Powerful Quasar-Driven Outflows in the Local Universe From the Cosmic Origins Spectrograph Hubble Space Telescope Far-Ultraviolet Spectroscopic Archive

Foo, Orion (School: Poolesville High School)

There is much that is still unknown about the properties and effects of active galactic nuclei (AGN)-driven winds. They are an important process in galaxy evolution, but several questions remain. The primary goal of the research described in this paper is to systematically characterize strong AGN-driven winds traced by blue-shifted phosphorus V (P V) absorptions in the local universe and contribute our analyses and derivations in this study to what little we currently understand about AGN outflows. Several properties of P V, such as its need for high column density and the existence of the P V doublet, make it an optimal choice for revealing information about AGN outflows. We find the following: (1) The P V doublet detection rate for data in the Hubble Spectroscopic Legacy Archive (HSLA) is around 0.5% (3/565); this is much smaller than the rate of 3-6% detection rate among the more distant ($z > 2.6$) quasars studied using ground-based telescopes. (2) The kinematics were measured for each of the 3 quasars with an average outflow velocity of magnitude 1720 km/s. (3) The energetics of three quasars (NGC 5548, PG1126−041, B1411+4411) with the presence of P V reveal that radiation pressure alone is enough to drive the observed AGN-driven outflows of all three objects. (4) The comparison of the kinetic energy outflow rate with the bolometric luminosity of each target reveals that on average, 0.16% of the total radiative energy from the quasar is needed to drive the observed outflow.

Awards Won:

Third Award of $1,000