

S05a

IR Spectroscopy of the Gravitationally Lensed Quasar B1422+231

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We observed the rest frame UV/optical (2000 – 5300 Å) spectrum of the gravitationally lensed flat-spectrum radio-loud quasar B1422+231 system at $z = 3.62$ in near-infrared bands (I , J , H , and K) using the 4-meter telescope of Kitt Peak National Observatory (KPNO).

The spectrum shows emission lines of Mg II $\lambda 2798$, H γ , H β , and [O III] $\lambda 5007$ as well as broad features of optical and UV Fe II emission lines. Note that this is the first detection of [O III] $\lambda 5007$ in a quasar beyond $z = 3$. The spectrum is similar to the LBQS (Large Bright Quasar Survey) composite spectrum, which indicates no significant UV/optical spectral evolution in some quasars at $0 < z < 3.6$. The Fe II (UV+optical)/Mg II $\lambda 2798$ flux ratio is 12.2 ± 3.9 , which is comparable to 8.9 for the LBQS composite spectrum of quasars at $z = 1 - 2$ (Francis et al. 1991), and 9.0 ± 3.5 for the quasars at $z = 0.15 - 0.63$ analyzed by Wills, Netzer, & Wills (1985).

The similarity in the Fe II/Mg II $\lambda 2798$ flux ratio between B1422+231 and low-redshift quasars suggests that the majority of stars in the host galaxy of B1422+231 had formed and the host galaxy had already been in the late evolutionary phase of the iron enrichment at $z = 3.6$. If the iron enrichment started at 1.5 Gyr (the lifetime of SN Ia progenitors) after the onset of the first star formation, the host galaxy of B1422+231 would have formed at $z \sim 9$ or earlier for $q_0 = 0$ and $H_0 = 75 \text{ km s}^{-1} \text{ Mpc}^{-1}$.