An emulator for the non-linear matter power spectrum in $f(R)$CDM cosmology

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Structure formation in $f(R)$ gravity

$$\frac{1}{a^2}\nabla^2\phi = \frac{16\pi G}{3}\delta\rho - \frac{1}{6}\delta R(f_R) \quad (1)$$

$$\frac{1}{a^2}\nabla^2 f_R = \frac{1}{3}\left[\delta R(f_R) - 8\pi G\delta\rho\right] \quad (2)$$

- new **scalar field** f_R
- **fifth force** with chameleon screening
- enhanced clustering at **non-linear** scales

Simulations:

- N-body code ECOSMOG [Li et al. 2012, Bose et al. 2017] based on RAMSES [Teyssier 2002]
- Effective volume: $\left(560 h^{-1}\mathrm{Mpc}\right)^3$
- Particle mass resolution: $m_\mathrm{p} \sim 2\cdot 10^{10} h^{-1}\mathrm{M}_\odot$
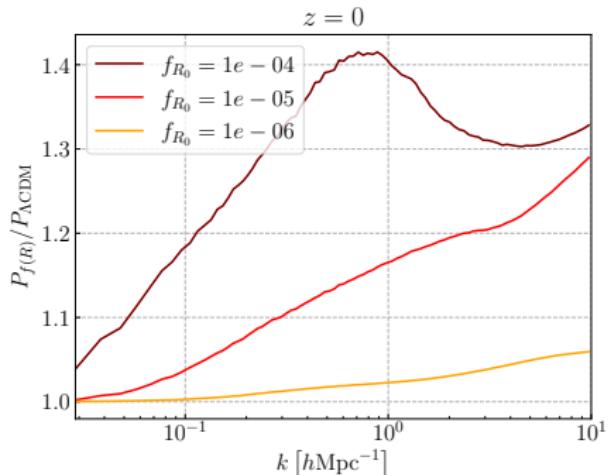
An emulator for the matter power spectrum boost

Power spectrum boost:

- only 3 parameters: f_{R_0}, Ω_m and σ_8
- smaller statistical and systematic errors

$\longrightarrow$ reduced computational needs

Emulation:

- 110 cosmological models
- interpolation: **Gaussian Process**
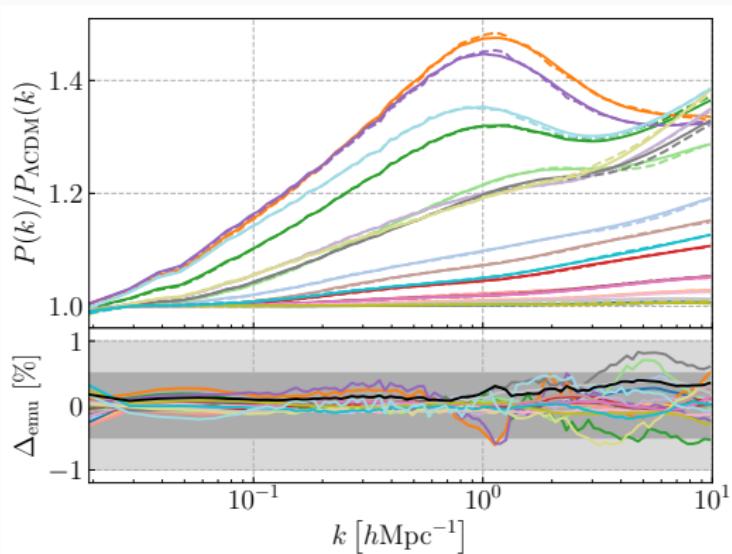
Validation:

- emulation & statistical errors $< 1\%$
- systematic errors $< 3\%$
- $3 \cdot 10^{-2} h\mathrm{Mpc}^{-1} < k < 10 h\mathrm{Mpc}^{-1}$
- $0 < z < 2$

Soon on the arXiv!