Observable relics from the Simple Harmonic Universe

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Cosmology from Home 2020

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Simple Harmonic Universe

- SHU: $\Omega_k < 0$ (closed/sphere), $\Lambda < 0$, exotic matter with $-1 < w < -1/3$. Bouncing cosmology with GR + NEC.

$$\left(\frac{\dot{a}}{a}\right)^2 = -\frac{K_{eff}}{a^2} + \frac{8\pi G_N}{3}\left(\rho_0 \frac{a_0^{3(1+w)}}{a^{3(1+w)}} - \Lambda\right)$$

- Can be made stable at the level of linearized perturbations, or may tunnel/evolve into present epoch.

- Novel search templates include:

  - Positive curvature ($\Omega_k < 0$)

  - Exotic matter with $w = -1/3$ cancels out curvature in Friedmann equation

  - Recollapsing dark energy sector with $\Omega_\Lambda < 0$ and Ω_{fld} with $w > -1$

Results (CLASS + Monte Python)
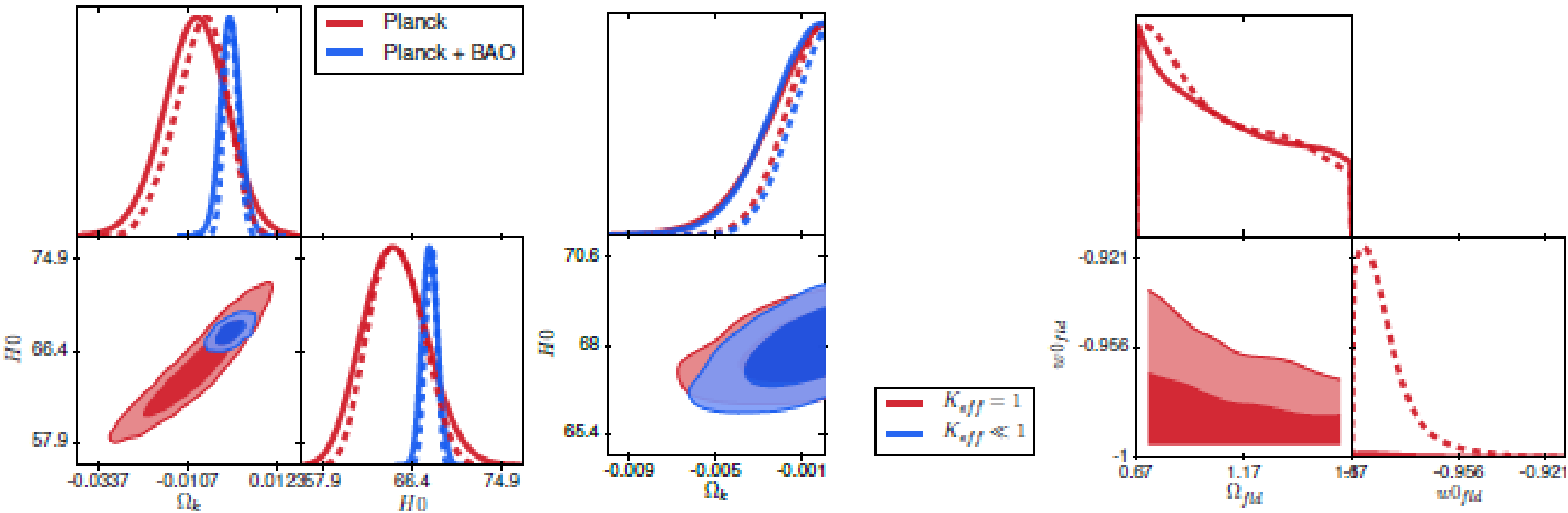
- $|\Omega_k| < 0.02$ (Planck), 0.005 (Planck + BAO); may suppress primordial quadrupole if $c_s < 1$ or S3 → S3/Zk

  string-like matter changes curvature constraints very slightly

- Constraints on modified DE imply recollapse time > 470 Gyr