Baryonic effects in lensing statistics

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Motivation

❖ Lensing statistics contains useful information about cosmological parameters.
❖ The next generation cosmological data is very promising (Euclid like survey).
❖ Precision cosmology is the key goal.
❖ Universe contains baryons…
Lensing Statistics

\[ n(z) \propto z^\alpha \exp \left[ - \left( \frac{z}{z_0} \right)^\beta \right] \]

\[ \int_0^{\chi_H} n(\chi) d\chi = 1 \]

\[ g_i(\chi) = 2 \frac{c}{H_0} \int n_i(\chi') \frac{\chi(\chi' - \chi)}{\chi'} d\chi' \]

\[ \kappa(\tilde{\theta}) = \frac{3H_0^2 \Omega_m}{4c^2} \int_0^{\chi_H} \frac{g(\chi)}{a(\chi)} \delta(\chi \tilde{\theta}, \chi) d\chi, \]

\[ C_{ij}(\ell) = \frac{9H_0^4 \Omega_m^2}{16c^4} \int \frac{g_i(\chi)g_j(\chi)}{a^2 \chi^2} P \left( \frac{\ell}{\chi}, \chi \right) d\chi \]

Smail et. al. 1994
**Dark matter only (DMO) universe**

\[
\rho(r|M) = \frac{\rho_s}{(r/r_s)^\alpha(1 + r/r_s)^\beta},
\]

\[
u(x|M) = \frac{\rho(x|M)}{\int_0^c 4\pi x^2 \rho(y|M) dy}.
\]

\[P(k) = P_{1h}(j) + P_{2h}(k),\]

\[P_{1h} = \int d\nu f(\nu) \frac{M}{\rho} |u(k|\nu)|^2,\]

\[P_{2h} = \left(\int d\nu f(\nu) u(k|\nu)b(\nu)\right)^2 P_{\text{lin}}(k),\]

\[\alpha = 1, \beta = 2 \Rightarrow \text{NFW profile}\]

Navarro et al. 1997
An analytic model for baryons

\[ \rho_{mNFW}(r) = \rho_{ac}^{NFW}(r) + \rho_{m*}(r) + \rho_{gas}(r), \]

\[ f_{\text{gas}} = \frac{0.15}{1 + \left( \frac{M_{\text{crit}}}{M_{\text{halo}}} \right)^\beta} \]

\[ f_{\text{DM (AC)}} = f_{\text{DM}} + \text{Boost} \]
Baryonic fit with free $M_{\text{crit}}$

Baryonic fit with fixed $M_{\text{crit}}$

DMO fit
ongoing...

- Adiabatic contraction,
- Tomography,
- Covariance matrix - Gaussian and non-Gaussian,
- Fisher analysis and MCMC.
Thank you for your attention...