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A Heavily Obscured Quasar in the Early Universe

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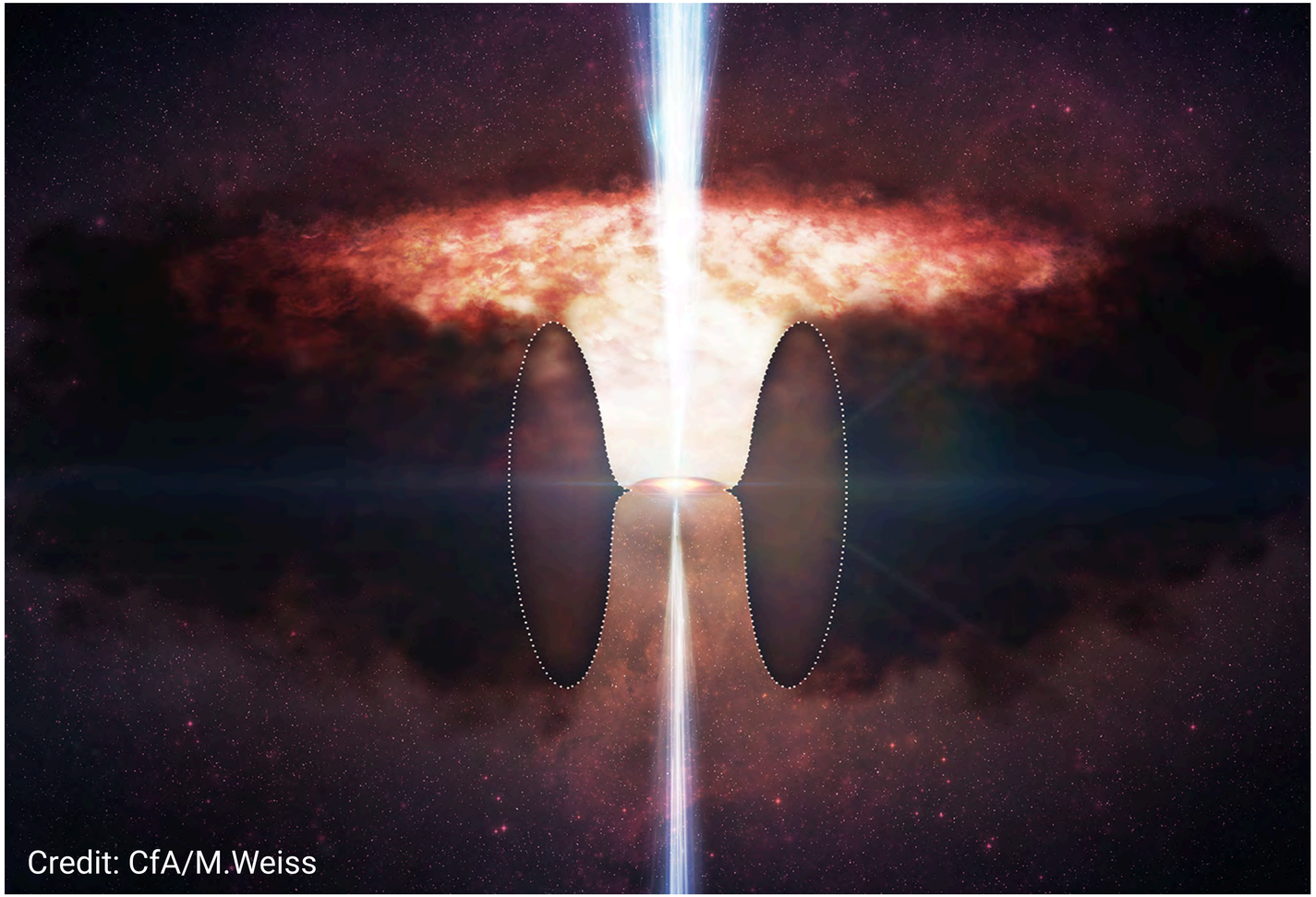
Quasars

- Extremely luminous active galaxy
- Supermassive black hole powers the total emission
- Black hole approximately one billion times more massive than the Sun
- Among the most luminous objects in the Universe

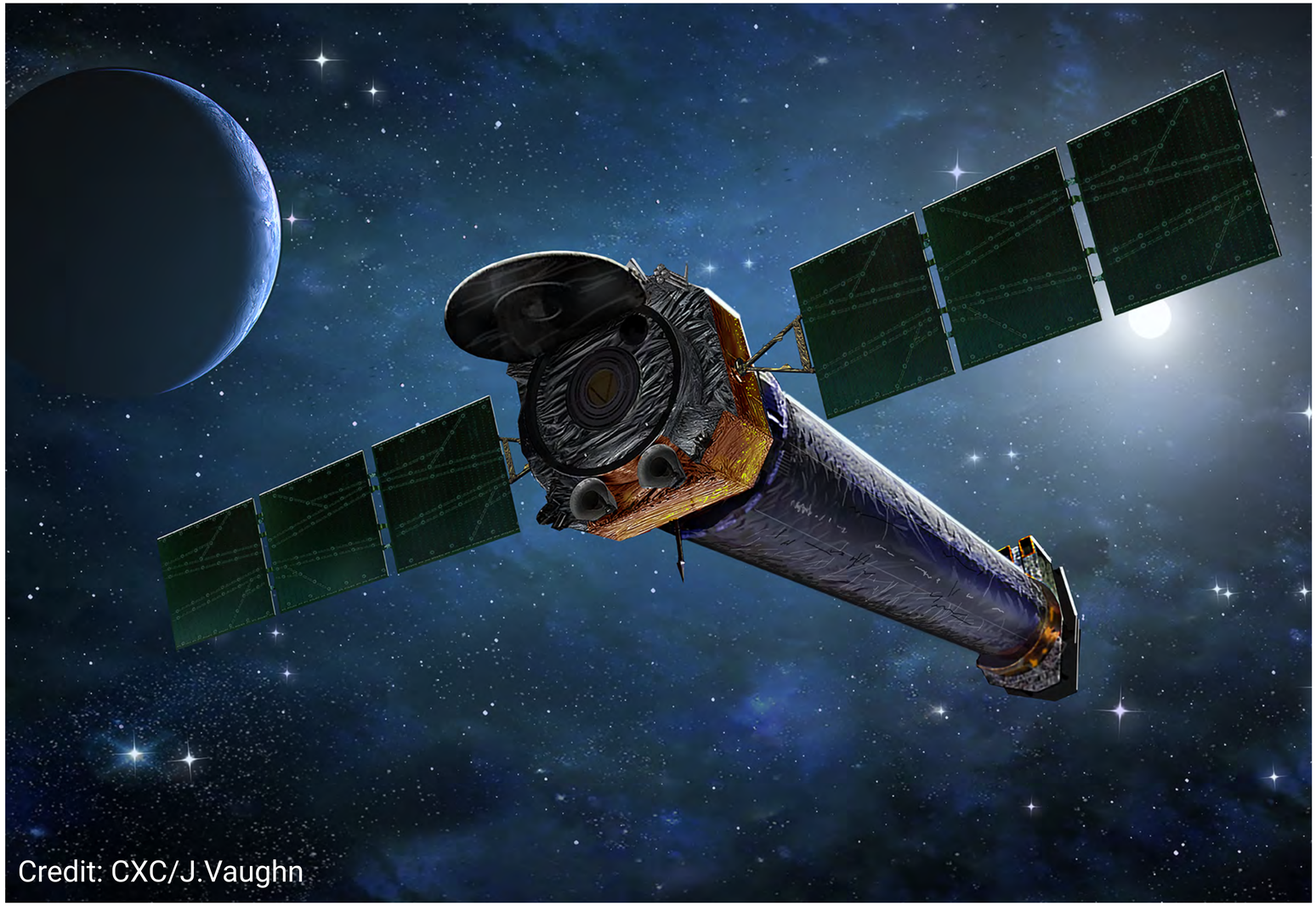
Centaurus A (credit: NASA/CXC & ESO)

Quasar Formation in the Early Universe

- Black hole absorbs matter and obscured by dust/debris
- Majority of early Universe quasars predicted to be heavily obscured
- Despite prediction, **obscured quasar population remains undetected**
  - Only 3 known obscured quasars in early Universe ($z > 4$)
- Are missing quasars due to invalid models or inadequate observing methods?


Credit: CfA/M.Weiss

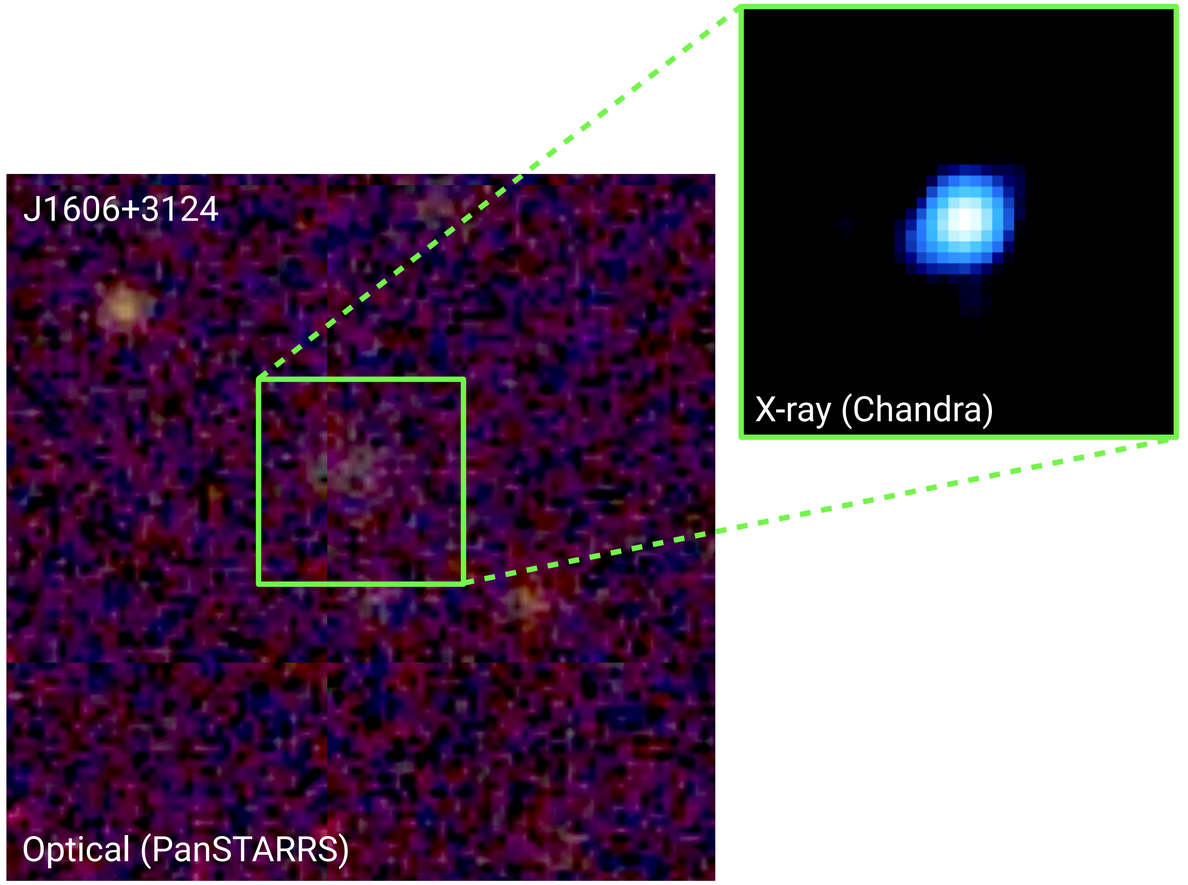
Chandra X-ray Observatory



- X-rays not obscured by dust & debris
  - Uniquely capable of detecting obscured quasars
- Used Chandra X-ray Observatory to survey X-ray from sample of quasars
  - Targets selected from radio catalog of young quasars

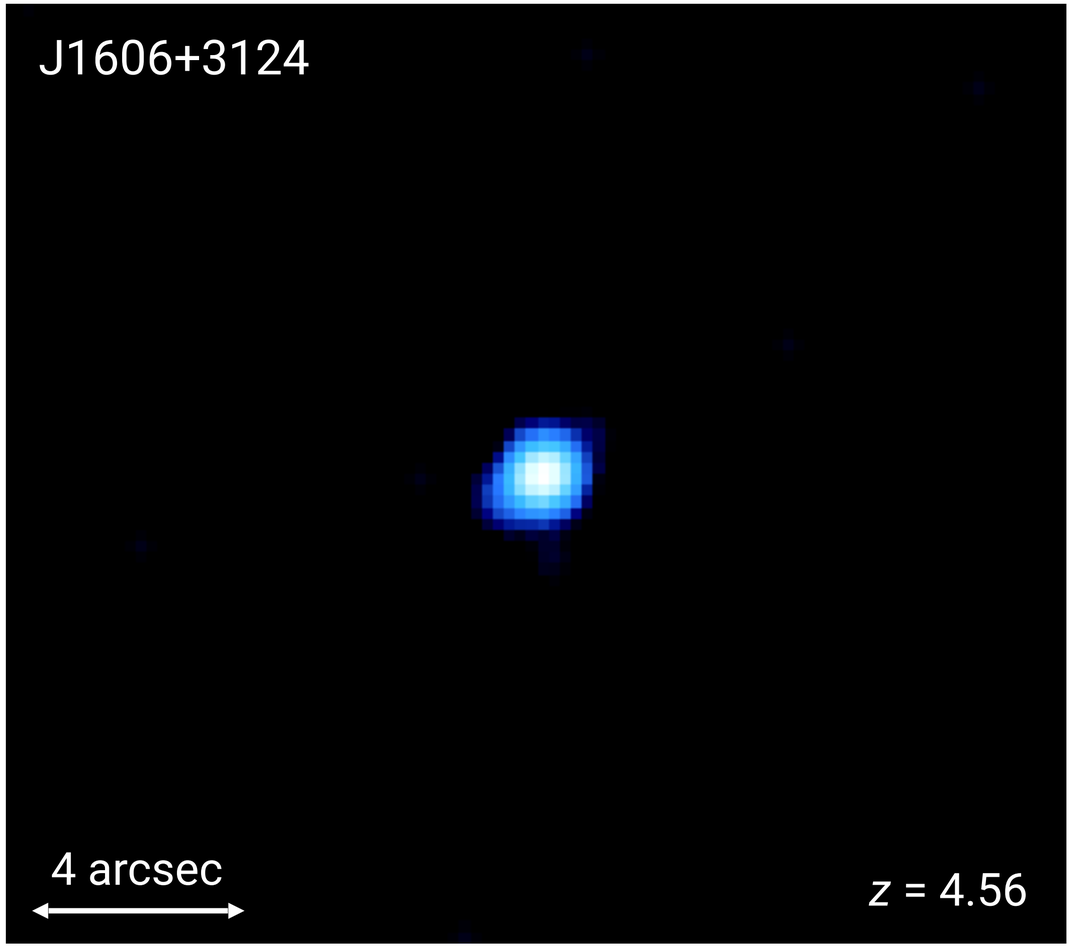
Discovery of Obscured Quasar J1606+3124

- From Chandra survey, we detect X-rays from Quasar J1606+3124
  - Located at 10% the age of Universe (z = 4.56)
- J1606+3124 demonstrates significant reduction in optical and UV
- Spectroscopically verified to be a heavily obscured source
- 4th confirmed obscured quasar in early Universe



J1606+3124: High-Luminosity Quasar

- 10-10,000 times brighter than other obscured quasars discovered in the early Universe
- Confirms presence of high-luminosity, obscured quasars in early Universe
  - Constrains quasar evolution models
- Follow-up X-ray observations approved for Q3/Q4 2021
  - Classify composition, geometry, and lightcurve



Summary

- Quasar J1606+3124 (z = 4.56) verified to be obscured using X-rays observations
- Located at 10% the age of the Universe
- 4th quasar of this classification identified
- Brightest obscured quasar in early Universe
- Can a single model incorporate this diversity, or is quasar production significantly different that predicted?