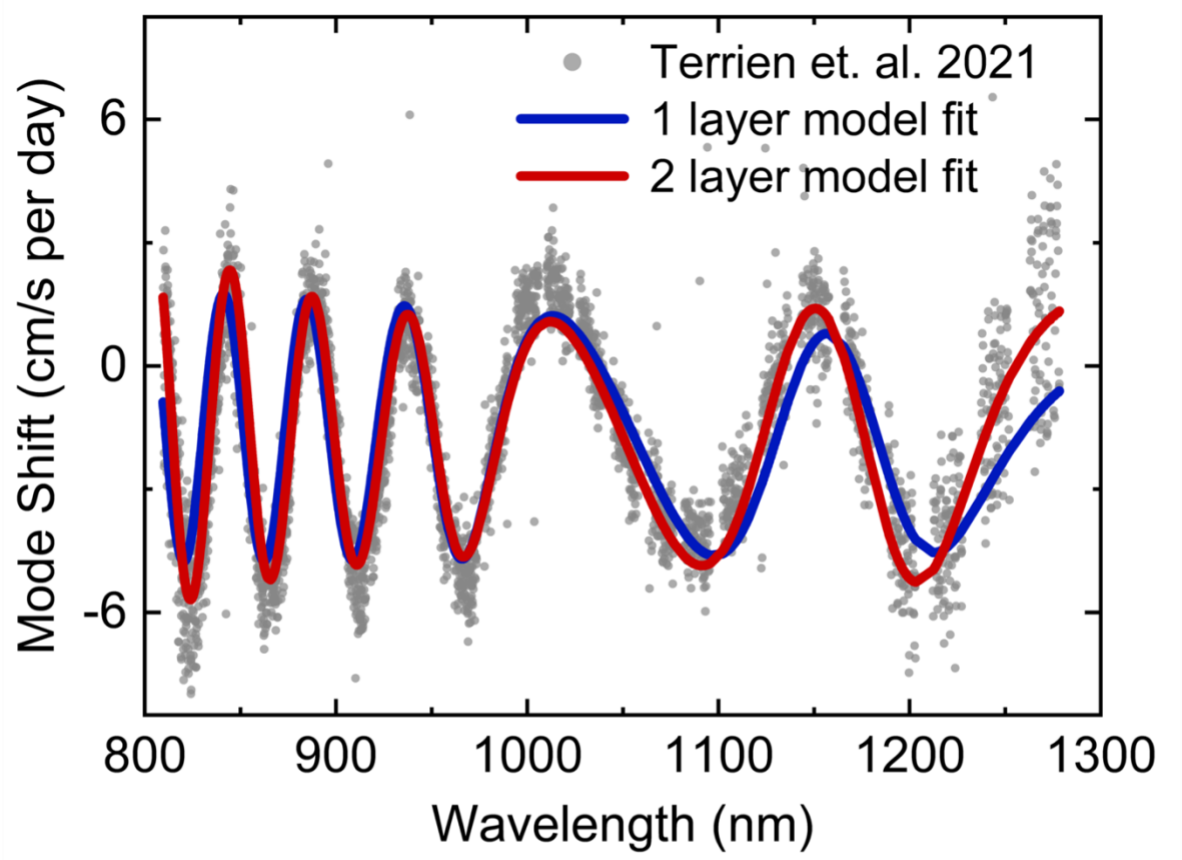
Flat-top Optical Fibers as Scramblers for EPRV Measurements

Stephen Eikenberry
University of Central Florida

A key technology for fiber-fed EPRV measurements is fiber mode scrambling. Any change in mode excitation in the fiber output will result in apparent centroid shifts (and thus artificial RV shifts) in the target spectrum. Several technologies are currently used to mitigate this effect, including scramblers, mechanical agitators, and others. Here we present our experimental results on the modal illumination stability of “flat top” optical fibers. These fibers use deliberately-introduced internal mode scrambling features in their fabrication process to distribute light evenly within the fiber modes during transmission from input to output. Importantly, this scrambling occurs with minimal (few percent) light losses. Furthermore, by splicing a length of flat-top fiber into the existing fiber feed, there is no need for external optical alignment or mechanical motion to achieve excellent mode scrambling. We will present our measurements of flat-top fiber throughput and scrambling gain, and the expected benefits from incorporating such a fiber into existing EPRV spectrographs.



Mode drift measurements made on the HPF etalon (gray) with modeled fits for refractive index and layer thickness perturbations to the first (blue) and first two (red) layers of the dielectric mirror coating.