

SMBH at $z > 6$

- **Direct: Environment**

- If BHs are from PopIII star seed they should likely be in highly star-forming galaxies
- If BHs are from direct collapse of gas cloud they should be far from sources of UV light (big luminous star-forming galaxies)

Light from first stars

- $LX \equiv 10^{42}$ ergs/s \rightarrow SFR $\sim 100/200 M_{\text{sun}}/\text{yr}$

\rightarrow star-forming galaxies at $z \sim 6-7!$

1-2 arcsec resolution may distinguish between point sources and SF galaxies

Robust estimate of SFR (contribution from HMXB only), unlike UV and even IR

Direct measure of HMXB, i.e. constraints on IMF at high- z

Light from first stars: GRBs!

- GRB with higher spectroscopic redshift:
- GRB with higher photometric redshift:
- Spectroscopy of X-ray afterglows of high- z GRBs can constrain metallicities, i.e. progenitor stars. See the science case of ORIGIN