Basic template

Main topic/research area

(Please set as Heading 1)

Observational capabilities of Spec S5

- Capability A (+ possible synergy with other instrument)
- Capability B
- Capability C

1. Subfield 1

1.1. Derived quantities (what basic quantities can we infer from these measurements)

1.1.1. Quantity A
1.1.2. Quantity B
1.1.3. Quantity C

1.2. High-level scientific outputs (phenomenology we can we infer from these measurements)

1.2.1. Constrain fundamental property Z to some % precision
1.2.2. Break covariance/degeneracy between fundamental properties A and B

1.3. Potential forecasts (how does the above translate to specific DM models and forecasts)

1.3.1. Rule out or detect some benchmark case for dark matter model X or Y
1.3.2. Distinguish dark matter model X from dark matter model Y

2. Subfield 2

2.1. Derived quantities (what basic quantities can we infer from these measurements)

2.1.1. Quantity A (using capability A)
2.1.2. Quantity B (using capability B)
2.1.3. Quantity C (using capabilities A and B)

2.2. High-level scientific outputs (phenomenology we can we infer from these measurements)

2.2.1. Constrain fundamental property Z to some % precision
2.2.2. Break covariance/degeneracy between fundamental properties A and B

2.3. Potential forecasts and “cartoon plots” (how does the above translate to specific DM models and forecasts)
  2.3.1. Rule out or detect some benchmark case for dark matter model X or Y
  2.3.2. Distinguish dark matter model X from dark matter model Y

Far field cosmology

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Observational capabilities of Spec S5

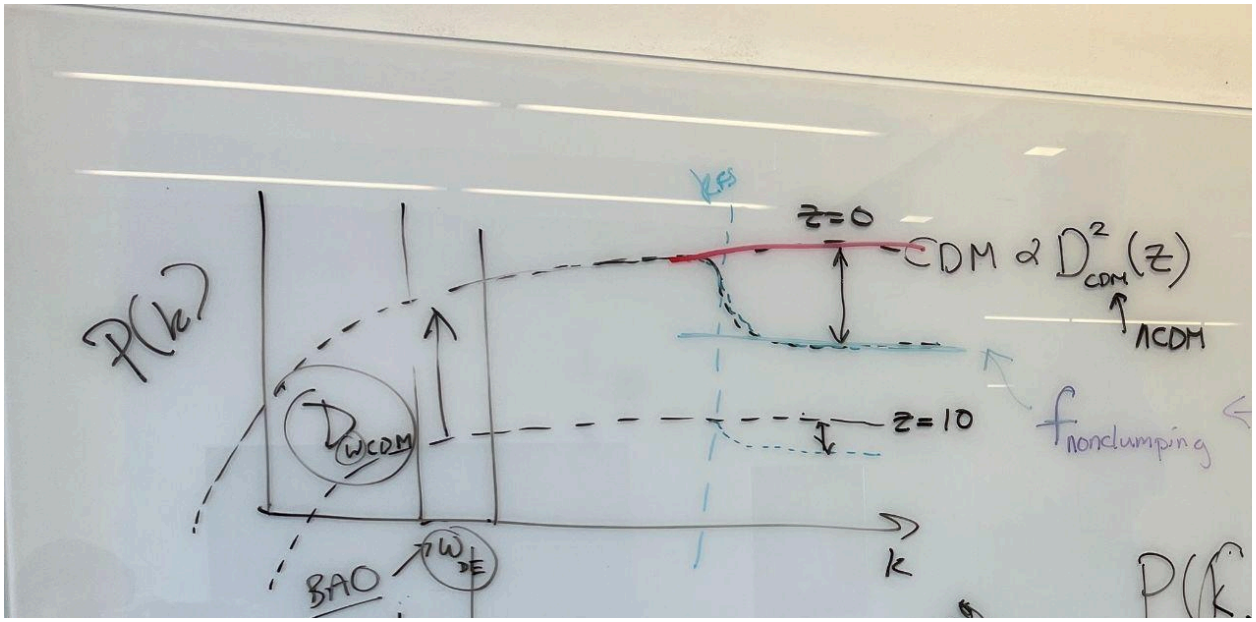
A) More spectra; Lyman-break galaxies have higher sky density (synergy: joint constraints with high-resolution spectra?)
B) Combine P_3D and P_1D measurements to disentangle isotropic dark matter and anisotropic HCD effects (that limit the DESI P_1D analysis)?

1. Lyman-alpha forest

1.1. Derived quantities
  1.1.1. P_linear(k,z) at k ~ 1(?) *h* Mpc^-1, z ~ 3 [amplitude, running, running of running compression] (for example)
  1.1.2. Growth rate from z = 2 to 4 at this pivot wavenumber(?)
  1.1.3. Or work towards P_linear(k,z) in k,z bins (cf. https://arxiv.org/abs/2505.02233 for this approach with weak lensing)?

1.2. High-level scientific outputs
  1.2.1. Measure primordial spectral index and running of spectral index (for example)
  1.2.2. Detect/exclude GUT-scale axion model (for example)
  1.2.3. Constrain general dark matter linear transfer function
  1.2.4. Constrain dark forces by scale-dependent growth rate measurement

1.3. Potential forecasts and “cartoon plots”
  1.3.1. Forecast posterior on pivot wavenumber linear matter power spectrum amplitude/running/running of running/growth rate(?) with dark matter models also projected onto this space
  1.3.2. Cartoon-ish plot showing constraints on scale-dependent evolution of linear matter power spectrum (see workshop plan below – or just project onto standard z = 0 matter power spectrum compilation? – also project dark matter models)



1.3.3. Limits projected onto dark matter model space, e.g., axion particle mass vs. energy density, showing synergy with other probes

1.3.4. Illustrate degeneracy breaking between power spectrum parameters and HCD parameters(?)

2. Galaxy clustering

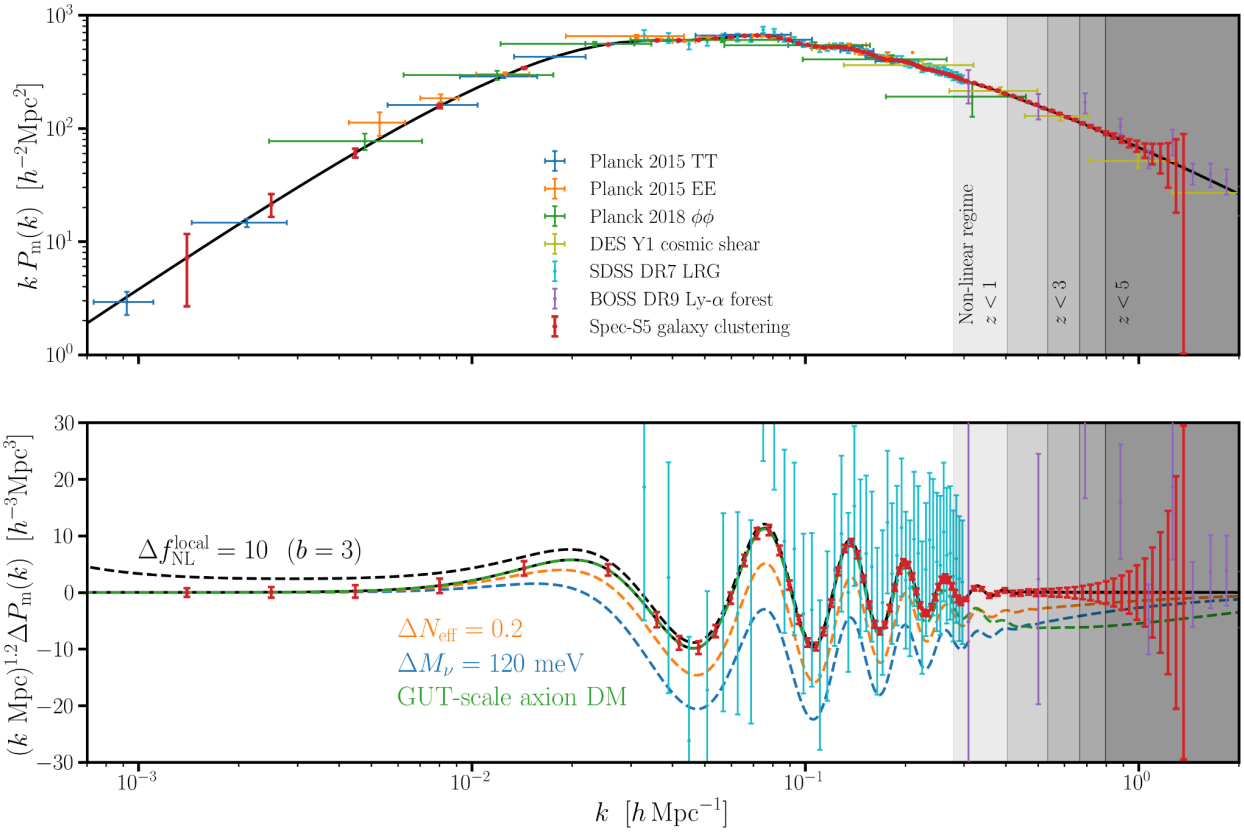
2.1. Derived quantities

2.1.1. Linear matter power spectrum at z = 0

2.2. High-level scientific outputs

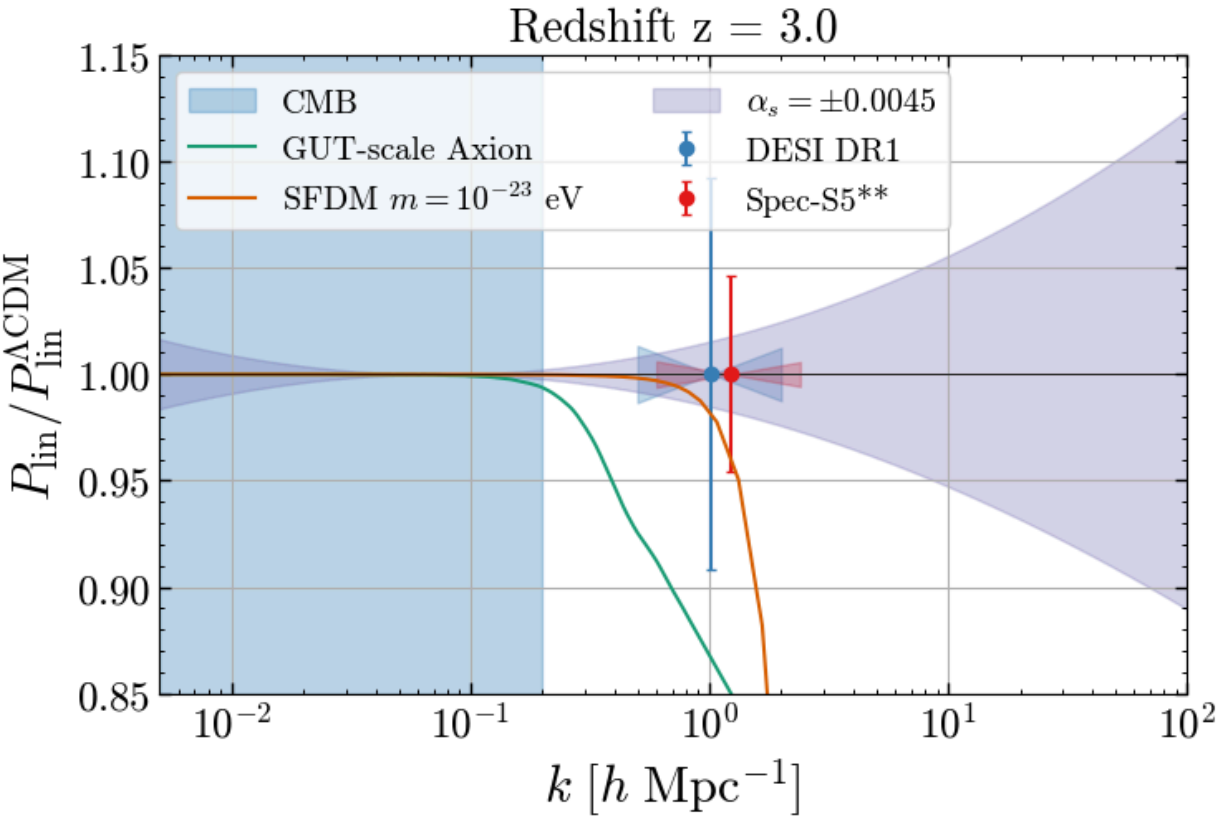
2.2.1. Constrain general dark matter linear transfer function

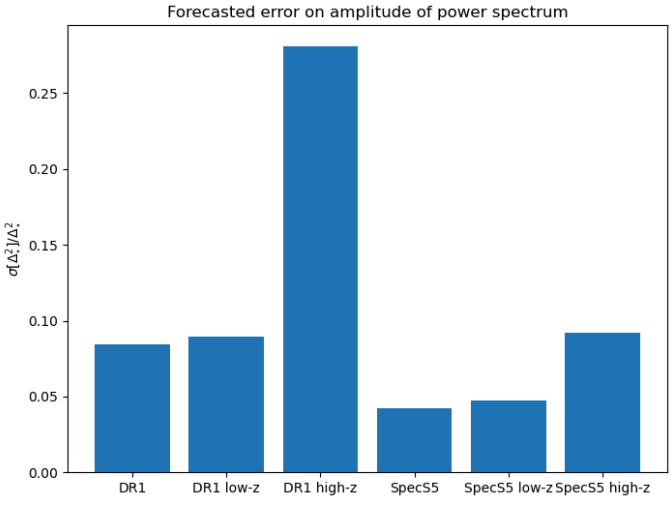
2.3. Potential forecasts and “cartoon plots”



Galaxy clustering

Arizona workshop
Contributors: Alma, Naim, Anoma, Keir, Jonas, Hiram





This is a single-parameter Fisher forecast.

- Preliminary plot and simple forecast
- The current forecast is based on scaling the DR1 P1 covariance, assuming systematics do not improve:
  Dr1 -> Dr3 (Year 5) is a factor of 4
  Dr3 -> Spec-S5 is another factor of 10

$$C_{\rm S5} = C_1^{\rm stat}/4/10 + C_1^{\rm syst}$$

- To improve this, we have been working on the LaCE emulator to forecast Delta2p and np.
- Probably after the workshop, we'll generate LBG mock observations based on numbers from the Spectroscopic Stage-5 Experiment white paper Table 2 and methodology in https://arxiv.org/pdf/2507.21852
- A 2500 per deg^2 LBG target density allows testing small angular scales for DM constraints.
- Using LBG mocks to measure a null Px and its covariance