Black Holes as Probes of the String Axiverse

Extra dimensions +Rich Topology+Gauge Fields

STRING MULTIVERSE:
LANDSCAPE of $\sim 10^{500}$ VACUA

STRING AXIVERSE:
PLENITUDE of AXIONS in OUR VACUUM

Testing Multiverse through Axiverse

AXIONS: PSEUDOSCALAR VERY WEAKLY INTERACTING PARTICLES

OBSERVATIONAL PROBES:

- CMB Polarization
- Matter Power Spectrum
- Anthropically Constrained
- Black Hole Superradiance

Axion Mass in eV

Black Hole Superradiance:
Instability of Rotating Black Holes Caused by Axions

Rotating Black Hole

Gravitational Atom in the Sky

“Atomic” Transitions may be observed by gravity wave detectors

Advanced LIGO

Axion Mass in eV

$3 \times 10^{-20}$ QCD axion

$3 \times 10^{-18}$

$2 \times 10^{-20}$

$4 \times 10^{-28}$

$10^{-33}$

$H_{\text{today}}$

$H_{\text{rec}}$

Axion Mass in eV