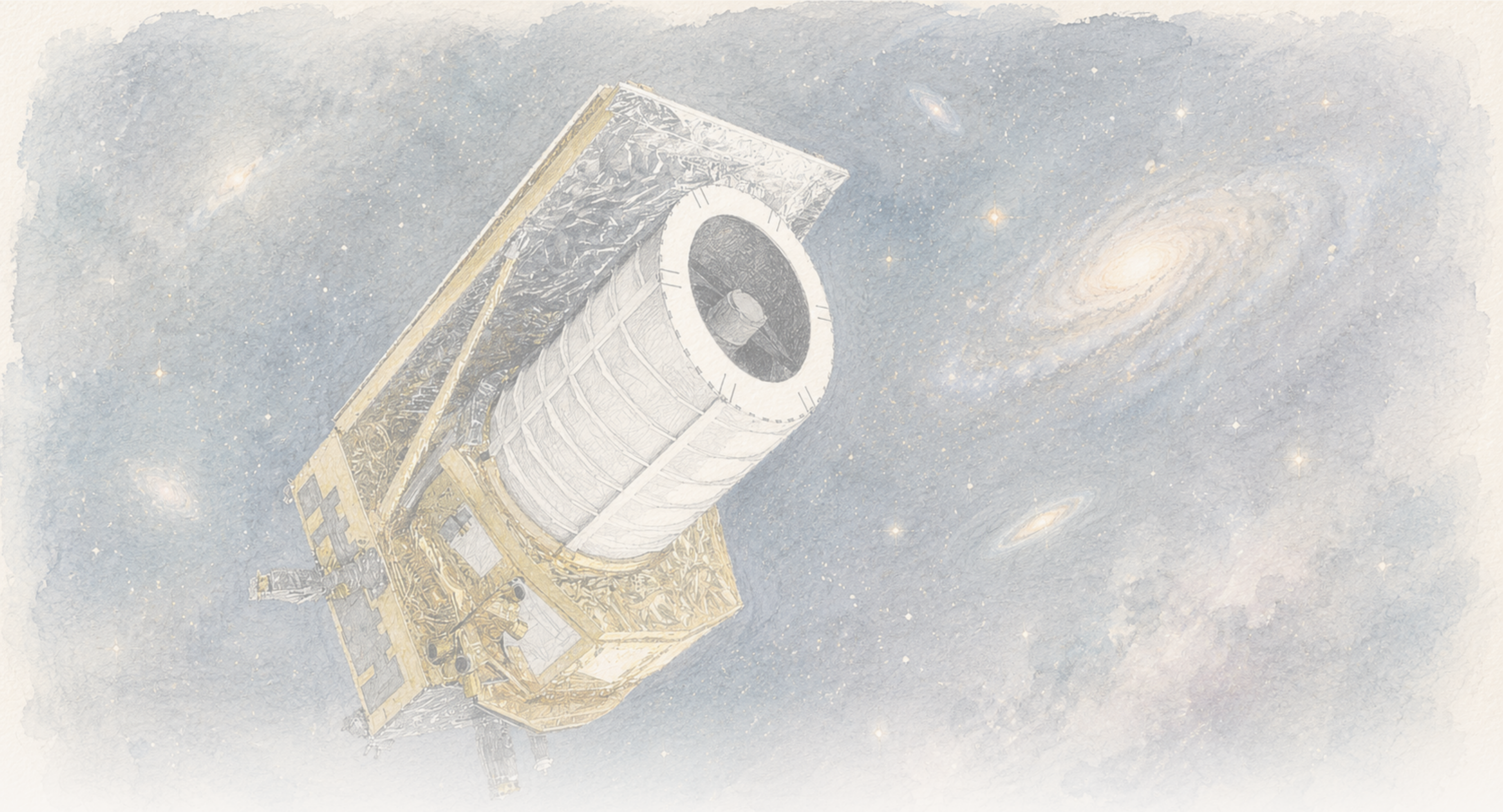

The CLEAN PAPER

WHAT THE PAPER SAYS · WHAT IT DOESN'T · WHY IT MATTERS

Euclid more than doubles small sample of quasars beyond redshift 7

Nínú first year and a half Euclid Wide Survey, search over roughly 3000 square degrees found 31 new quasars between redshift 6.6 and 7.8. Twelve lie at redshift 7 or higher, more than doubling handful known there before Euclid, one at 7.77 is now most distant quasar on record. Real advance kì í ṣe single record yẹn, which only nudges frontier; ó jẹ́ survey power to find rare, mostly faint objects in bulk, making them useful probes of young Universe. Èyí jẹ́ initial result, full statistical analysis àti much spectroscopic confirmation still to come.

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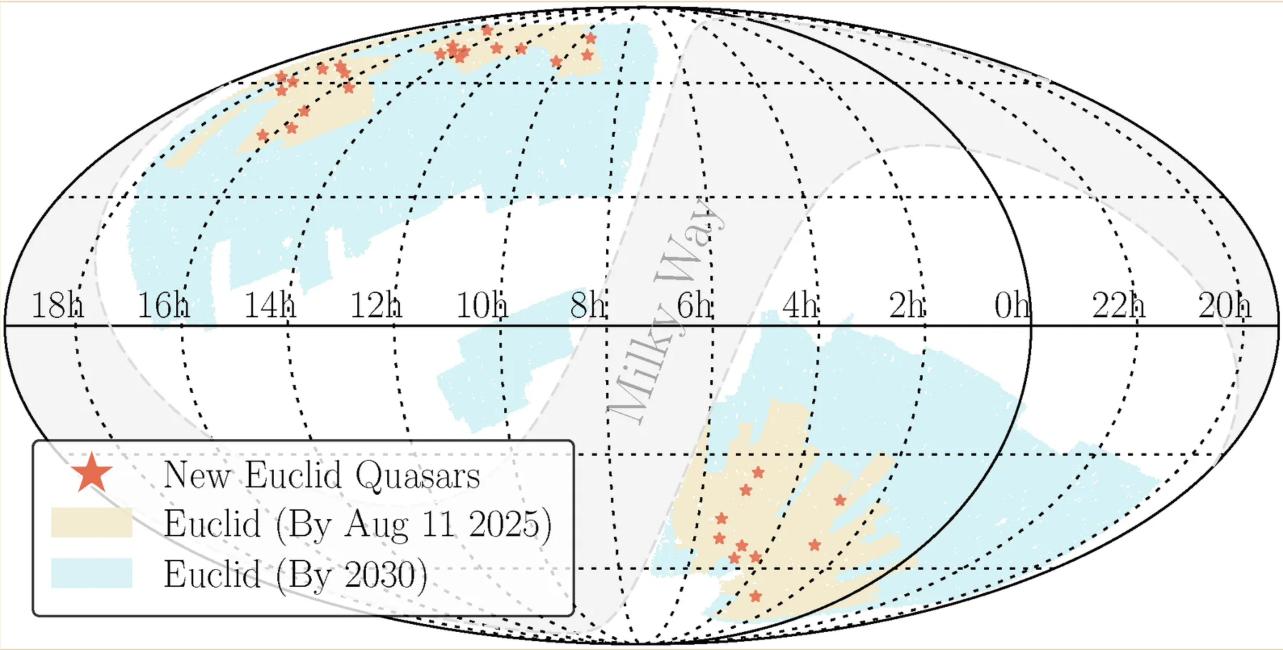
Paper: *Euclid: Discovery of 31 new quasars at 6.6 < z < 7.8*, D. Yang, J. F. Hennawi, F. Guarneri et al. (Euclid Collaboration), Astronomy & Astrophysics · DOI: 10.1051/0004-6361/202658883

Survey tí a kọ fún rare things ṣẹ̀ṣẹ̀ rí batch kan nínú wọn

Quasar ni supermassive black hole tí a mu nígbà tó ń feed, tó ń blaze tó bẹ́ẹ̀ bí ó ṣe ń swallow gas tí ó lè brighter ju entire host ìṣùpọ̀ ìràwọ̀ rẹ̀. Nítorí wọ́n jẹ́ ọ̀kan lára most luminous steady orísun nínú Universe, quasars ṣiṣẹ́ gẹ́gẹ́ bí beacons: rí ọkan tó jìn tó, light rẹ̀ di lamp tí a gbe sí ẹ̀yìn billions of years ti intervening space.

Most distant quasars — àwọn tí light wọn start journey nígbà tí Universe kò tíì pé billion year — ni rarest. Ṣáájú Euclid space telescope pàtàkì survey, nípa nine nìkan ni confirmed beyond redshift 7, tally tí a kọ slowly láti first discovery irú yìí ní 2011.

Nínú tuntun ìwé ìwádìí nínú *Astronomy & Astrophysics*, Euclid Collaboration report 31 tuntun quasars láàárín redshift 6.6 àti 7.8, rí nínú first year àti a half survey. Twelve wà ní redshift 7 tàbí ga sí i. Run kan yìí sí i than doubled known population ní redshifts wọ̀nyí. Èyí jẹ́ survey-power ìtàn, ó sì yẹ ká precise nípa ohun tí ó mean àti ohun tí kò mean.



Euclid Wide Survey area tí a cover títí di báyìí (beige) against full footprint planned by 2030 (cyan), pẹ̀lú 31 newly discovered high-redshift quasars marked in red. Wọ́n wá láti first slice nìkan ti survey designed láti eventually map nípa 14,000 square degrees — survey-power ìtàn nínú picture kan.

D. Yang et al. / Euclid Collaboration / Astronomy & Astrophysics CC BY 4.0

Ṣáájú Euclid, nípa nine quasars ni a mọ̀ beyond redshift 7 (2011–2024). Early run yìí fi 12 mìì kún un — “doubling” made concrete, lórí àpẹẹrẹ tó ṣì kéré.

Kí ló dé tí quasars tó jìn báyìí fi yẹ wahala?

Redshift measure bí expansion Universe ṣe stretch light orísun sí longer wavelength ní journey sí wa; higher redshift mean older light àti earlier Universe. Ní redshift 7, a ń wo back sí less than a billion years lẹ́yìn Big Bang, sí tail end ti epoch of reionization, nígbà tí first luminous objects ń burn off fog of neutral hydrogen tí kún early space.

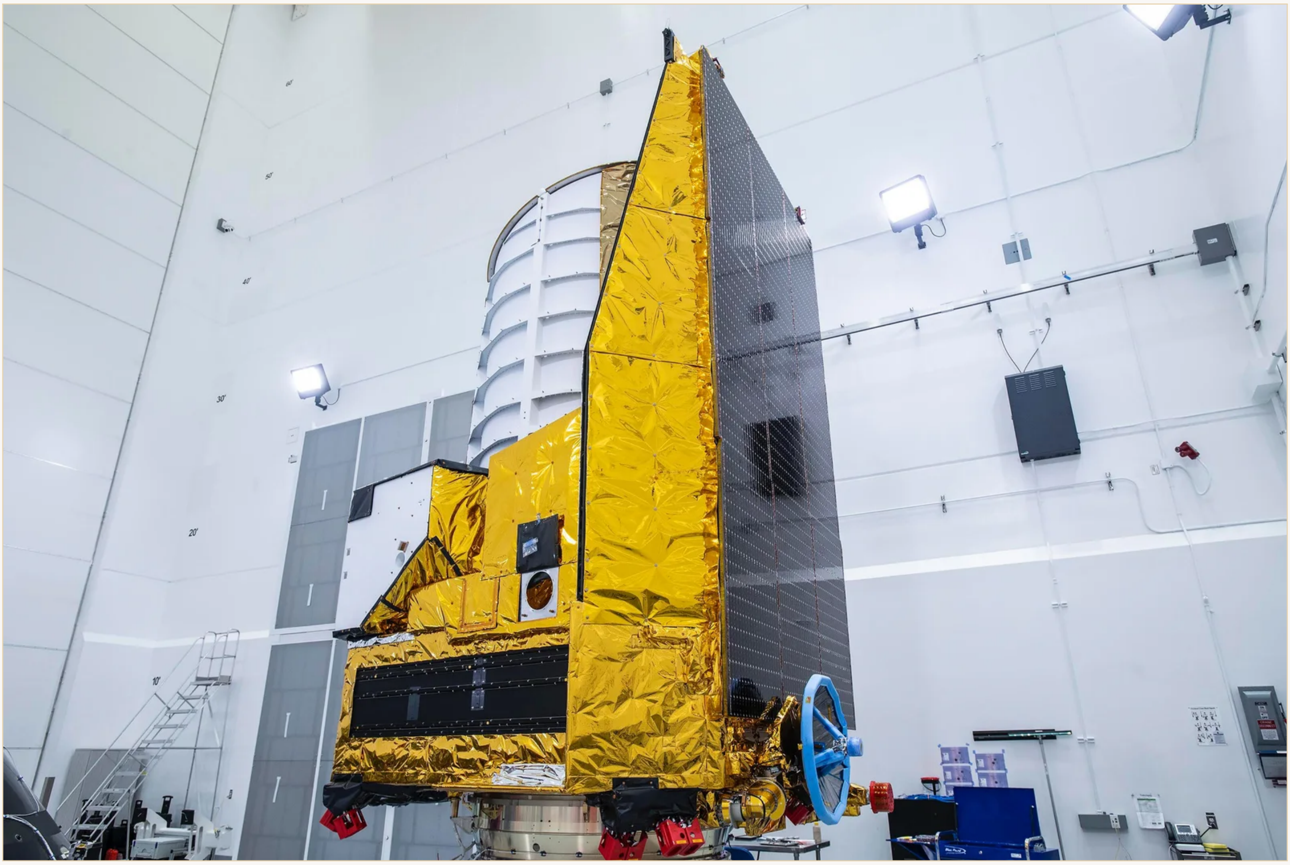
> **Kí ni redshift, kí ló sì dé tí ó fi jẹ́ distance àti clock ní akoko kan náà?**
>
> Tí vocabulary tuntun: *redshift* ni iye tí light orísun ti stretch sí longer, redder wavelengths nígbà tí ó dé ọdọ wa. Nǹkan méjì mú number kan yìí useful. Àkọ́kọ́, light travel ní fixed speed, nítorí náà nǹkan tó jìn ni a tún rí gẹ́gẹ́ bí ó ti wà ní igba pípẹ́ sẹ́yìn — looking deep sínú space ni looking back in àkókò. Ẹlẹ́ẹ̀keji, nítorí Universe ń expand jálẹ̀ journey light, journey tó gùn sí i mean sí i stretching. Nítorí náà larger redshift mean light tí set out earlier, láti farther away, nígbà cosmos younger. Redshift 7 níbí jẹ́ light láti lábẹ́ a billion years lẹ́yìn Big Bang — well lábẹ́ a tenth of present age Universe.

Quasars era yìí useful fún reasons méjì. Àkọ́kọ́, each ọkan already hosts black hole pẹ̀lú hundreds of millions sí billions solar masses. Growing something that heavy that early hard: lábẹ́ usual ààlà on accretion speed, nìkan fairly massive “seeds” ní enough àkókò láti reach masses wọ̀nyí nínú few hundred million years available. Nítorí náà mere existence àti census objects wọ̀nyí constrain bí first supermassive black holes form àti grow. Ẹlẹ́ẹ̀keji, quasar light passing nípasẹ̀ surrounding intergalactic medium carries imprint ti how neutral gas náà was, making each quasar a probe of reionization.

Catch ni pé wọ́n extraordinarily rare àti hard to rí. Ní redshift wọ̀nyí, strongest àbùdá quasar, Lyman-alpha break, stretch out of optical sínú near-infrared, nítorí náà o need deep near-infrared imaging over large area — roughly ọ̀kan quasar per hundred square degrees down to relevant brightness. Deep + wide nínú near-infrared láti ground ni exact combination tó prohibitively difficult. Gap yìí ni Euclid built to close.

Ohun tí Euclid ṣe gidi

Euclid jẹ́ 1.2-metre space telescope tó ń run six-year survey designed láti map nípa 14,000 square degrees sky nínú optical àti near-infrared light. Being above atmosphere jẹ́ kí ó reach depths over wide field tí ground-based near-infrared surveys kò match. ìwé ìwádìí yìí lò dátà láti first roughly year àti a half — nípa 3000 square degrees observed láàárín February 2024 àti August 2025.

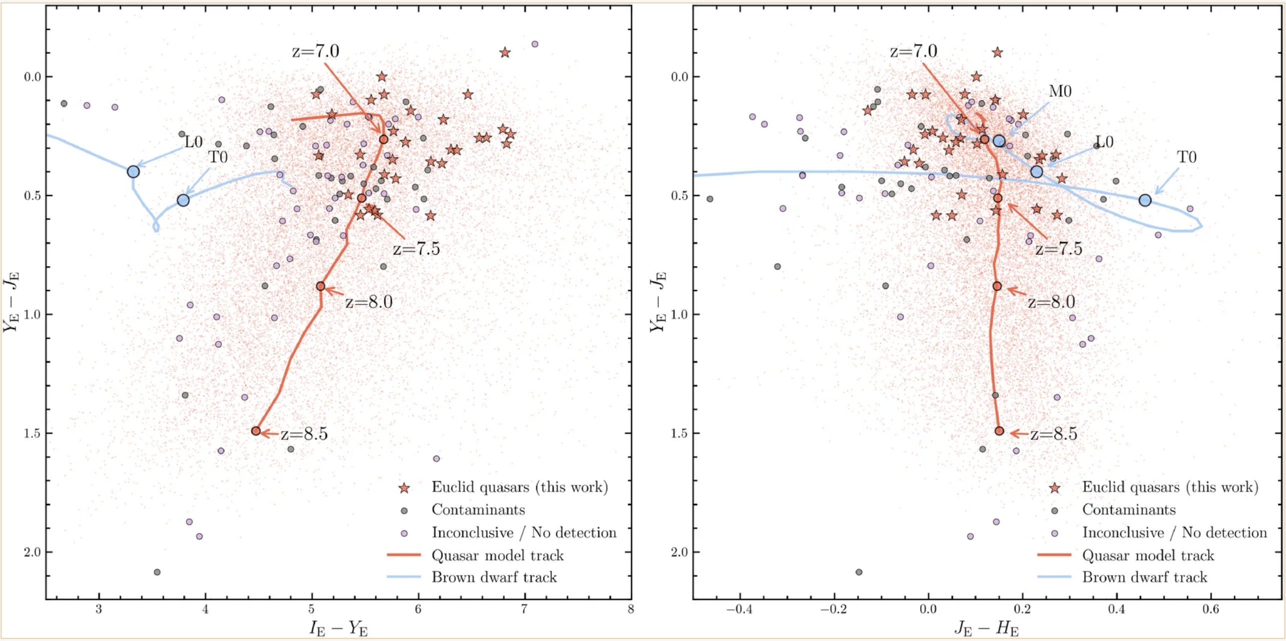


Euclid spacecraft nínú cleanroom ṣáájú launch. 1.2-metre telescope wo sky nípasẹ̀ top of white cylinder; láti above atmosphere, wide-field near-infrared camera rẹ̀ reaches depths over large area tí ground-based searches kò match.

ESA / NASA Science fair-use

Finding 31 needles nínú haystack kì í ṣe matter of looking. ẹgbẹ́ build custom photometry, run several machine-learning àti probabilistic classifiers — extreme-deconvolution density àwòṣe, gradient-boosted classifier, templatebased fits — láti ìṣírò àfojúsùn fún faint point-like orísun kọọkan probability pé ó jẹ́ high-redshift quasar dípò far sí i numerous contaminants, especially cool brown dwarfs tí colours mimic distant quasar. Candidates cross-checked láàárín ọ̀nà, inspected by eye, prioritized fún follow-up. Euclid images select candidates; confirmations come láti spectra on large ground-based telescopes — including Magellan àti Large Binocular Telescope — tó split light finely enough láti see tell-tale break àti emission lines.

Confirmation step yìí jẹ́ honest iṣẹ́ in progress. Spectroscopic follow-up ongoing, ìwé ìwádìí fúnra rẹ̀ sọ pé full completeness kò tíì dé, especially southern sky. Fún candidates followed up tí kò become ọ̀kan of 31 confirmed quasars, ìwé ìwádìí account plainly: many contaminants (large share likely brown dwarfs), some inconclusive, some no detectable àmì. Batch confirmed quasars ni àkọlé; full bookkeeping of what selection catches/misses deferred to later ìwé ìwádìí.

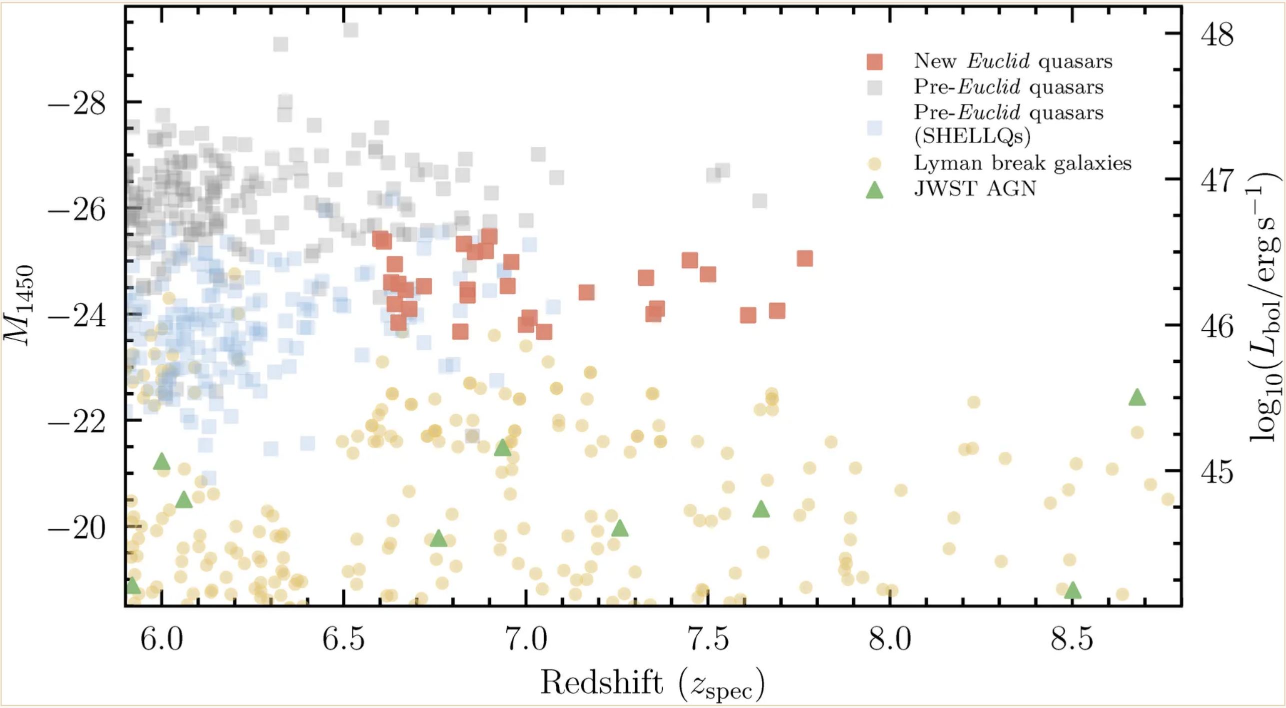


Colour-colour diagram: bí Euclid ṣe distinguish distant quasar láti nearby brown dwarf. Axis kọọkan fi hàn difference láàárín brightness in méjì Euclid filters, capturing colour rather than brightness. Red curve traces predicted high-redshift quasar track (labels redshift 7.0–8.5); light-blue curve traces cool brown dwarfs — pàtàkì impostors — labeled M0 to T0. 31 tuntun quasars (red ìràwọ̀) line up along quasar track; confirmed contaminants (grey) àti inconclusive/undetected candidates (violet) fall away. Níbi tracks méjèèjì sún mọ́ra, colour alone kò decide — every quasar still need spectroscopic confirmation.

Record náà, ní proportion tó yẹ

Ọ̀kan nínú 31, EUCL J1729+6410, wà ní redshift nípa 7.77, ó sì jẹ́ most distant quasar known. Real àkọsílẹ̀ ni, ṣùgbọ́n ó yẹ ká ipò ìwọ̀n step. Over méjì decades dedicated searching, frontier pushed sí around redshift 7.5, previous record-holder nípa 7.64. Moving to 7.77 genuine advance, ṣùgbọ́n incremental — ìwé ìwádìí puts increment nípa 0.13 redshift, roughly fifteen million years cosmic àkókò. Nudge, kì í ṣe leap.

More consequential number ni other ọ̀kan: doubling àpẹẹrẹ above redshift 7 nínú single early run. Record-holder jẹ́ object kan, dátà kókó kan. Doubled growing population ni ohun tó jẹ́ kí statistics ṣeé ṣe — measure how common black holes were, how bright, how clustered — statistics ni ibi science of early Universe lives. Most tuntun quasars tún comparatively faint, ọ̀kan to méjì magnitudes fainter than luminous quasars rí ṣáájú Euclid. Faint end harder to reach, sí i valuable fún reionization ìwádìí: fainter quasars carve smaller ionised bubbles around themselves, so light wọn àpẹẹrẹ sí i still-neutral gas.



Ibi tuntun quasars fall: brightness against cosmic ìjìnnà. Horizontal axis redshift — farther right mean earlier cosmic history. Vertical axis intrinsic ultraviolet brightness, M1450; old magnitude convention runs backwards, so higher up means brighter (right-hand scale restates as bolometric luminosity). Read that way, plot is census. Bright previously known quasars (grey) crowd lower redshifts; deeper survey SHELLQs (light blue) reached fainter objects ṣùgbọ́n not much further back. 31 tuntun Euclid quasars (red) extend luminous population to highest redshifts — rightmost record-holder at 7.77 — while sitting 1–2 magnitudes fainter than classic bright quasars. Below them are Lyman-break ìṣùpọ̀ ìràwọ̀ (yellow) àti very faint accreting black holes JWST rí (green triangles). Euclid contribution is distinct ẹgbẹ́: relatively bright quasars, very early, over wide area.

Ohun tí ṣì uncertain

Caveats mẹ́ta travel pẹ̀lú èsì, ìwé ìwádìí ipò each.

Àkọ́kọ́, initial èsì ni, kì í ṣe final measurement. òǹkọ̀wé explicitly hold back comprehensive statistical ìtúpalẹ̀ of selection function àti quasar population fún forthcoming publications. Luminosity-function constraints níbí first look.

Ẹlẹ́ẹ̀kejì, not every faint “quasar” guaranteed to be ọ̀kan. At faint end, some objects identified as quasars lè instead be compact early ìṣùpọ̀ ìràwọ̀, especially if they lack strongly broadened Lyman-alpha line. ẹgbẹ́ gives preliminary check that objects consistent pẹ̀lú kókó orísun rather than extended ìṣùpọ̀ ìràwọ̀, ṣùgbọ́n calls it preliminary: deep near-infrared spectroscopy, láti JWST àti similar, yóò settle faintest ones.

Ẹlẹ́ẹ̀kẹta, objects themselves faint near ààlà of ground-based spectroscopy. Pinning down black-hole masses, surroundings, place in reionization ìtàn yóò take JWST, ALMA, NOEMA. Euclid very good at àwárí them; it largely hands them to other instruments to ìwádìí.

Kí nìdí tí ó fi ṣe pàtàkì?

Value of iṣẹ́ is demographic. For decade, first billion years Universe offered astronomers bare handful quasars to reason láti. Euclid, in ọ̀kan early slice, added enough to change list sínú àpẹẹrẹ — on track consistent pẹ̀lú pre-launch forecasts to keep going.

That matters nítorí open ìbéèrè are population ìbéèrè. How did black holes get so big so fast? How patchy àti how neutral was intergalactic gas at yàtọ̀ times? Not answered by single spectacular object; answered by counting, comparing, mapping many. Euclid demonstrated capability to build census — including faint end connecting to puzzling population accreting black holes JWST turning up in kan náà era. ìwé ìwádìí does not resolve first black-hole formation, does not by itself measure reionization. It supplies raw ohun èlò, in bulk, those measurements need, àti sets frontier fún follow-up campaigns underway.

Àkótán kedere

Using first roughly 3000 square degrees of Euclid Wide Survey, Euclid Collaboration discovered 31 tuntun quasars láàárín redshift 6.6 àti 7.8, twelve at redshift 7 tàbí higher — sí i than doubling known population there — including ọ̀kan at 7.77 now most distant quasar on àkọsílẹ̀. Importance is survey demonstrated power to rí rare, mostly faint objects in bulk, not incremental redshift àkọsílẹ̀. èsì are initial dátà release: full statistical ìtúpalẹ̀, much spectroscopic confirmation, detailed characterisation still to come.

Àyẹ̀wò láìsí àṣejù

Ohun tí ìwé ìwádìí fi hàn: Euclid Wide Survey, in first ~1.5 years over ~3000 square degrees, lè rí high-redshift quasars in numbers no previous survey lè — 31 confirmed láàárín 6.6 àti 7.8, twelve at 7 tàbí above, roughly doubling known count, most distant at ~7.77.

Ohun tó ṣeé gbà ṣùgbọ́n not the kókó: Redshift àkọsílẹ̀ itself. Genuine, ṣùgbọ́n moves frontier nìkan ~0.13 — láti previous ~7.64 to 7.77, ~15 million years cosmic àkókò. àkọlé that ages well is doubled, growing, unusually faint àpẹẹrẹ, not ọ̀kan record-holder.

Ohun tí kò fi hàn: How first supermassive black holes formed, tàbí measurement of reionization. Quasars are irinṣẹ́ fún those ìbéèrè, not answers. Nor final population census — full statistical ìtúpalẹ̀ left to later ìwé ìwádìí.

Main limitations: Spectroscopic follow-up incomplete, especially south; luminosity-function èsì preliminary; some faintest objects labelled quasars lè be early ìṣùpọ̀ ìràwọ̀ until JWST-class spectroscopy confirms.

Confidence wo ni gbogbogbò reader yẹ kí ó ní? High that Euclid changed what is findable at these redshifts, high on peer-reviewed confirmations brighter objects. Lower, by òǹkọ̀wé' framing, on precise faint-end population numbers àti nature of faintest candidates — first èsì, not settled.

Àwọn orísun

D. Yang, J. F. Hennawi, F. Guarneri et al. (Euclid Collaboration), Astronomy & Astrophysics 711, A104 (2026), DOI 10.1051/0004-6361/202658883
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