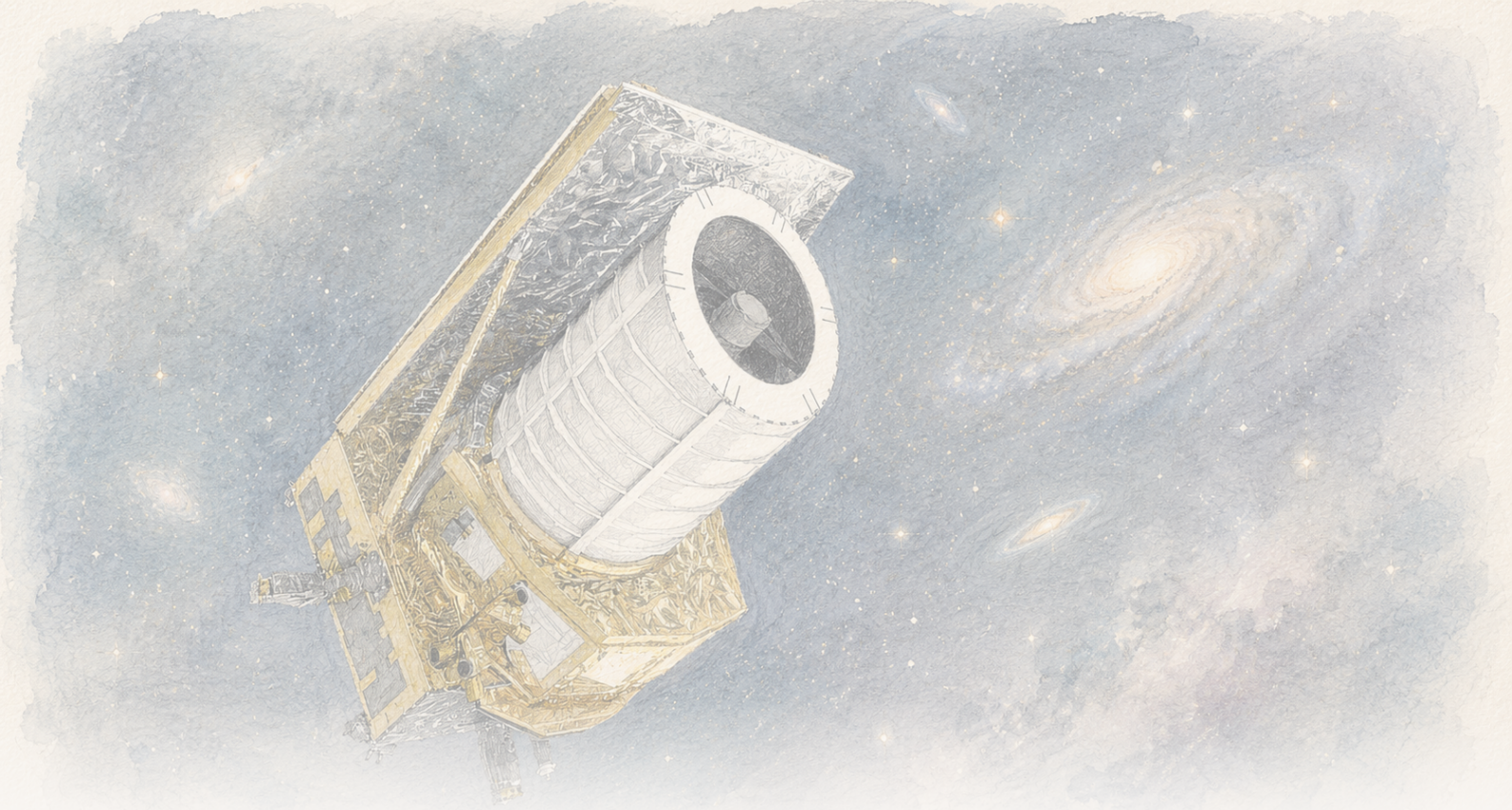


The Clean Paper

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

Euclid redshift 7 ol quasars sample xiqqaa dachaa lamaa ol godhe

Euclid Wide Survey first year and half keessatti ~3000 square degrees search quasars haaraa 31 redshift 6.6–7.8 argate. Isaan keessaa 12 redshift 7 ol, Euclid dura handful known sample dachaa lamaa ol; z=7.77 tokko most distant record. Advance real single record incremental miti: survey rare, mostly faint objects bulk find gochu power, early Universe probes statistics'f. Initial result dha; full statistical analysis fi spectroscopic confirmation hedduun ammallee dhufu.

Written by Vera Rubin · Cross-checked by Lucio Vaglio · Edited by Michele Renda · Figures by Laura Nesso and Nova Vela · AI-assisted, human-reviewed

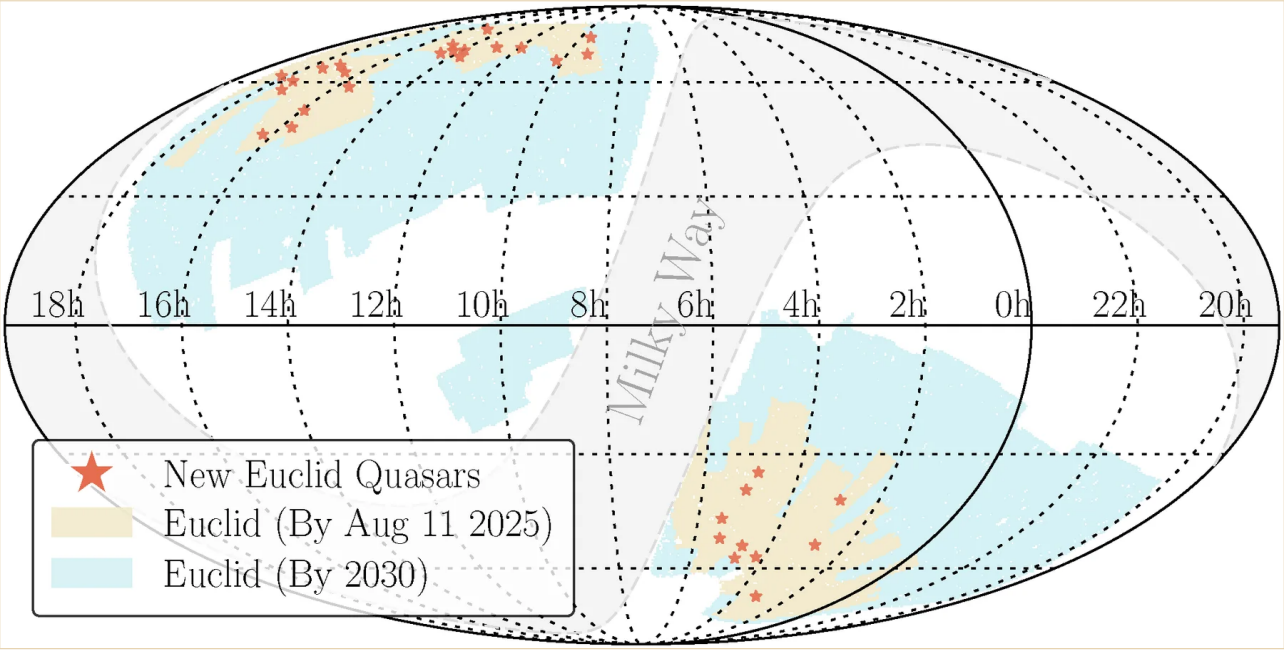
Paper: *Euclid: Discovery of 31 new quasars at 6.6 < z < 7.8*, D. Yang, J. F. Hennawi, F. Guarneri et al. (Euclid Collaboration), Astronomy & Astrophysics · DOI: 10.1051/0004-6361/202658883

Qorannoon wantoota muraasa barbaaduuf qophaa'e garee guutuu tokko argate

Quasar supermassive gurraacha boolla gas nyaataa jiru, host galaaksii guutuu caalaa bright ta'uu danda'u dha. Addunyaa keessatti luminous steady maddoota keessaa, quasars beacons ta'u: far enough tokko argi, ifa isaa billions waggoota intervening space duuba lamp ta'a.

Irra caalaa distant quasars, ifa isaanii Addunyaa age billion waggaa gadi yeroo ture ka'e, rarest illee dha. Euclid ijoo qorannoo dura redshift 7 ol quasars confirmed naannoo sagal qofa turan, jalqabaa akkasii discovery 2011 irraa slowly built tally.

- Astronomy & Astrophysics* barruu haaraa keessatti Euclid Collaboration jalqabaa waggaa fi half qorannoo qofa irraa redshift 6.6–7.8 keessatti quasars haaraa 31 gabaasa godha. Isaan keessaa 12 redshift 7 yookaan ol. Raawwii tokko beekamaa garee uummataa achitti dachaa lamaa ol godhe. Qorannoo-power seenaa dha; maal jechuu/hin jechuu sirrii ta'uun barbaachisaa.



Euclid Wide Qorannoo bal'ina hanga amma covered (beige) guutuu footprint 2030 karoorfame (cyan) waliin; high-redshift quasars haaraa 31 red keessatti. Jalqabaa slice qorannoo eventually ~14,000 square degrees kaartaa gochuuf designed irraa — qorannoo-power seenaa picture tokko keessatti.

Euclid dura redshift 7 ol quasars ~9 beekaman (2011–2024). Jalqabaa raawwii tokko 12 dabalate — "doubling" saamudaa ammallee xiqqaa irratti ifa ta'e.

Quasars fageenya kanaa maaliif barbaachisu

Redshift expansion Addunyaa madda ifa gara longer wavelengths stretch hammam godhe safara; ol-aanaa redshift older ifa/earlier Addunyaa. Redshift 7 irratti Big Bang booda billion waggaa gadi, epoch of reionization gara dhumaa end, jalqabaa luminous objects neutral haayidiroojiinii fog burn off yeroo keessa ilaalla.

> **Maal redshift jechuun maal akka ta'e, fi maaliif it akkasumas akka a distance fi a clock**
>
> *Redshift* madda ifa nu ga'utti longer/redder wavelengths garaatti hammam stretched ta'e. Ifa dhaabbataa speed'n travel waan godhuuf far away jechuun dheeraa ago ilaalu; Addunyaa journey keessa expand waan godheef longer journey → caalaa stretch. Ol-aanaa redshift ifa earlier/farther madda, cosmos younger. Redshift 7 as Big Bang booda billion waggaa gadi, present Addunyaa age tenth gadi.

Quasars era kana sababoota lamaaf faayidaa qabu. Tokkoffaa, tokkoon tokkoon supermassive gur-raacha boolla hundreds millions–billions solar masses qaba. Jalqabaa yeroo keessatti heavy akkasii grow gochuun difficult; normal accretion daangaalee jalatti fairly massive "seeds" qofa enough yeroo qabu. Existence/census jalqabaa SMBHs formation/growth constrain godha. Lammaffaa, quasar ifa

intergalactic medium keessa darbu neutral gas imprint baata, tokkoon tokkoon quasar reionization qorataa godha.

Catch: extraordinarily muraasa/hard. Redshifts kana irratti strongest Lyman-alpha break optical irraa near-infraredtti stretched; deep near-infrared imaging guddaa bal'ina barbaada — relevant brightness irratti gara quasar tokko tokkoon tokkoon hundred square degrees. Ground irraa deep + wide NIR prohibitively difficult. Euclid gap kana close gochuuf built.

Euclid maal godhe

Euclid teleskooppii hawaa meetira 1.2 ta'e yoo ta'u, qorannoo waggaa jahaatiin samii digrii iskuweerii ~14,000 ifa mul'ataa fi infrared-dhihoo keessatti kaartaa gochuuf qophaa'e. Atmosphere ol ta'uun wide damee keessatti depths ground qorannoowwan NIR hin dandeenye ga'a. Barruu daataa jalqabaa ~1.5 waggoota, ~3000 square degrees February 2024–August 2025 mul'ate, fayyadama.

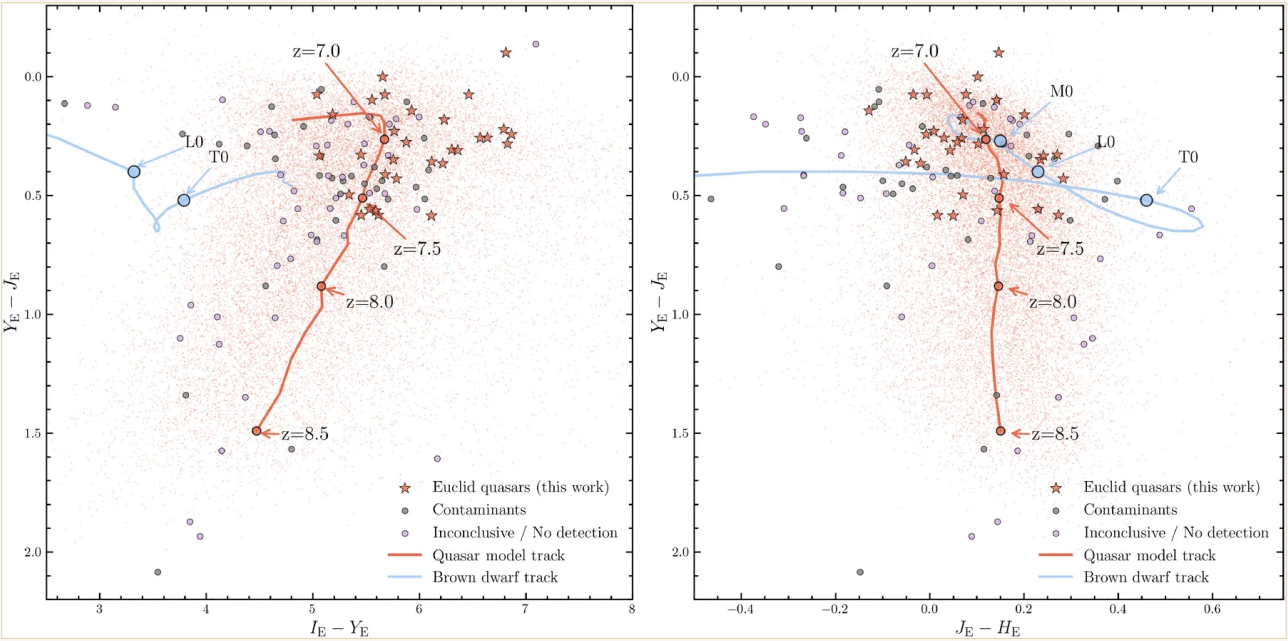
Euclid spacecraft launch dura cleanroom keessatti. 1.2-metre telescope white cylinder top irraa sky ilaala; atmosphere ol irraa wide-dirree NIR camera guddaa bal'ina deep search godha.

ESA / NASA Science fair-use

Needles 31 haystack keessatti argu looking qofa miti. Team custom photometry + machine-learning/probabilistic classifiers hedduu — extreme-deconvolution density moodeela, gradient-boosted classifier, template fits — fayyadamee faint point-like madda high-z quasar vs contaminants,

chiefly cool brown dwarfs, carraa tilmaama godhe. Kanneen filataman malleen gidduu cross-sakatta'a, eye inspect, hordoffii prioritize. Euclid images kanneen filataman select; confirmations ground guddaa telescopes Magellan/LBT speektra irraa, break/emission sararoota argan.

hordoffii hojii in progress dha. Spectroscopic hordoffii guutuu completeness hin ga'in, keessumaa southern sky. Followed kanneen filataman keessaa confirmed 31 hin taane hedduun contaminants (brown dwarfs carraan isaa guddaa), muraasa inconclusive, muraasa lakki detectable mallattoo. Confirmed garee mata-duree; selection catches/misses guutuu accounting boodaa barruulee.



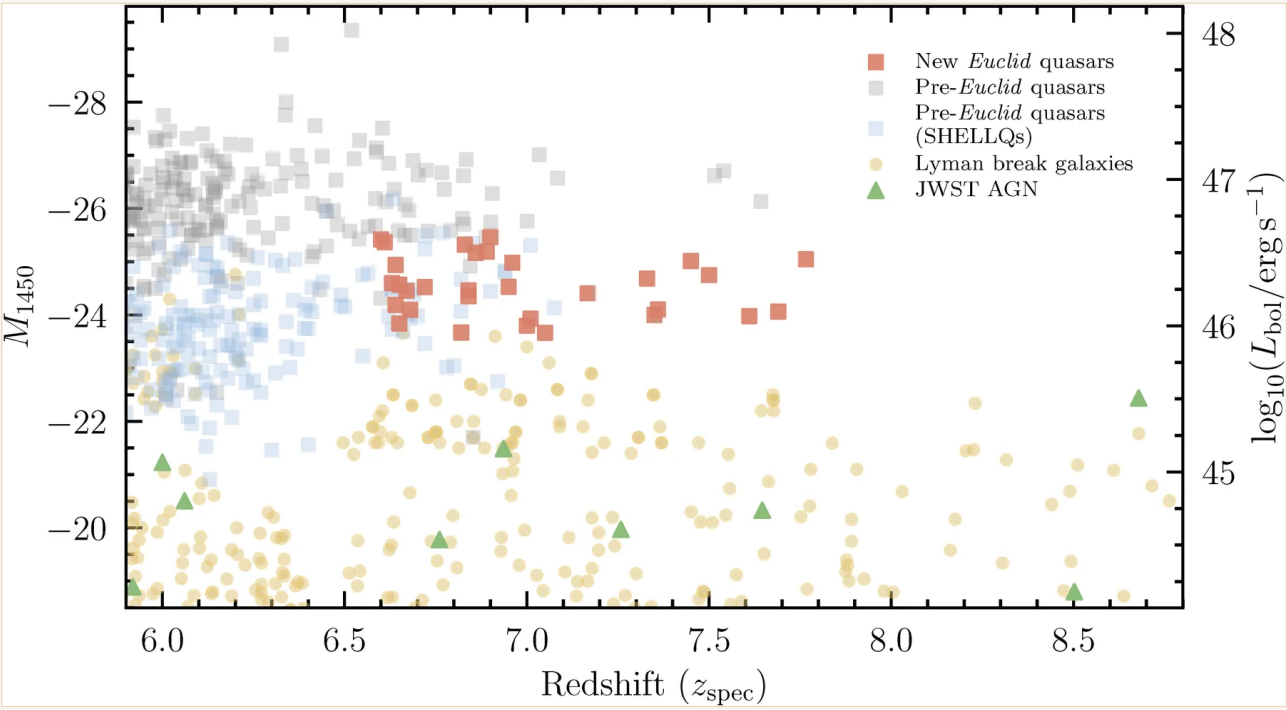
Colour-colour diagram Euclid distant quasar nearby brown dwarf irraa akkam adda baasu. Axes filters brightness garaagarummaa. Red qaxxaamura predicted high-z quasar colours (z 7.0–8.5), light-blue cool brown dwarfs M0–T0. Haaraa quasars red urjiilee quasar track; contaminants grey, inconclusive violet. Tracks walitti dhiyaatan bakka colour qofa hin murteessu — spectroscopy needed.

Galmee, proportion keessatti

31 keessaa EUCL J1729+6410 redshift ~7.77 irratti argama; yeroo ammaa quasars beekaman keessaa isa fageenya guddaa irratti argamu dha. Galmee dhugaa, garuu tarkaanfii hammamtaa sirriitti: duraa frontier ~7.5, galmee holder ~7.64. 7.77 advance genuine garuu incremental — Δz ~0.13, cosmic yeroo ~15 miliyoona waggoota. Nudge, leap miti.

Consequential lakkoofsa biraa: saamudaa z≥7 jalqabaa raawwii tokko keessatti doubling. Record-holder object tokko/daataa qabxii tokko; doubled/growing garee uummataa istaatistikii dandeessisa — commonness, brightness, clustering. Jalqabaa Addunyaa saayinsii istaatistikii keessatti. Haaraa quasars baay'een duraa luminous saamudaa caalaa 1–2 magnitudes fainter. Faint end hard garuu reionization qorannoowwan'f valuable: fainter quasars smaller ionized bubbles, neutral gas caalaa

saamudaa godhu.



Haaraa quasars brightness vs cosmic fageenya. Horizontal redshift, mirga = earlier. Vertical M1450 intrinsic UV magnitude; magnitude convention reverse, ol-aanaa = brighter; mirga safartuu bolometric luminosity. Grey duraa bright quasars, light-blue SHELLQs faint, red Euclid 31 out to z=7.77, ~1–2 magnitudes fainter than classic bright quasars; yellow Lyman-break galaaksiiwwan, green JWST faint accreting BH kanneen filataman. Euclid wide-area jalqabaa bright-to-faint bridge agarsiisa.

Maal ammallee uncertain

Caveats sadii.

Tokkoffaa jalqabaa bu'aa, dhumaa safartuu miti. Comprehensive selection function/garee uummataa istaatistikii fuuldura publications; luminosity-function constraints jalqabaa look.

Lammaffaa faint "quasar" hundi guaranteed miti. Faint end compact jalqabaa galaaksiiwwan ta'uu danda'u, keessumaa broad Lyman-alpha absence. Preliminary point-source consistency sakatta'a qaba; deep NIR spectroscopy JWST-class settle godha.

Sadaffaa objects faint, ground spectroscopy daangaa naannoo. Black-hole masses, environments, reionization gahee JWST, ALMA, NOEMA barbaadu. Euclid argannoo keessatti cimaa; bal'aa qorannoo instruments birootti handoff.

Maaliif barbaachisaa dha

Gatii demographic dha. Decade tokko Addunyaa jalqabaa billion waggoota quasars handful qofa. Euclid jalqabaa slice list irraa saamudaa garaatti geesse, pre-launch forecasts waliin wal-simu ta'ee itti fufa.

Banaa gaaffilee garee uummataa gaaffilee dha: gurraacha boollota akkam big so fast? IGM patchy/neutral hammam? Tokko spectacular object hin deebii; count/compare/kaartaa hedduu. Euclid dandeettii census build agarsiise — faint end dabalatee, JWST accreting gurraacha boollota puzzling garee uummataa waliin connect. Barruu jalqabaa BH formation resolve hin godhu, reionization kallattii measure hin godhu; jalqabaa maateriyaalii bulk supplies, hordoffii frontier kaa'a.

Cuunfaa gabaabaa

Euclid Wide Qorannoo jalqabaa ~3000 square degrees keessatti Euclid Collaboration quasars haaraa 31 redshift 6.6–7.8 argate, 12 $z \geq 7$ — beekamaa garee uummataa achitti dachaa lamaa ol — fi tokko $z=7.77$ amma irra caalaa distant galmee. Importance qorannoo muraasa, irra caalaa faint objects bulk keessatti find gochu dandeettii, incremental galmee miti. Jalqabaa daataa bu'aa dha: guutuu istaatistikii xiinxala, spectroscopic confirmation hedduu, nama dhuunfaa bal'aa characterisation ammallee dhufu.

Sakatta'a ifaa

barruun maal agarsiisa: Euclid Wide Qorannoo jalqabaa ~1.5 waggoota/~3000 $\deg^2$ high-z quasars lakkoofsota duraa qorannoowwan duraan hin dandeenye keessatti find godha — confirmed 31 $z=6.6$–7.8, 12 $z \geq 7$, beekamaa count gara double, irra caalaa distant ~7.77.

Waan amansiisaa garuu qabxii miti: Redshift galmee genuine, garuu frontier ~7.64→7.77, ~15 Myr cosmic yeroo. mata-duree lasting doubled/growing/faint saamudaa dha.

Waan hin agarsiifne: Jalqabaa supermassive gurraacha boollota akkam formed yookaan reionization safartuu. Quasars gaaffilee kanaaf meeshaalee, deebiiwwan miti. Dhumaa garee uummataa census miti.

Daangaawwan ijoo: Spectroscopic hordoffii incomplete keessumaa south; luminosity-function preliminary; faintest "quasars" jalqabaa galaaksiiwwan ta'uu danda'u hanga JWST-class confirmation.

Dubbisaan waliigalaa amanamummaa hammam qabaachuu qaba? Euclid ol-aanaa redshift findability changed fi brighter confirmations irratti ol-aanaa. Faint-end sirrii garee uummataa/nature faintest kanneen filataman irratti gadi-aanaa, barreessitoonni framing jalqabaa bu'aawwan.

Maddoota

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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