

Paid Research Assistant Positions for Physics Students

Biomedical Optics and Imaging Lab (BOIL), Department of Biomedical Engineering, Stony Brook University

BOIL is recruiting undergraduate and MS physics students for paid, hourly research assistant positions. We build noninvasive optical instruments for brain monitoring, tissue biomechanics, and cancer therapy monitoring, and the underlying physics is coherence, speckle statistics, Brownian dynamics, and photon counting. Students with hands on experience in optical setups, programming, and hardware data acquisition will find problems here that reward those skills.

Research Tracks

Speckle physics of blood flow. Our time gated diffuse correlation spectroscopy and speckle contrast systems recover cerebral blood flow from the decorrelation of laser speckle caused by red blood cells in Brownian and advective motion. Students build and characterize the optical and photon counting hardware, write acquisition and analysis code, and help validate systems in phantoms and human studies.

Laser speckle rheology and biomechanics. The same Brownian motion reports the viscoelastic modulus of the medium the scatterers sit in. Our benchtop laser speckle rheology setup measures it without contact using polarization controlled illumination and a high speed scientific camera. A student on this track owns the system end to end, from alignment and camera timing to the analysis that turns speckle decorrelation into a mechanical measurement.

Quantum enabled photon counting at Brookhaven National Laboratory. A newly funded SBU-BNL Seed Grant with the Center for Functional Nanomaterials adapts superconducting nanowire single photon detectors and time correlated single photon counting to a photon starved measurement: the direct 1270 nm luminescence of singlet oxygen during light activated cancer therapy. Students spend time on site at BNL working with national laboratory scientists, a natural path toward future internships and positions there.

Wearable speckle sensing for overnight brain monitoring. A new project under development takes speckle based blood flow out of the lab and onto a self applied headband for all night use at home, using a compact shortwave infrared camera with 1064 nm illumination and multispectral reflectance channels alongside EEG. The physics problems are photon budget in a multiply scattering medium at eye safe power, speckle statistics with pixel ensembles and short exposures, depth sensitivity versus source detector separation, and Monte Carlo photon transport to choose the geometry.

Who We Are Looking For

Physics students with demonstrated aptitude for experimental work. Useful experience includes optical system integration (lasers, detectors, cameras, fiber and polarization optics), hardware control and high speed data acquisition (NI-DAQ, LabVIEW, timing and photon counting electronics, scientific CMOS or SPAD cameras), FPGA development, and Python or MATLAB for acquisition and analysis. No one is expected to have all of these, and curiosity about how physics translates to medicine matters more than prior biology coursework.

Project details and recent publications: <https://sunarlab.org/research>

How to Apply

Email a single PDF with your CV and a statement of interests (1 page or less) naming the track that draws you to Prof. Ulas Sunar at ulas.sunar@stonybrook.edu. If you are already working in a research group, please discuss this with your current advisor before applying. Positions are reviewed on a rolling basis.