

Characterizing Late-Time Phase Transitions with Cosmology

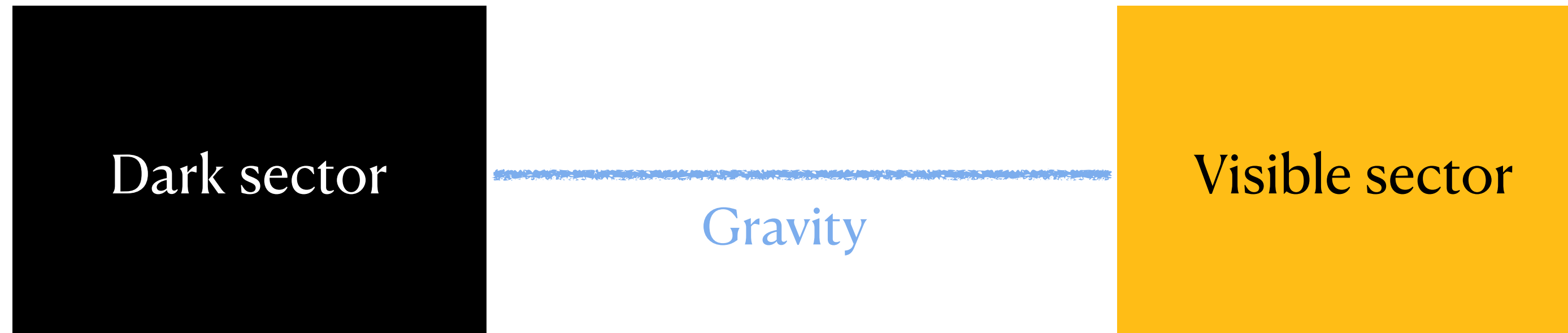
Salvatore Bottaro

In collaboration with: M. Geller, B. Hatzofe, D. Redigolo, M. Tsur



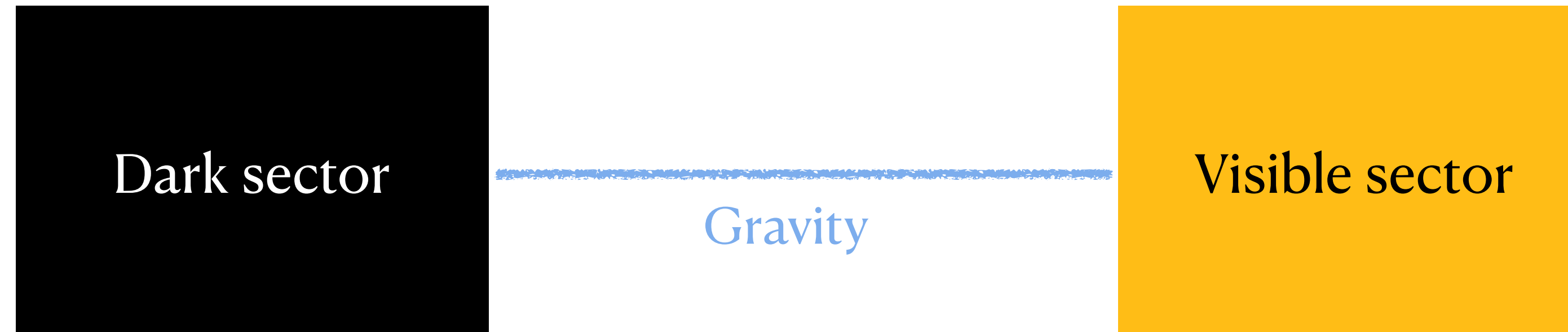
New Physics from Galaxy Clustering III, Parma, 4/11/24

Can we test late-time PT?



Cosmological PT is one of the few examples of dynamics that can be probed in a completely secluded dark sector

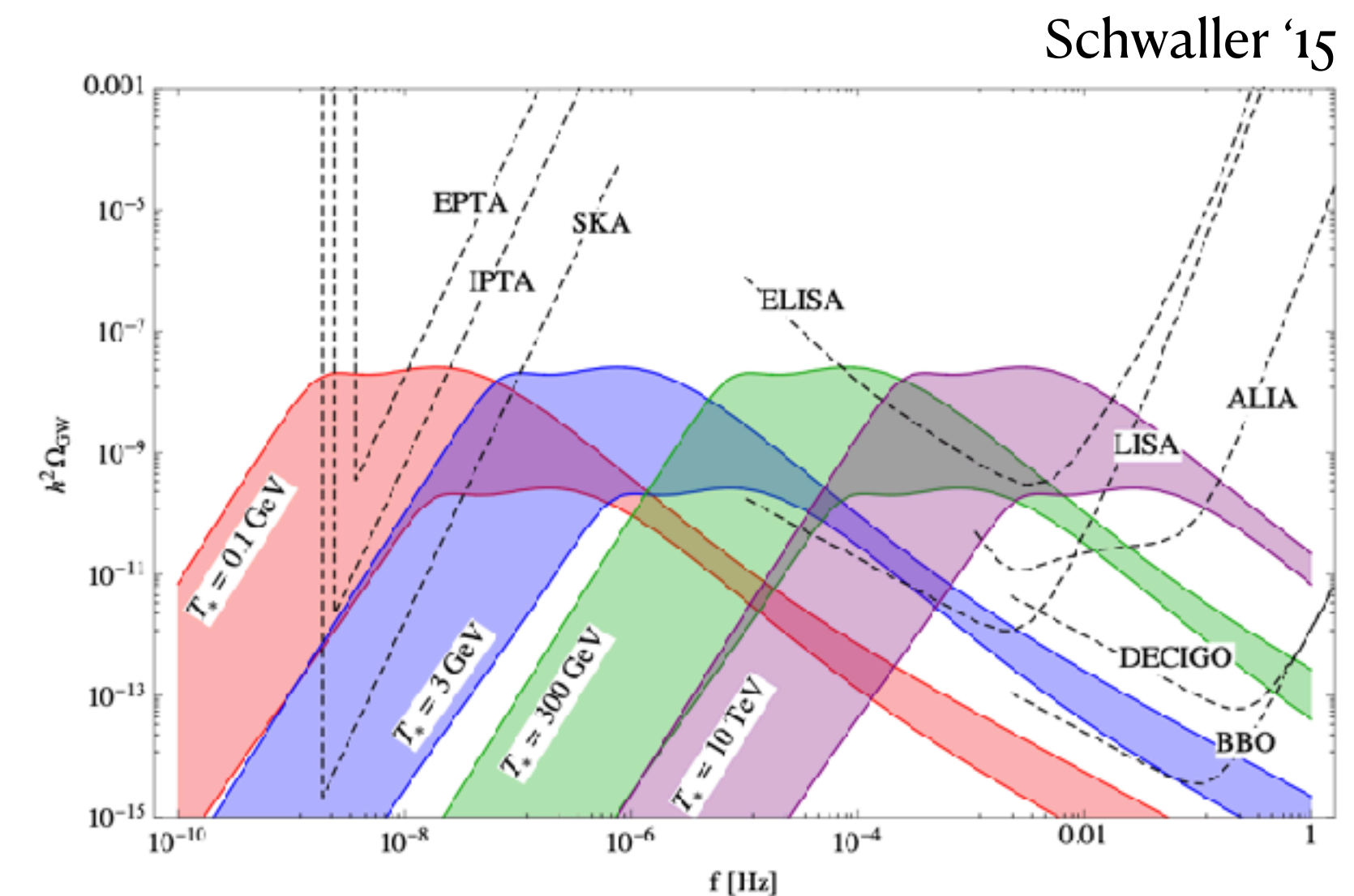
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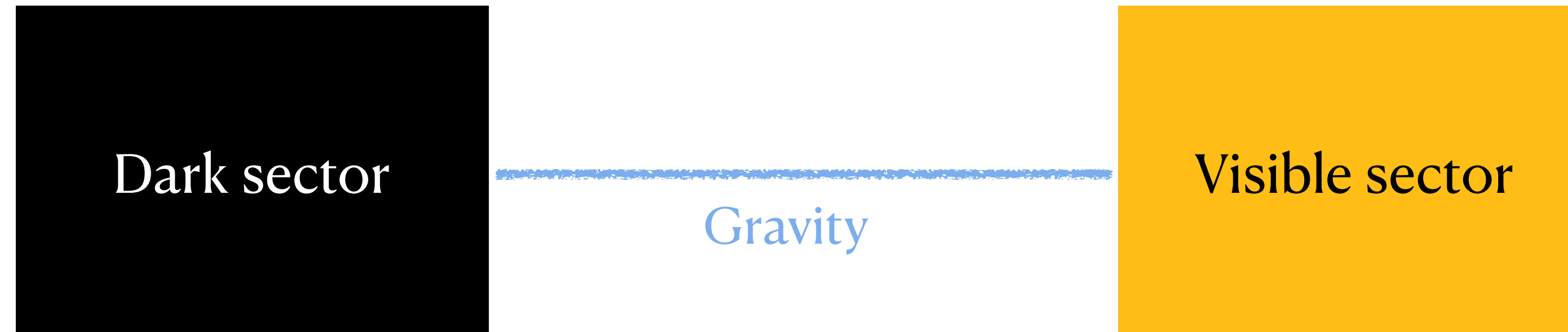
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Early Universe
 $T \gtrsim 1 \text{ eV}$

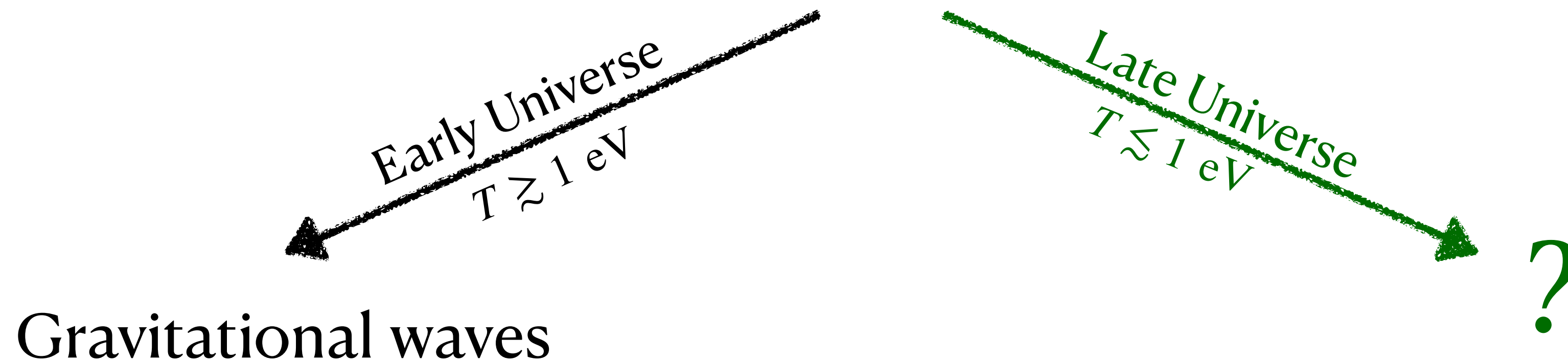
Gravitational waves



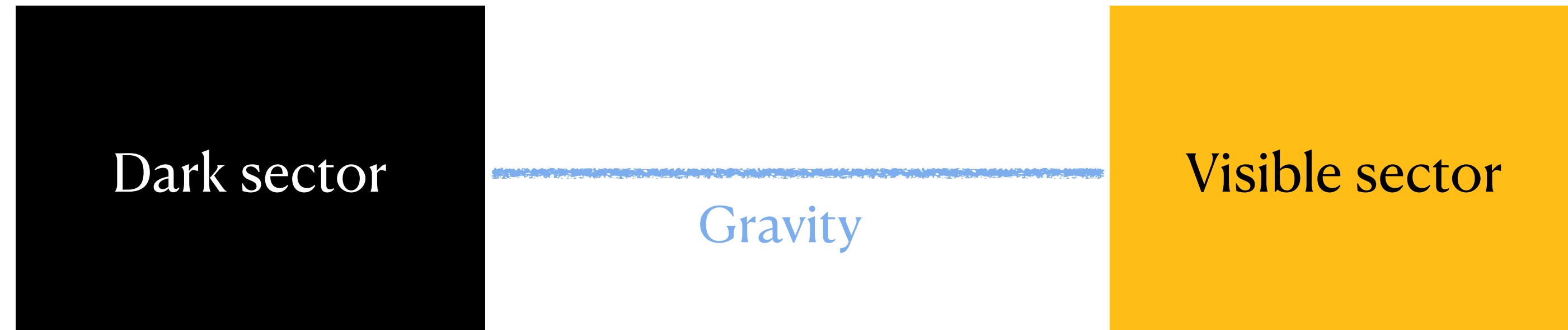
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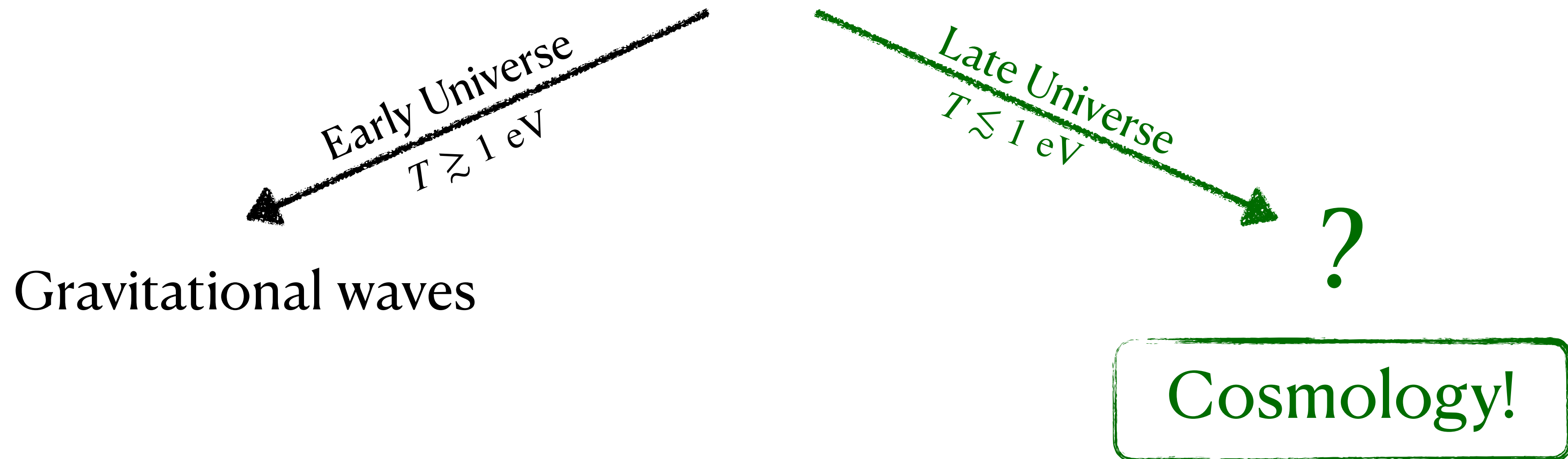
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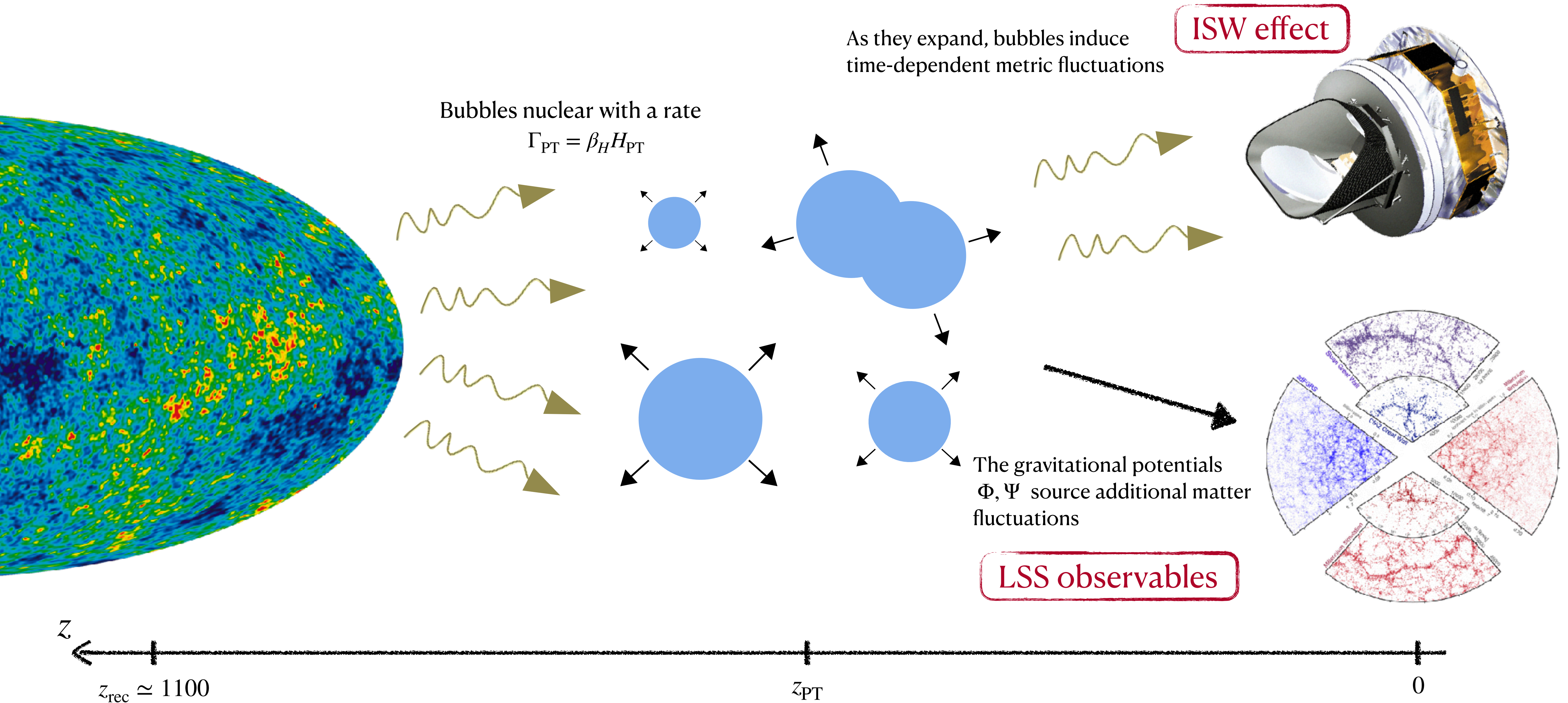
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Dynamics of a Late PT

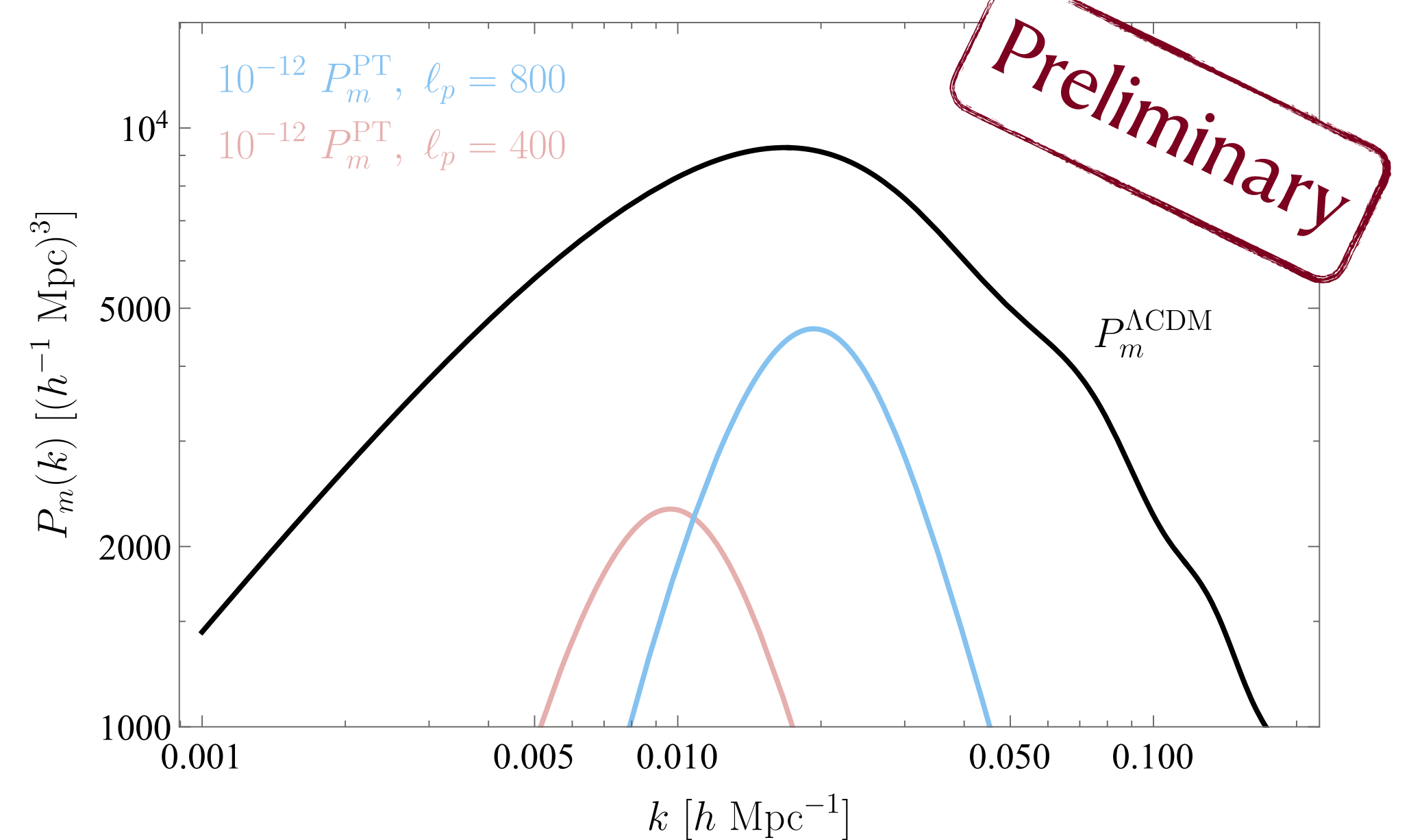
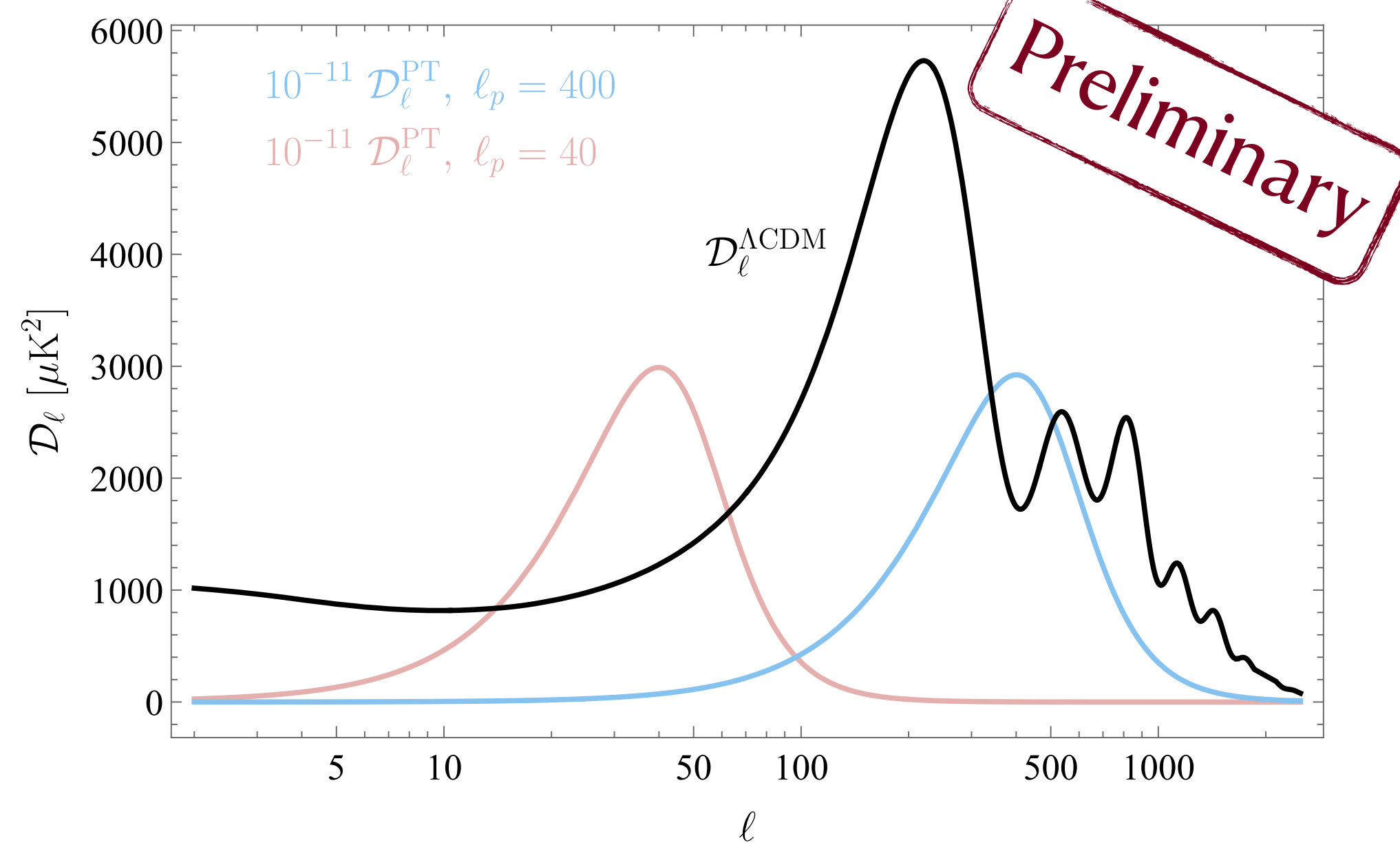


Features of the Signal

$$\ell_p \simeq 4.3 \sqrt{z_{\text{PT}}} \beta_H \sim \frac{\chi_{\text{PT}} \Gamma_{\text{PT}}}{1 + z_{\text{PT}}}$$

Both ISW and matter power peak at a scale set by Γ_{PT}

$$k_p \simeq \frac{H_0 \ell_p}{13} \sim \frac{\Gamma_{\text{PT}}}{1 + z_{\text{PT}}}$$



➡ Negligible degeneracies with cosmological parameters

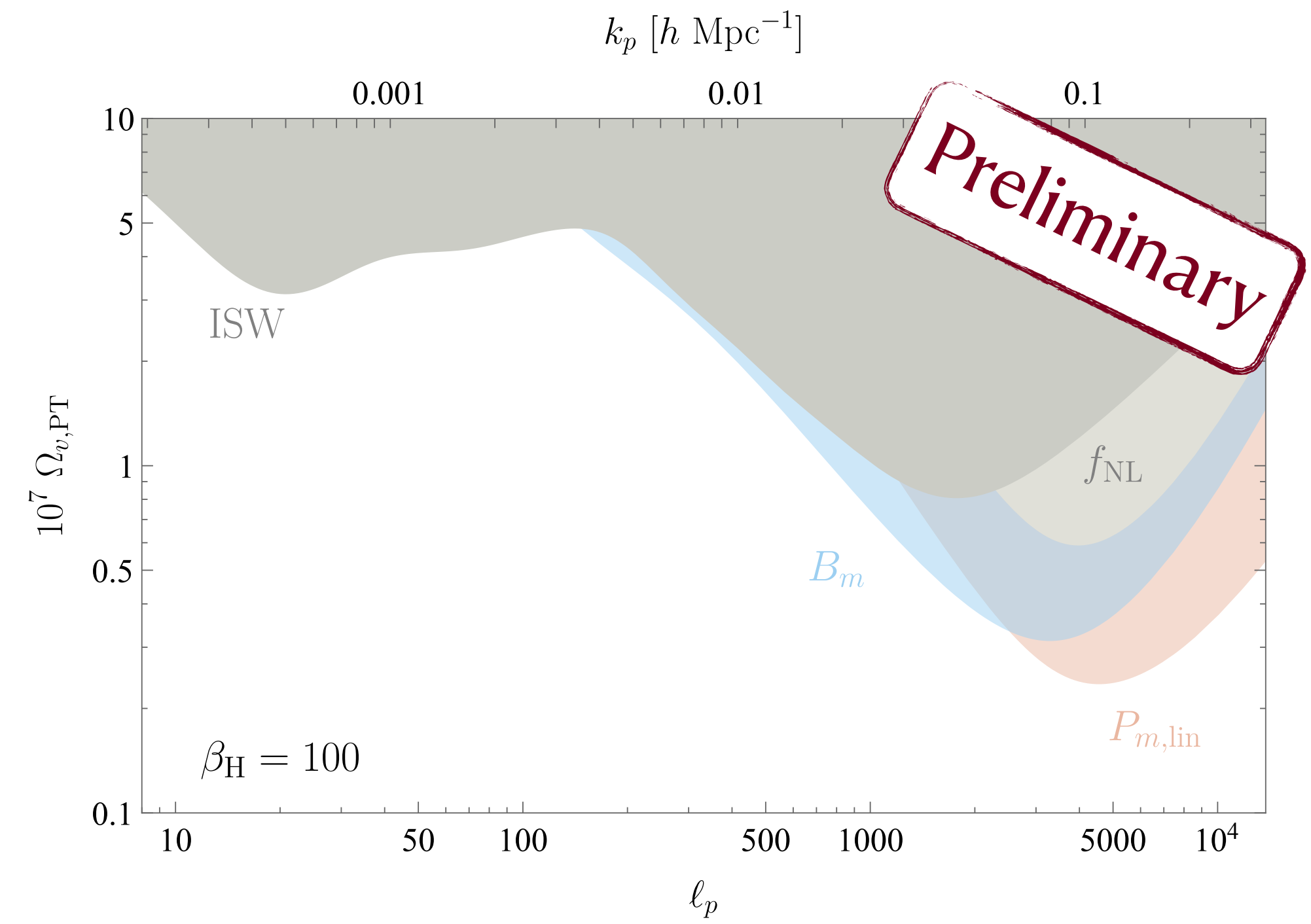
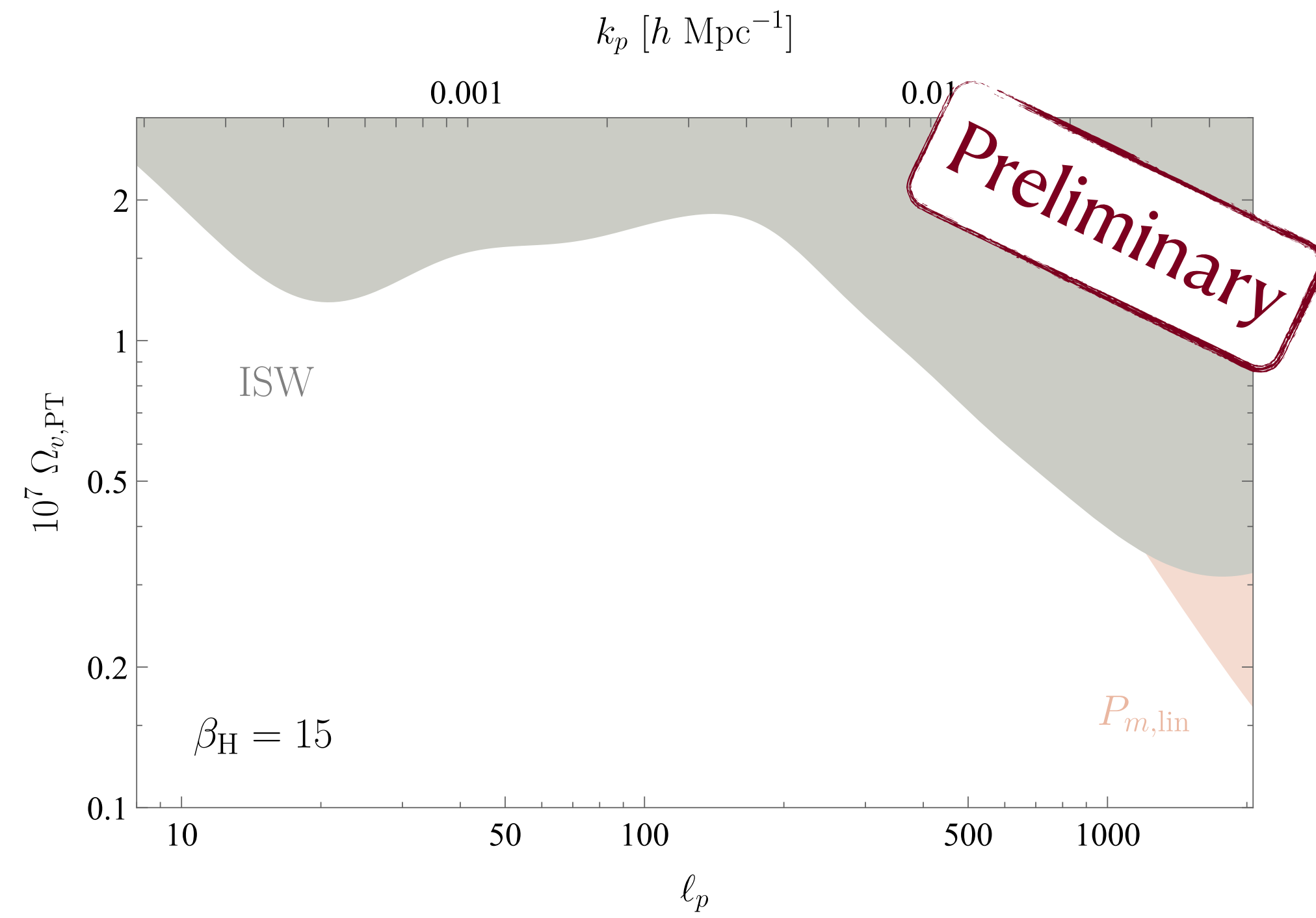
Significant non-Gaussianities are produced

$$\langle \Phi \Phi \Phi \rangle^2 \approx \langle \Phi \Phi \rangle^3$$

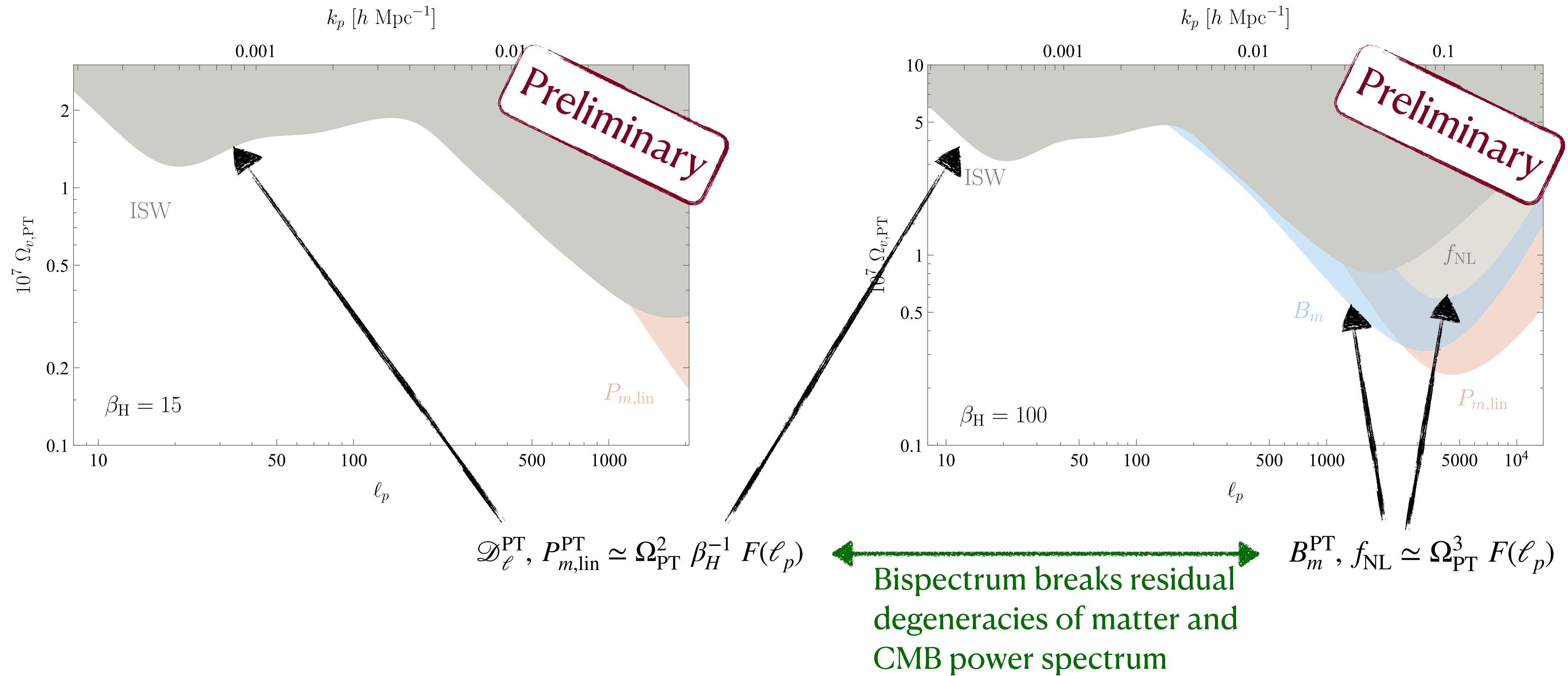


Constraints from bispectrum and f_{NL}

Bounds and Projections

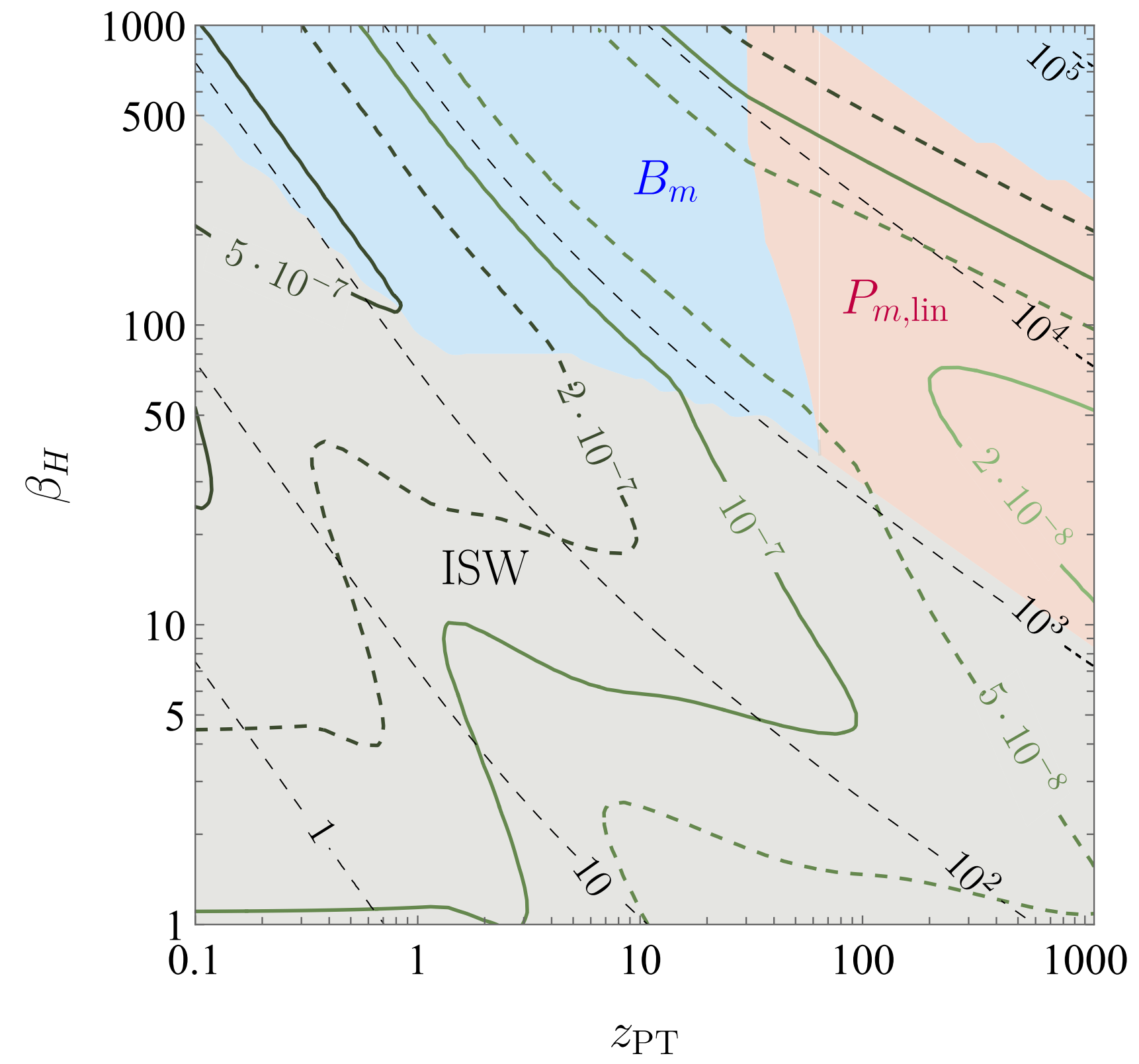


Bounds and Projections

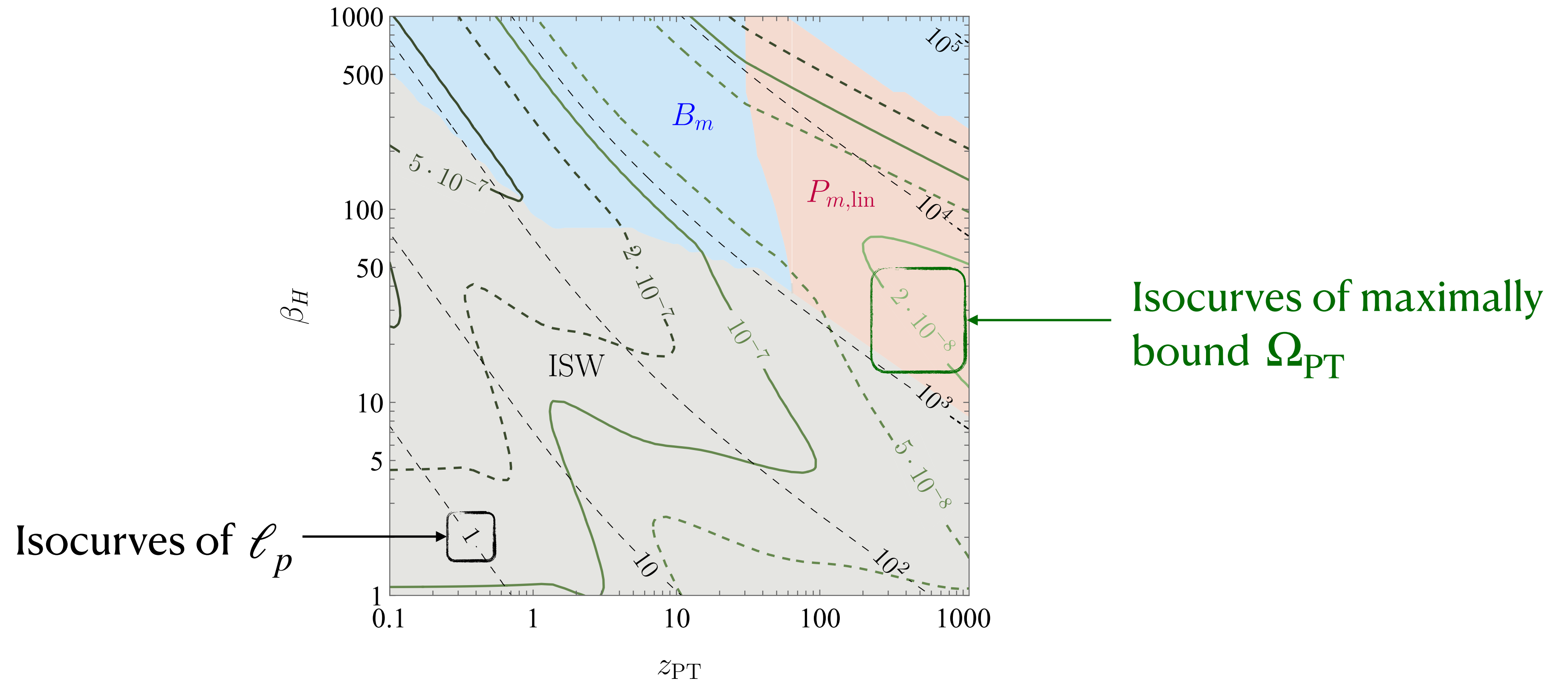


Phase transition can be fully characterized and $\Omega_{PT} \equiv \frac{\Delta\rho_{PT}}{\rho_{cr,PT}}$ can be probed at $\mathcal{O}(10^{-7})$

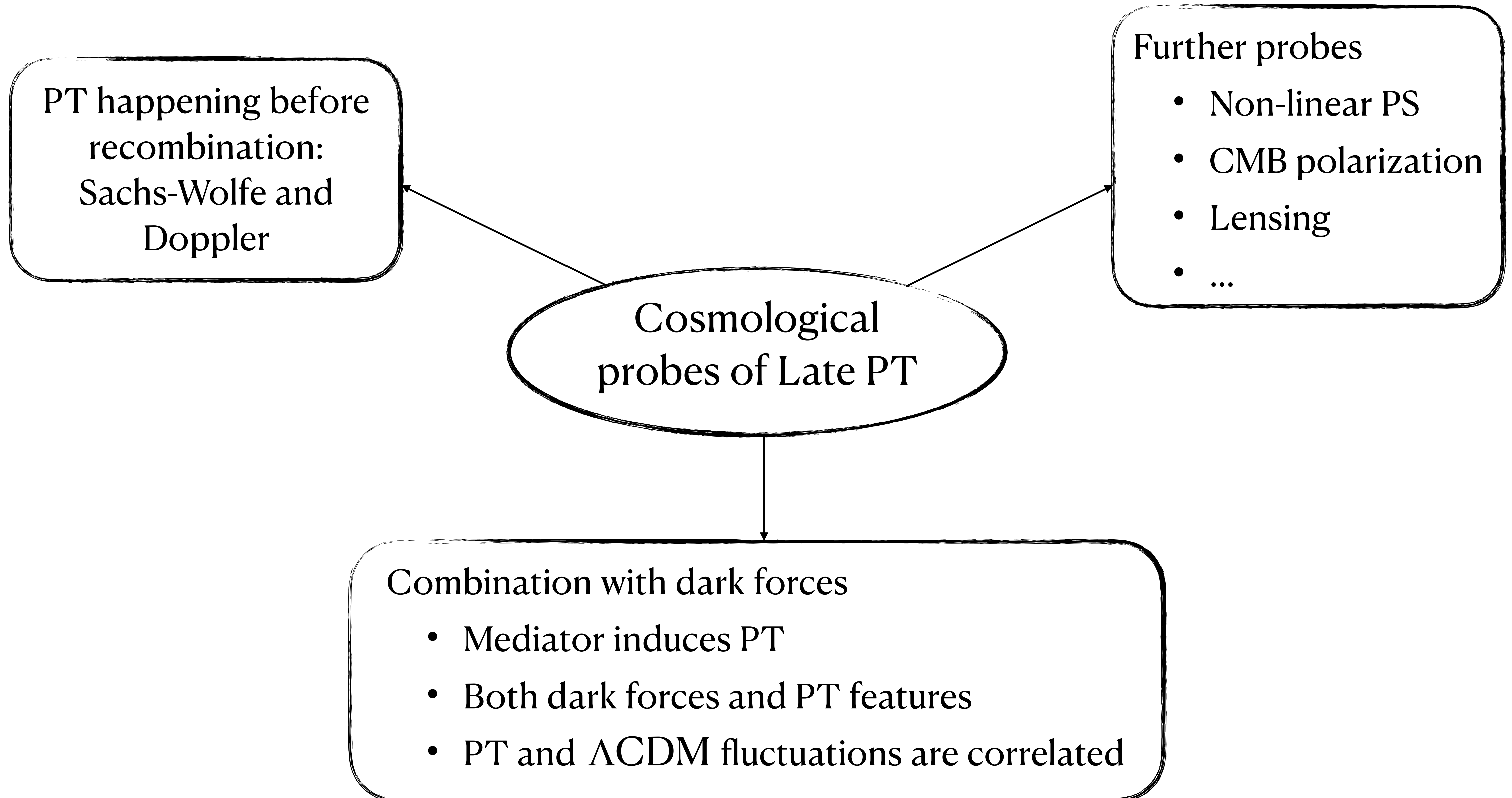
Bounds and Projections



Bounds and Projections

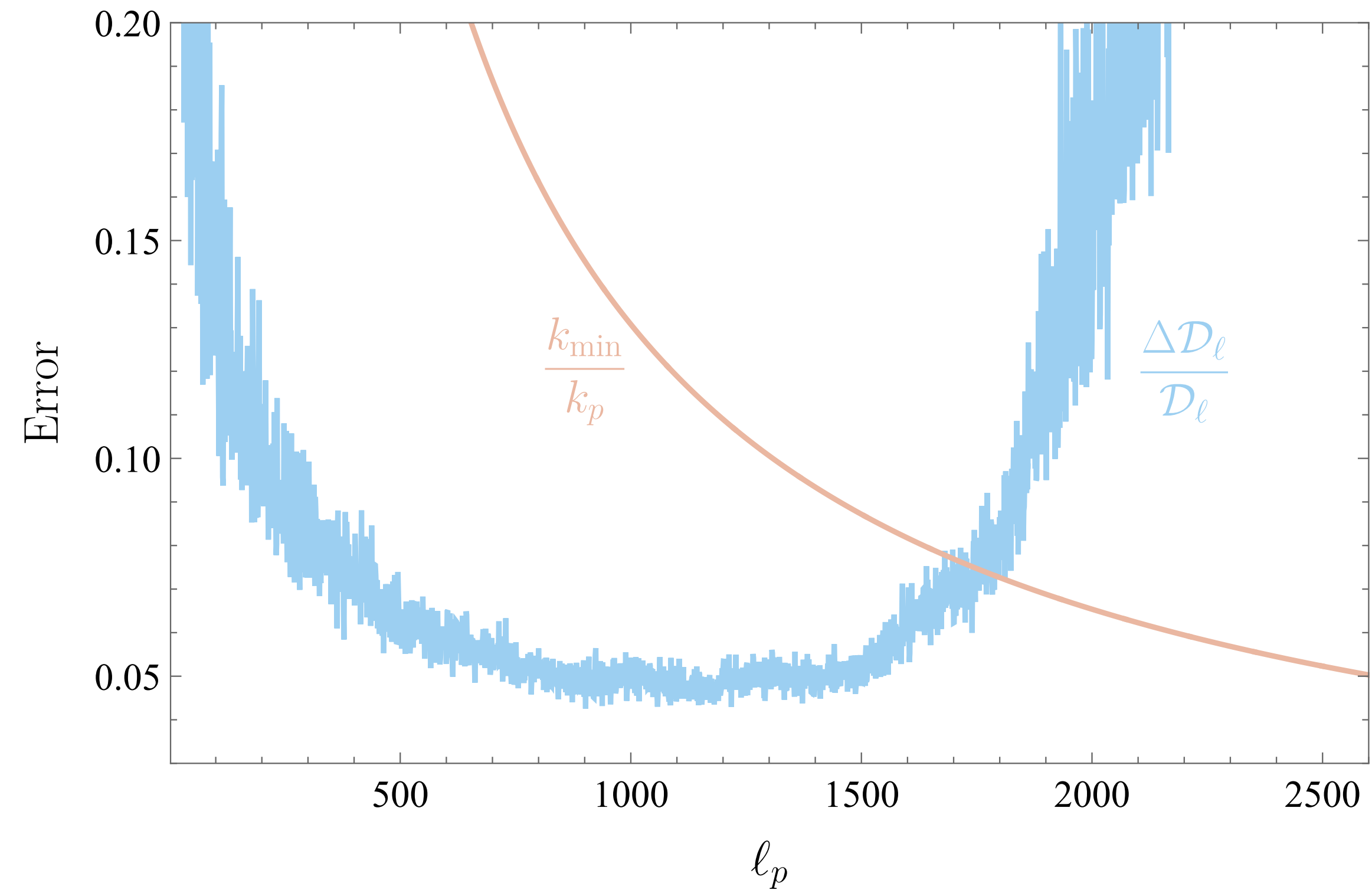


Outlook

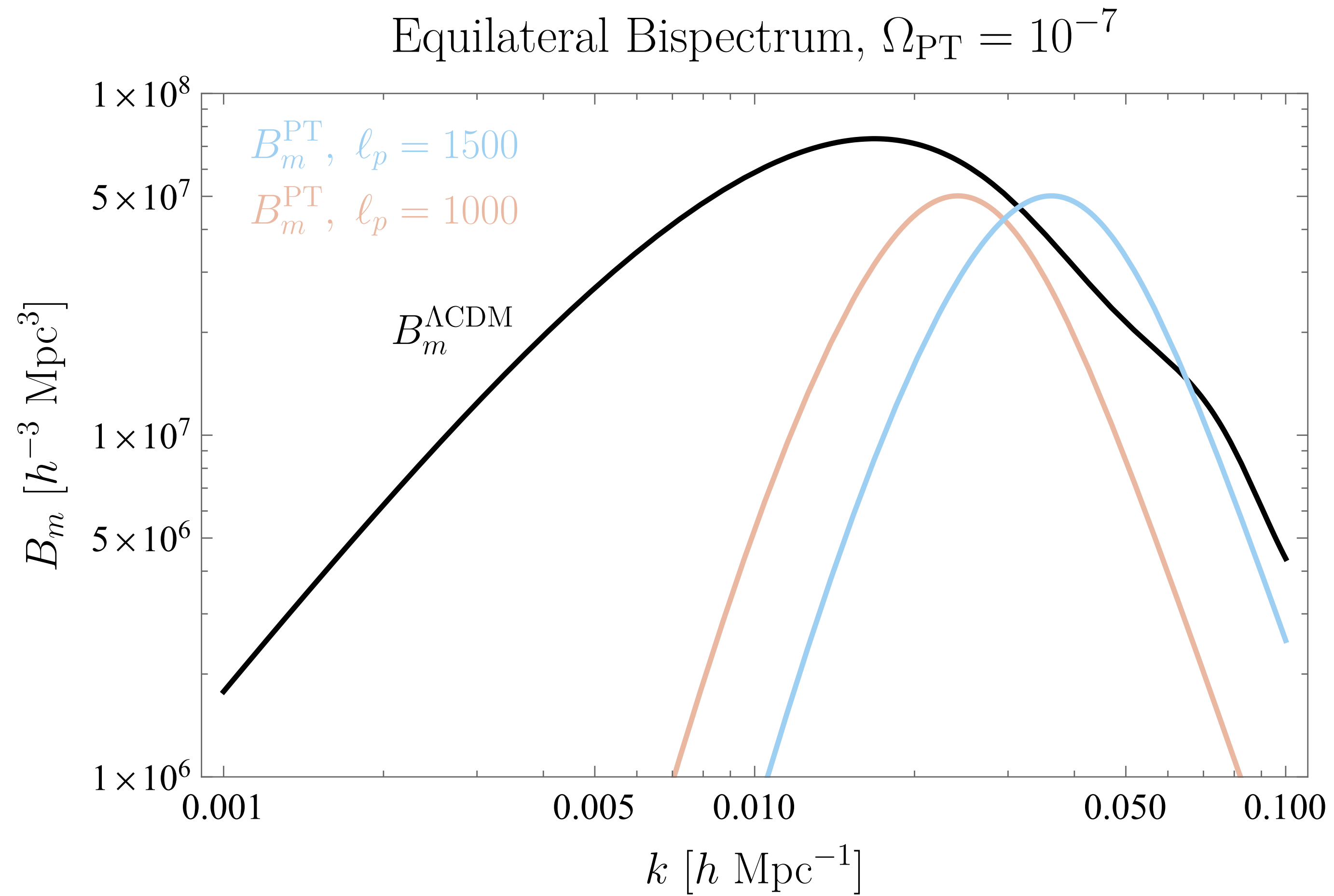


Back-up

CMB vs. Power spectrum



Bispectrum



ISW from GWs

