Exploring the Universe Through Distant Quasar Light

Internship location: Virginia Cosmology Group, Galaxy Evolution and Cosmology Initiative, Astronomy Department, University of Virginia, Charlottesville, VA, USA
Internship supervisor: Prof. Satya Gontcho A Gontcho
Supervisor's email: satya@virginia.edu
Group's website: https://satyagontcho.space/
International collaborations: Dark Energy Spectroscopic Instrument
Internship duration: minimum 4 months. [M.Sc. internships or Gap Year]
Funding: Yes.

Proposition de stage / Internship topic:

We are inviting applications for a research opportunity that centers on exploiting the information contained in the spectra of distant quasars.

Quasars are among the brightest objects in the universe - supermassive black holes actively accreting matter and emitting across the electromagnetic spectrum with luminosities that allow us to observe them across billions of light-years. When we observe high-redshift quasars from the early universe $(z > 2)$, their light has traversed vast cosmological distances, passing through the intergalactic medium and intervening neutral hydrogen clouds. This gas imprints characteristic Lyman-alpha absorption features - the "Lyman-alpha forest" - in the quasar's spectrum, creating a powerful probe of the distribution of dark matter and baryons at different cosmic epochs.

In this internship, you will work with spectroscopic data from these distant quasars to extract scientific insights about cosmic structure formation and evolution. Depending on your interests and background, we can tailor the project in several directions: if you are curious about astrophysics, we can focus on what the spectra tell us about the quasars themselves and the gas around them; if you're drawn to cosmology, we can use the data to study large-scale structure and test models of the universe's evolution; if you have a machine learning background or want to develop those skills, we can build/perfect algorithms to automatically detect and classify spectral features from large datasets. A basic understanding of physics or astronomy is helpful, but no deep cosmology background is required - just curiosity and a willingness to learn how we decode the universe's history from spectroscopic observations.

To Apply: send a concise introductory email highlighting your interests and relevant experience, along with a CV. Applications are considered on a rolling basis. For longer stays and gap-year, there is the possibility to visit collaborators at UC Berkeley / Lawrence Berkeley National Laboratory.