Project Title: Early detection of corneal ectasia with *in vivo* Brillouin optical imaging of corneal biomechanical properties

Abstract: The biomechanical properties of the cornea are essential for its function. Corneal collagen fibers provide the mechanical strength to withstand the intraocular pressure; if corneal tissue becomes abnormally weak, corneal ectasia (i.e. thinning and bulging) ensues, causing severe vision degradation. Abnormal weakening of the cornea occurs due to degenerative ocular conditions, e.g. keratoconus, affecting ~1/2000 of the general population or as a complication of LASIK surgery. Concerns about post-LASIK ectasia prevent about 15% of prospective patients from benefitting from laser vision correction. When clinical symptoms manifest, corneal ectasia is often at an advanced stage that leads to corneal transplant. If inherent corneal weakness were detected early, corneal collagen crosslinking could stop the degenerative bulging and at-risk subjects could be consulted to avoid LASIK surgery. Early detection requires an imaging technique that uses elasticity as a contrast mechanism; current clinical instruments only provide morphological information. This proposal addresses this need by bringing Brillouin imaging to corneal applications. Brillouin imaging can map the elastic modulus of material without contact and with 3D resolution. A pilot clinical study will be performed to compare normal to keratoconus corneas (Aim 1) and normal to post-LASIK ectasia corneas (Aim 2). Brillouin imaging has the potential to revolutionize current diagnostic paradigms for keratoconus and screening protocols for LASIK surgery. This study will collect crucial data to design large-scale clinical studies to prove the technology effectiveness. This proposal is the result of collaboration between the inventors of Brillouin imaging and an expert in ophthalmology and corneal refractive surgery.