UV SPECTRAL ATLAS OF MASSIVE STARS AND CLUSTERS AT LOW METALLICITY
A Legacy Library for Stellar Physics, Star Formation, ISM and CGM

Summary: Form a FUV+NUV spectral atlas of 120 massive stars in the Magellanic Clouds and 10 super star clusters in low-metallicity environments, all at high S/N (> 20) and resolution (R > 15,000). Expected size ~900 orbits.

(1) **Overview**: Massive stars are responsible for the bulk of ionizing, mechanical and chemical feedback in galaxies. Their evolution remains unclear owing to the role of mass-loss, rotation and binarity. Massive stars are the *only* stellar populations directly seen in high-z galaxies, via P Cygni resonance lines from OB stars and emission lines from O supergiants and Wolf-Rayet stars in the far-UV. This Legacy dataset would provide the fundamental reference data set for UV spectroscopy at low metallicity by constructing a comprehensive UV spectral atlas of massive stars in the Magellanic Clouds (60 stars in each galaxy). The sample would span OB dwarfs, giants and supergiants plus their evolved progeny, Wolf-Rayet stars, and Luminous Blue Variables, and stars in the Magellanic Bridge. A few metal-poor, extragalactic clusters are included to supplement the parameter space. This dataset would also be used to make fundamental progress on our understanding of massive stars, binarity, star formation, the ISM, dust, and the CGM of our nearest galactic neighbors in unprecedented detail. This would double the number of existing high-quality spectra of hot, luminous stars in the Magellanic Clouds.

(2) **Key science goals:**

Spectral Templates: This library would provide OB, Wolf-Rayet and LBV spectroscopic templates for rest-frame UV studies of high-z galaxies with JWST and ELTs. The proximity and low metallicity of the LMC (0.5 solar) and SMC (0.2 solar) makes them ideal targets. This atlas would greatly extend the number of high quality UV spectroscopic templates in both galaxies, and provide more representative examples since archival datasets were largely selected on the basis of being UV-bright for ISM studies or focused on unusual systems (e.g. magnetic O stars).

Atmospheres and Evolution. The FUV provides access to P Cygni profiles from hot luminous stars from which wind properties (velocities, mass-loss rates, clumping, porosity) can be obtained, which in turn influence the evolution of massive stars, together with binarity, while photospheric lines - such as the iron forest in the FUV - provide a direct signature of the ionization conditions of iron and other elements within the stellar atmosphere.

Stellar Populations at Low Metallicity: The metal-poor clusters will clarify the IMF and ionizing SED in massive clusters that serve as analogs to higher redshift objects. Stellar abundances at low metallicity are more accurate in weak-wind populations, and can be compared to nebular diagnostics.

ISM Gas and Dust: The stellar and cluster spectra will contain many interstellar metal lines across the FUV. This will enable comprehensive studies of the interstellar medium of the Magellanic Clouds and metal-poor galaxies, including metal abundances, dust depletions, kinematics, ionization state, and spatial distribution. Furthermore, UV continuum studies will further characterize the dust extinction law in a range of metallicities and environments, since the foreground Milky Way component of the extinction is low.

The CGM: Inflows and Outflows on Galactic Scales. The stellar and cluster spectra will also reveal absorption lines from the circumgalactic medium (CGM) of the LMC, SMC, and the metal-poor galaxies. This data set can thus be leveraged to study the baryon and metal cycle of star formation, feedback, and multi-phase ISM in the Magellanic Clouds and metal-poor galaxies.