How Black Holes Grow Across Cosmic Time

Fabio Pacucci
BHI & Clay Fellow
Harvard University
Center for Astrophysics | Harvard & Smithsonian

AAS 236th Meeting Press Conference

Illustrations: M. Weiss

Media Inquiries: fabio.pacucci@cfa.harvard.edu
Phone: +1 (857)928-7612
Black Holes Come of All Sizes

Observed mass range of black holes

Up to 10,000,000,000

Object Mass
(Relative to the Sun)

NASA/JPL – Caltech (adapted)
Growth by Accretion
Growth by Mergers
Accretion vs. Mergers Across Cosmic Time

FINAL GOAL

Determine the main growth channel as a function of:
- BLACK HOLE MASS
- REDSHIFT
Accretion vs. Mergers Across Cosmic Time

Pacucci & Loeb (2020)
Accretion vs. Mergers Across Cosmic Time

- Farthest Galaxies
- Cosmic Time
- Peak of Quasar Activity
- Local Universe

Pacucci & Loeb (2020)
Growth Channel → Observation

Future Space Observatories
- LISA
- Lynx
- AXIS
- Athena

GRAVITATIONAL WAVES to probe MERGERS
X-RAYs to probe ACCRETION

Pacucci & Loeb (2020)
IMPLICATION #2

Accretion vs Mergers & Spin

GROWTH MOSTLY BY ACCRETION
Black hole is:

1) Rapidly spinning:

2) More efficient in emitting radiation

GROWTH MOSTLY BY MERGERS
Black hole is:

1) Slowly spinning:

2) Less efficient in emitting radiation
IMPLICATION #2

Accretion vs Mergers & Spin

Pacucci & Loeb (2020)

Farthest Galaxies

Cosmic Time

Local Universe

Pacucci & Loeb (2020)
Takeaway Message

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