

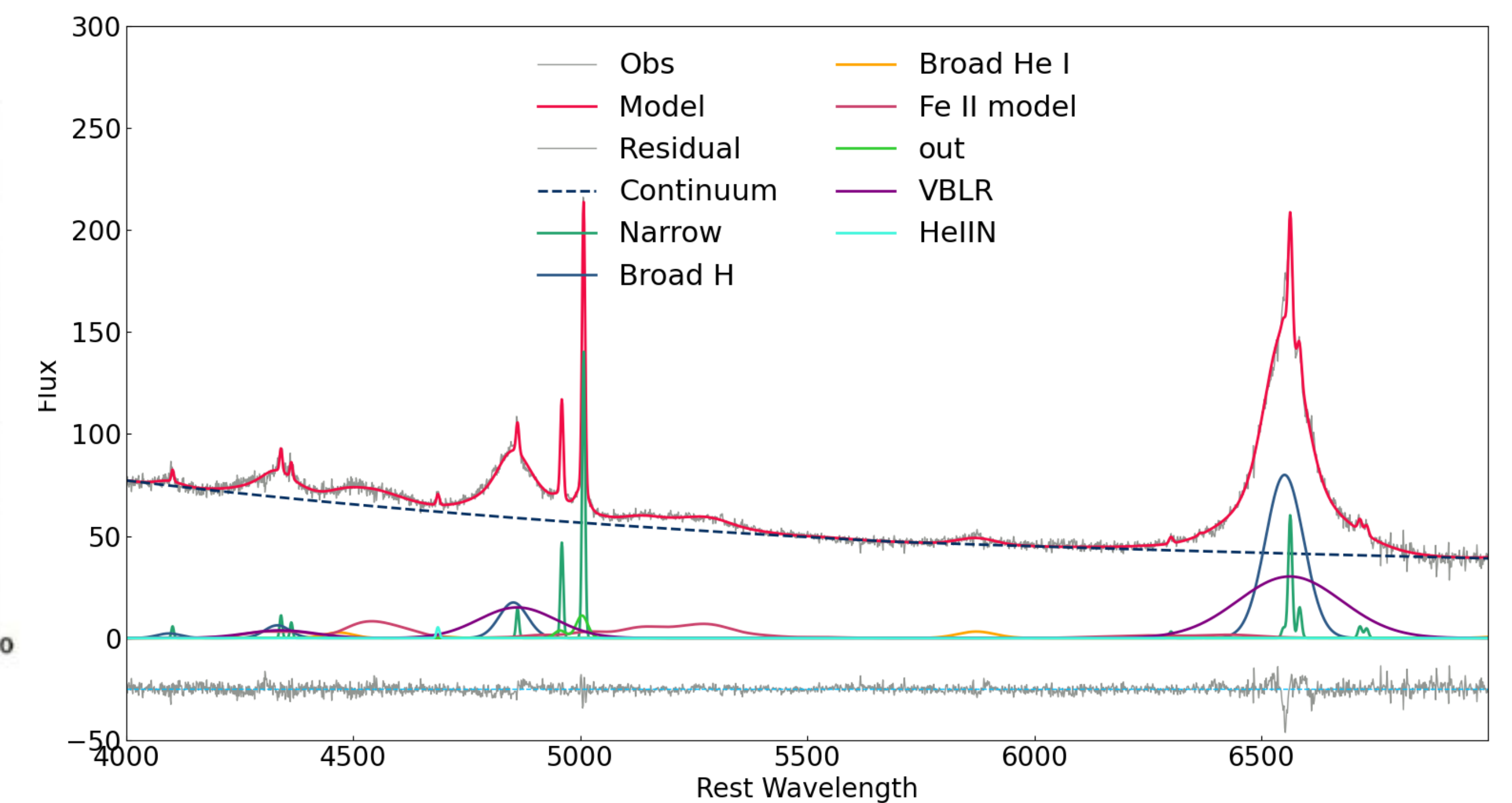
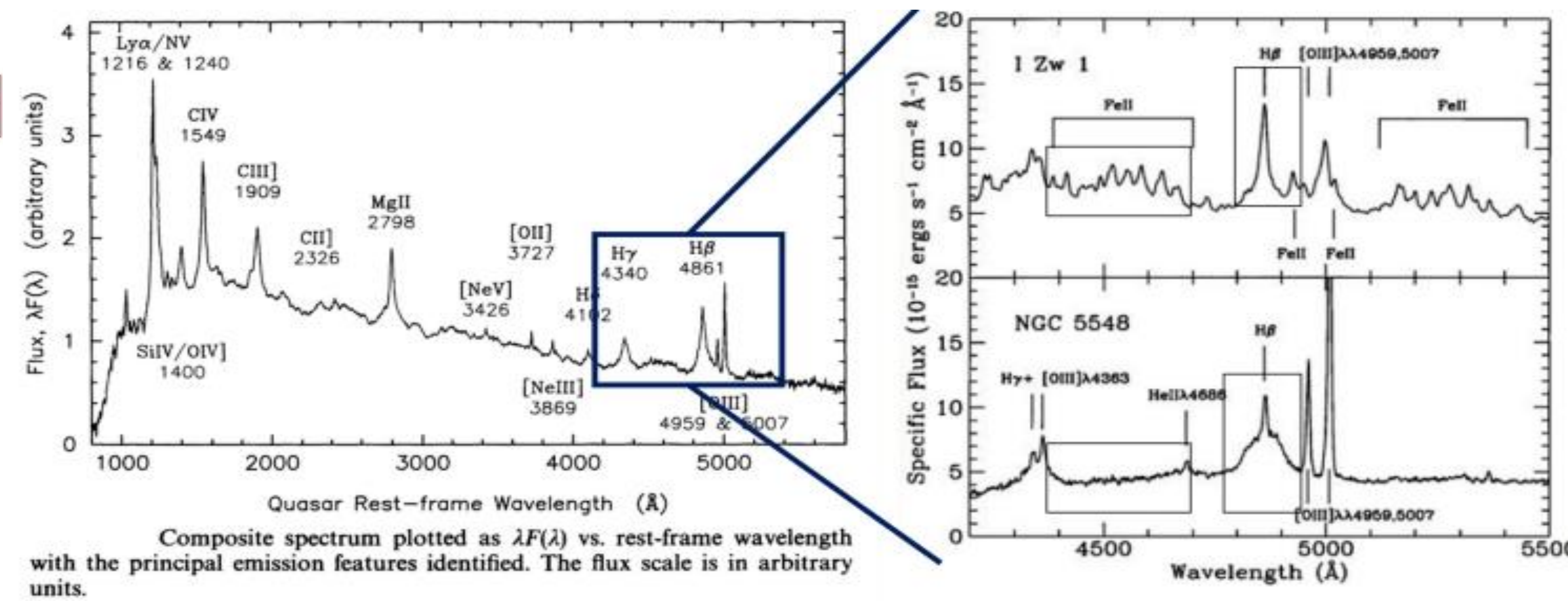
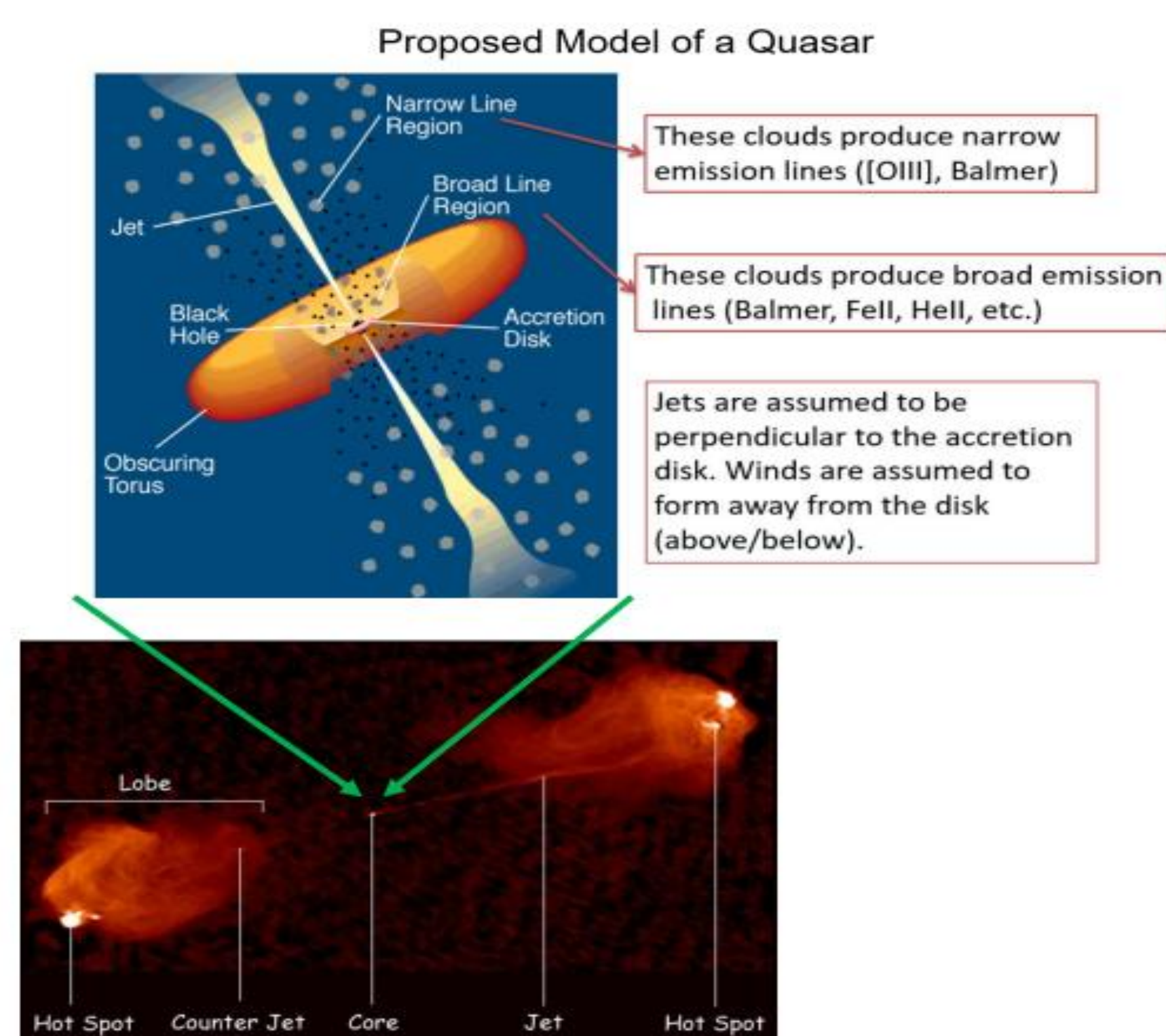


Using FANTASY (Fully Automated python Tool for AGN Spectra analysis) to Explore the Diversity of Quasar Phenomenology

Abstract: Quasars give us a glimpse into how the physics work in the center of active galactic nuclei (AGN) and its surrounding environment. This research utilizes FANTASY, an open-source Python tool for multi-component AGN spectral fitting in the optical rest-frame (3600-8000 Å). We analyze low-redshift ($z < 0.85$) quasars using high signal-to-noise SDSS spectra, focusing on (1) internal broad emission line shifts (e.g., FeII, Balmer lines), (2) giant radio quasars (GRQs) with jets >0.7 Mpc, and (3) quasars with extreme colors (very red or very blue color indices in optical or infrared filters). This poster presents progress on spectral modeling and initial findings, with ongoing work aimed at refining emission-line diagnostics and quasar classification.

Sample Selection:

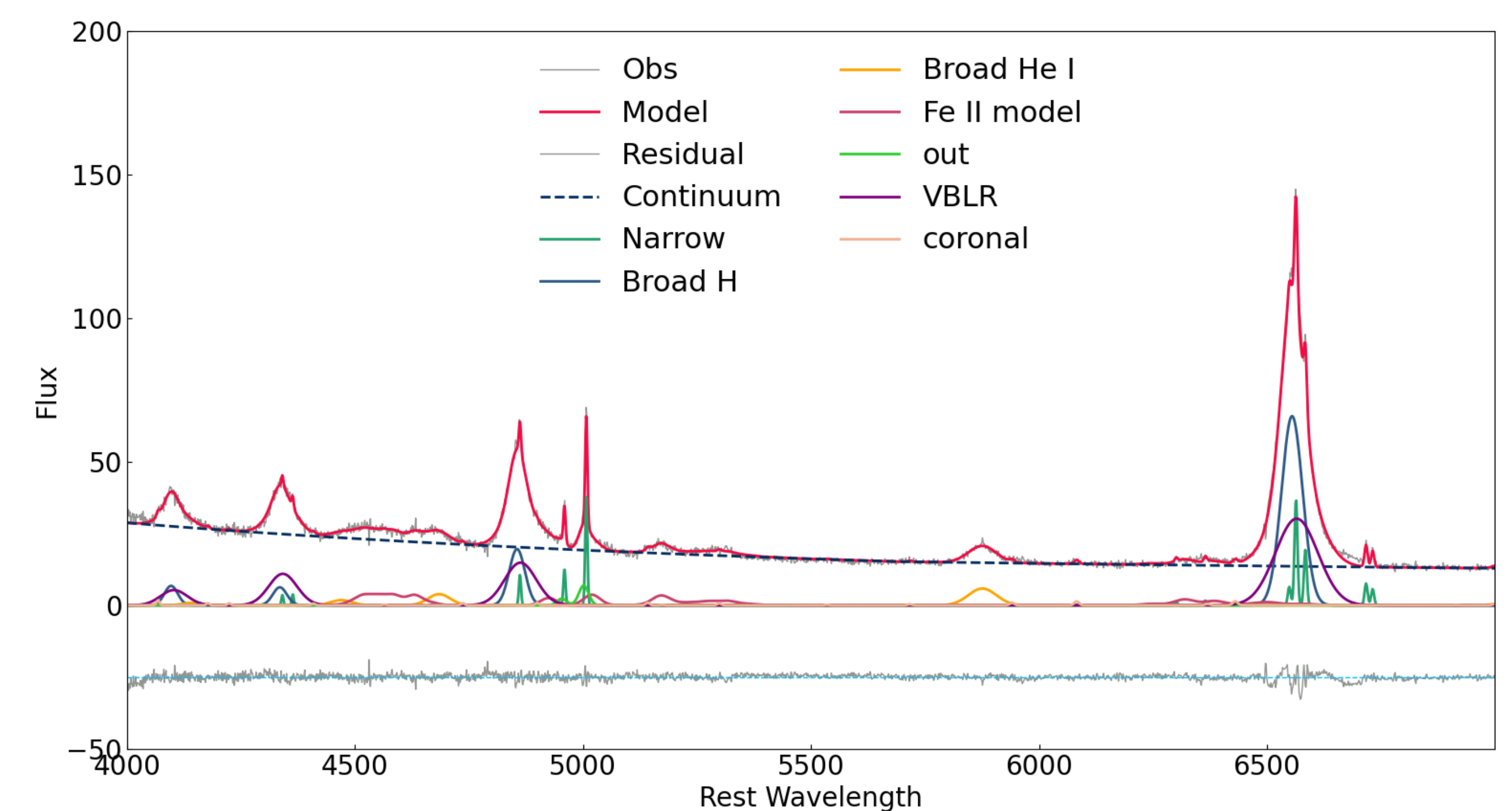
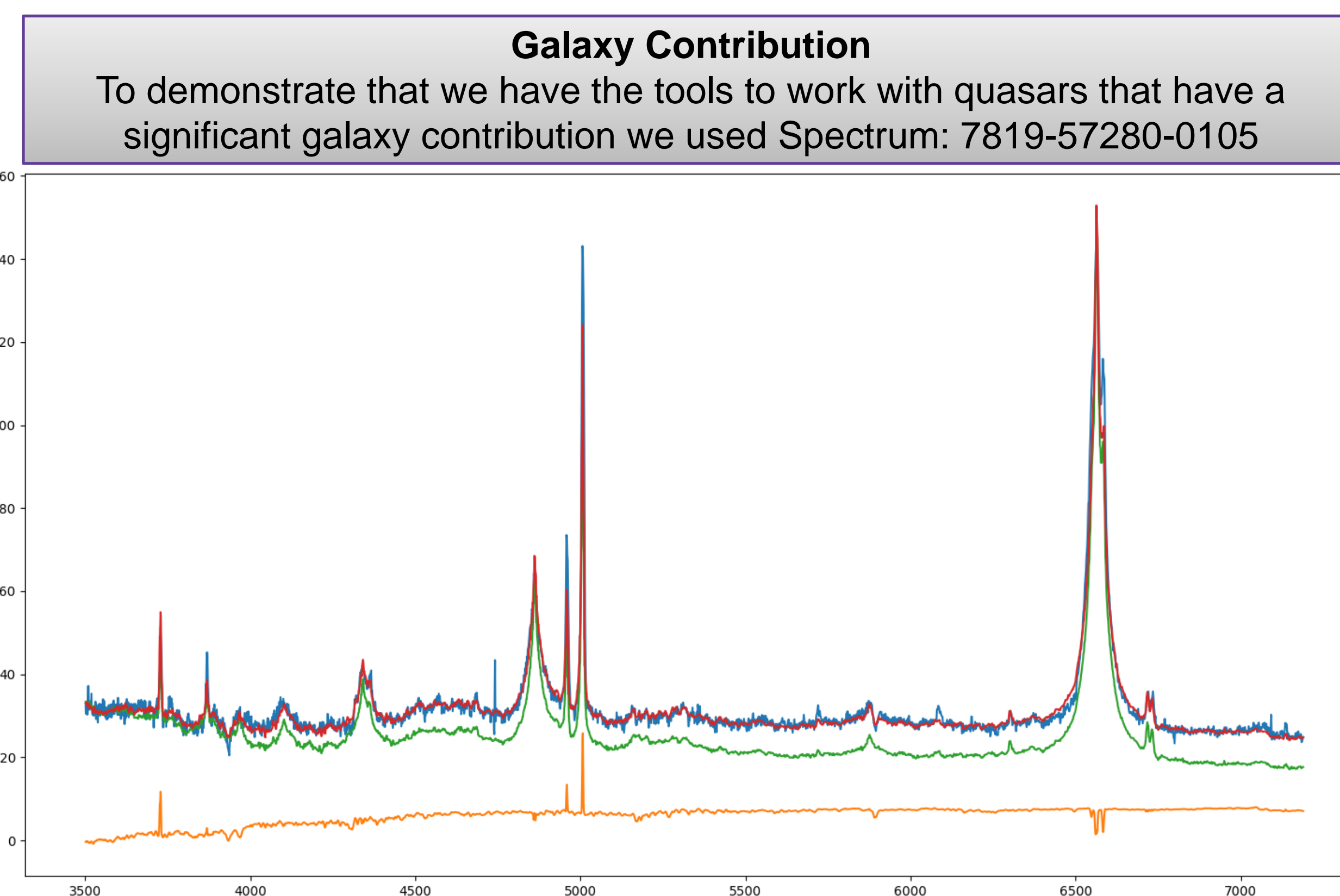
In 2008, Hu et al. studied a sample of 4000+ quasars with redshift $z < 0.8$ and reported that the broad FeII lines show a systematic redshift relative to the rest-frame of the quasars. They interpreted this as evidence of matter falling towards the central supermassive black hole. From their original sample of spectra, we extracted the ten objects with the largest FeII measured redshift (larger than 2,000 km/s) and the ten objects with the largest measured blueshift (larger than - 800 km/s). We are currently using the FANTASY Python code to fit these extreme quasars one-by-one and see if the fitting parameters pertaining to the FeII model are consistent with the findings of Hu et al. Preliminary results indicate that their claims are not systematically replicable or valid.



Spectrum: 0485-51909-0506 – Blue
Fantasy detected an FeII offset of about -758km/s

The quasars shown in figures are identified by Plate-MJD-Fiber. The orange in the lower panel shows the galaxy model and the green line shows the “cleaned-up” quasar spectrum, all modeled by FANTASY.

One future project will focus on the study of spectra associated with Giant Radio Quasars (GRQ, Kuźmicz & Jamrozy, 2021), whose projected sizes in radio maps exceed 0.7Mpc, i.e. over twenty times larger than the disk of our Milky Way galaxy. We want to explore whether their optical spectra are systematically different from those of quasars that are not either undetected in similar radio surveys or show weak core-like radio morphology. We want to investigate if the optical spectra can help us reveal some special properties of the AGN that is conducive to the extremely large-scale outflows of relativistic plasma.



Spectrum: 8186-57452-0308 – Red
Fantasy detected an FeII offset of about 69km/s

Another future project will be to work with spectra of quasars that show extreme color indices in optical (SDSS u, g, r, i, z filters) or infrared filters.

References:

- Software: TOPCAT (Taylor 2005) --- <https://www.star.bris.ac.uk/~mbt/topcat/>
- Software: FANTASY (Fully Automated python Tool for AGN Spectra analysis) --- <https://fantasy-agn.readthedocs.io/en/latest/index.html>
- Urry, M. & Padovani, P. - 1995, Publications of the Astronomical Society of the Pacific, Volume 107, Pg. 803
- Hu et al., 2008 - The Astrophysical Journal, Volume 687, Pg. 78
- Kuźmicz & Jamrozy, 2021 - The Astrophysical Journal Supplement Series, Volume 253, Pg. 25
- Ilić, D. et al. – 2020, Astronomy & Astrophysics, Volume 638, Pg. 7
- Rakić, N. – 2022, Monthly Notices of the Royal Astronomical Society, Volume 516, Pg. 624
- Ilić, D., Rakić, N. & Popović, L. Č. - 2023, The Astrophysical Journal Supplement Series, Volume 267, Pg. 20
- Francis, P. J. et al. –1991, The Astrophysical Journal, Volume 373, Pg. 465