

A Scaling Relation of “Little Red Dots” between H α and Bolometric Luminosities: Enhanced H α Emission Relative to Low-z Type 1 AGNs

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We investigate the spectroscopic demography of “little red dots” (LRDs) using 37 objects at $z \sim 3-7$ compiled from various JWST programs. We identify a tight scaling relation between H α luminosity ($L_{\text{H}\alpha}$) and bolometric luminosity (L_{bol}), which is enhanced by a factor of ~ 40 in $L_{\text{H}\alpha}$ relative to that of low- z type 1 AGN. We explore the physical origin of this enhancement based on the classic locally optimally-emitting cloud (LOC) framework, and find that it can be explained by an increase in the broad line region (BLR) covering factor from $\sim 20\%$ (Type 1 AGN) to $\sim 100\%$ (LRDs), together with an increase in the hydrogen column density from $N_{\text{H}} \sim 10^{23} \text{ cm}^{-2}$ to $> 10^{24} \text{ cm}^{-2}$.

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