Title: Do high redshift super massive blackhole($z > 7$) quasars grow disproportionately faster than their host galaxies in reference to lower redshift super massive black hole quasars?: An Analysis of ULAS J1120+6041 and its host galaxy.

Principle Investigator: Dr. James Harper, Massachusetts Institute of Technology

Proposal Category: General Observer (Cycle 6)

Scientific Justification: We propose to obtain IFU data from JWST's NIRSpec of the quasar ULAS J1120+0641 as well as that of its host galaxy. The aforementioned quasar has a redshift of $z = 7.085 \pm 0.003$, indicating that it formed quite early after the big bang(0.77 billion years). Our objective is to compare the total percentage of mass the super massive black hole takes up out of the mass of the whole galaxy with that a much younger, lower redshift black hole (Sagittarius A*, and its host galaxy the milky way). We can calculate these masses using the JAM model and the GALFIT model respectively. This comparison will tell us whether or not earlier super massive black holes formed proportionally quicker than their host galaxy in reference to younger super massive black holes, indicating a method of formation other than star-seed.

Observing Strategy: We request 15 hours of JWST/NIRSpec time to observe the quasar and collect IFU data using the G395M grating($2.9–5.2\ \mu m$, $R \approx 1000$) which will provide optimal resolution and spectral coverage to isolate both the host galaxy stellar emission and the black hole emission itself. The IFU mode is the only mode that will always ensure removal of the quasar AGN, allowing us to observe the host galaxy stellar emission. Exposure times are chosen to ensure a signal-to-noise ratio > 10 to ensure accurate and consistent measurements.

Data Management Plan: Both the raw and calibrated data will be made publicly available at the Mikulski Archive for Space Telescopes (MAST) in accordance with the standard 12-month proprietary period. All scripts and models will be made publicly available and documented in a

Github repository licensed under GNU GPLv3. An academic article will also be published on the matter under the Astronomy & Astrophysics journal.

Team Expertise: The PI has conducted previous stellar research regarding super massive blackholes. They have also developed their own model for predicting the radio waves emitted towards the Earth from Jupiter due to magnetic interference from IO. The team is very capable of analysing and publishing the data.

Time Requested: 15.0 Hours

Target Visibility Window: September-October 2027

Works Cited

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