Mapping the 3D Gas Distribution of the Milky Way

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Our Milky Way serves as an unique laboratory for investigating gas flow dynamics from the local interstellar medium (ISM) into the circumgalactic medium (CGM) (Lan et al 2014; Murga et al 2015). We develop statistical methods, utilizing SDSS spectroscopic measurements, including stars and quasars along a line of sight. Together with the distance information of stars form Gaia parallax, we are able to locate the gas responsible for the absorption line features and map the gas distribution of Milky Way in 3D.

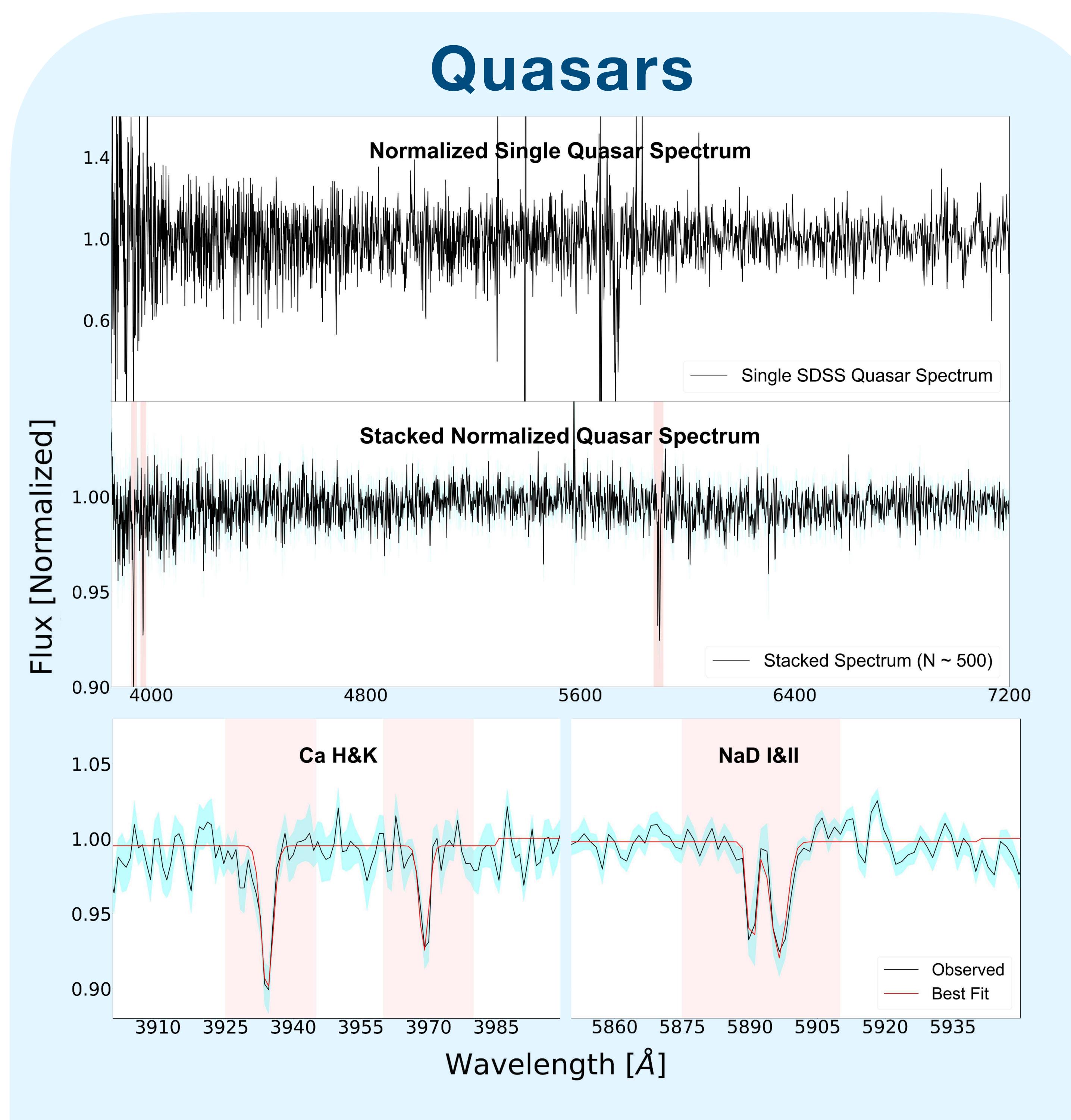


Figure 1. A schematic diagram of the methods

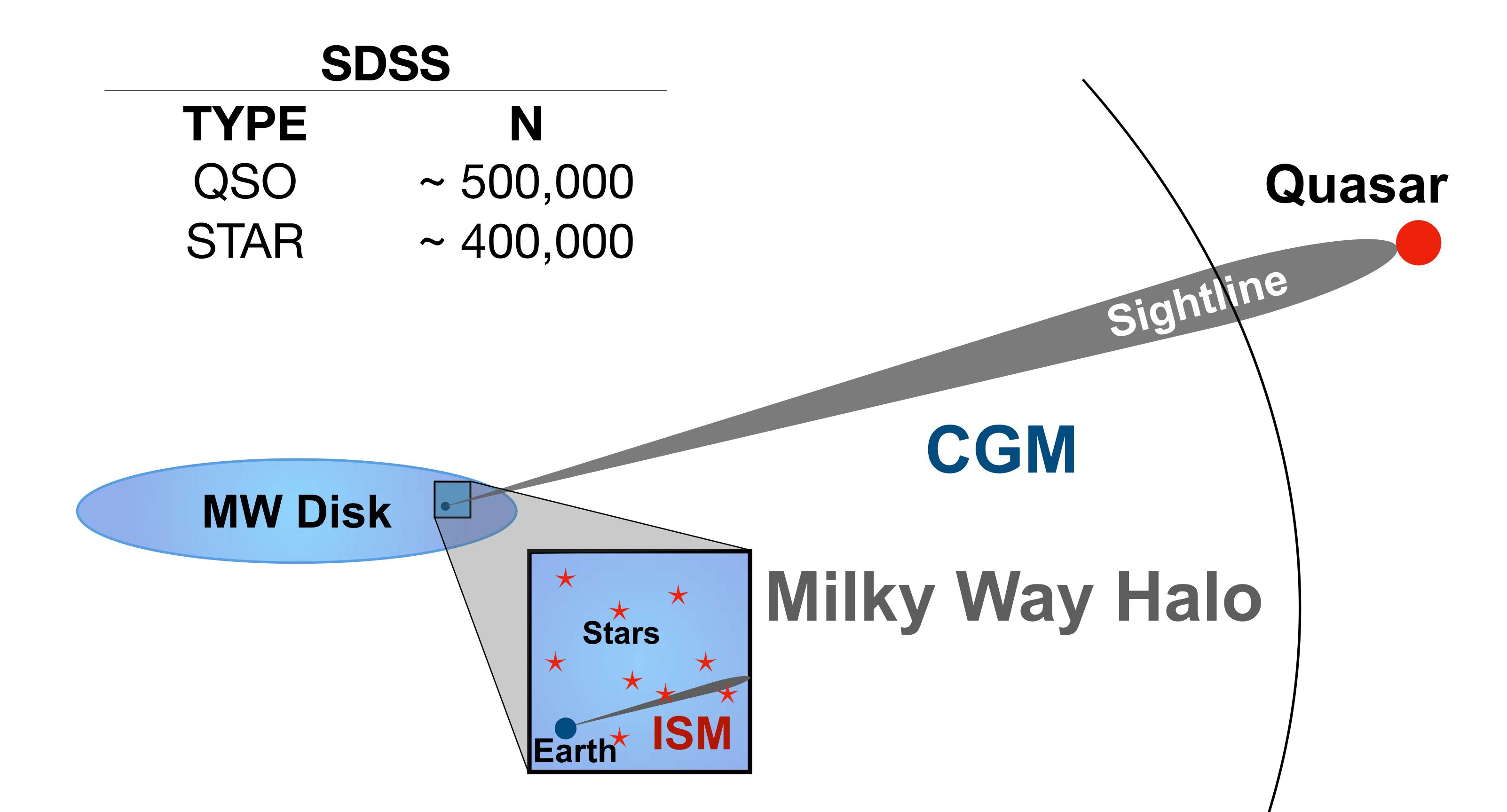


Figure 2: Extracting absorption features from quasar spectra.

- The signal-to-noise of a single SDSS quasar spectrum is insufficient for detecting the absorption line features.
- Stacking spectra enhances S/N. Uncertainties calculated with bootstrap.
- Measuring rest equivalent width of Ca H&K and NaD I & II lines across the sky.

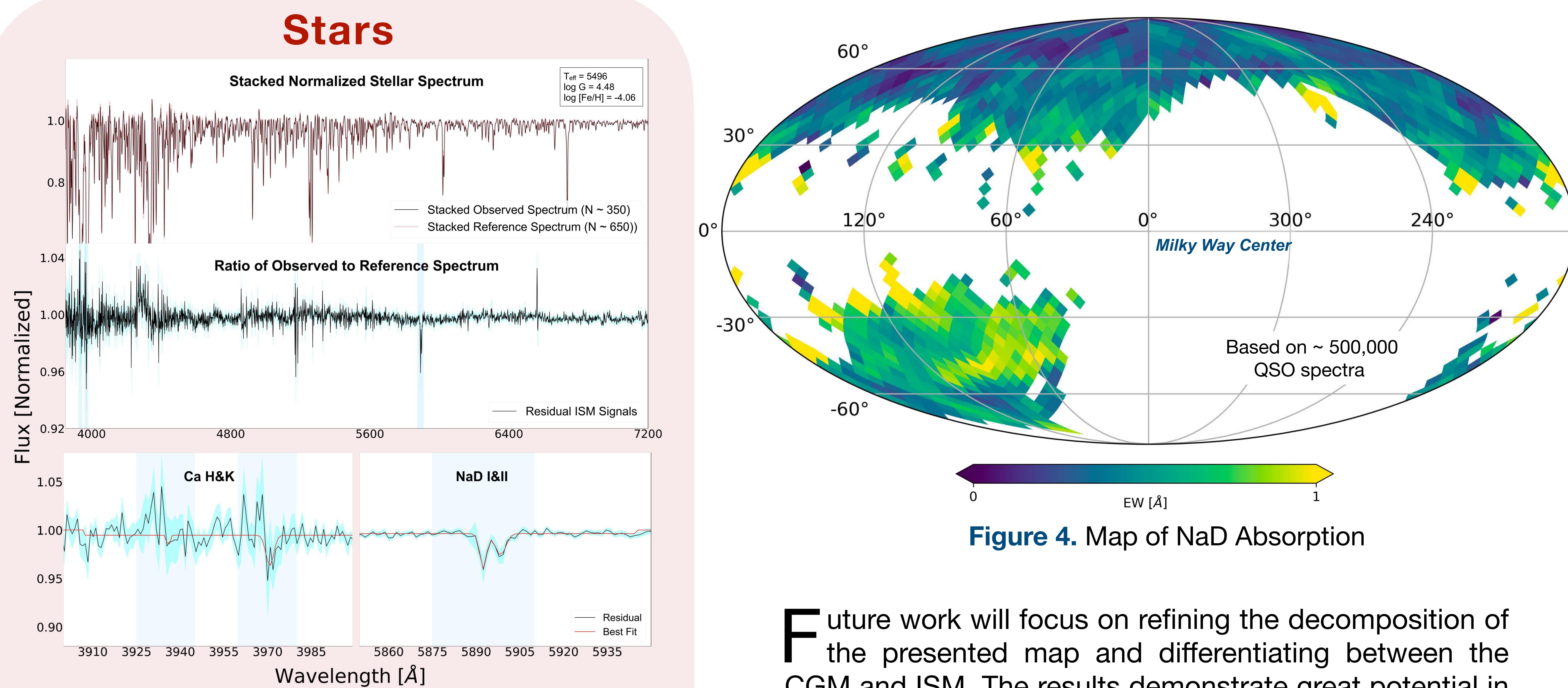


Figure 3: Extracting absorption features from stellar spectra.

- The challenge is to extract the ISM absorption features from intrinsic stellar lines.
- We approach by stacking stellar spectra observed at large distance (> 3 kpc), and compare them with the reference at a similar parameter space but in low HI regions (log N[HI]) < 20.3).
- The ratio between the stacked spectra reveals the ISM signals.

CGM and ISM. The results demonstrate great potential in unraveling the galactic-scale baryon cycle and its connection with the evolutionary history of our Milky Way.

References:

1. Lan, T.-W., Ménard, B., & Zhu, G. 2015, MNRAS, 452, 3626 2. Murga, M., Zhu, G., Ménard, B., & Lan, T.-W. 2015, MNRAS, 452, 511 BAC and TWL acknowledge the support from grants NSTC 111-2112-M-002-015-MY3, MOE Yushan Young Scholar NTU-110VV007, and NTU-CC-111L894806.