Cosmology and primordial non-Gaussianity with the X-ray cluster survey eROSITA

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from A. Pillepich, C. Porciani and T. Reiprich 2011, to be submitted

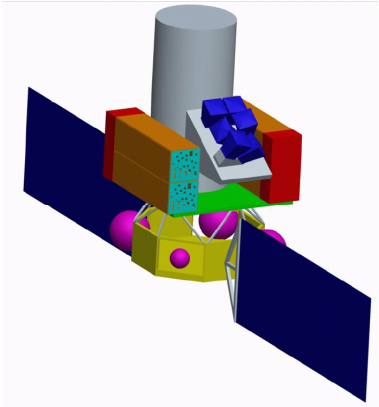
The telescope eROSITA

eROSITA:
german-russian
telescope
to be launched in 2012.

~ 1.6 x10^5 X-ray clusters of galaxies
(> 5 x 10^{13} M_sun/h)

- full sky (27,000 deg^2)
- cts_{min} = 50 photons
- Band 0.5-2 keV

PARAMETERS: **cosmological + fnl + scaling-relation**



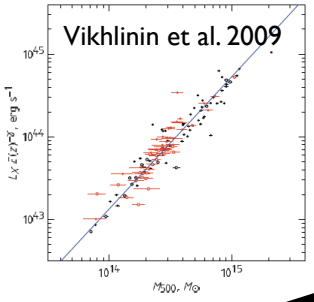
QUANTITIES: cluster abundances + angular clustering

OBSERVABLE: **raw photon counts**

Optical follow-up for photo-z... ?

From the Mass to the X-ray observable

$$\mu_L \equiv \langle \ln L_X \rangle = [\beta_{\rm LM} + 1.5(\sigma^2_{\rm lnL} - 0.396^2)] \quad (16)$$
$$+ \alpha_{\rm LM} \ln(M_{500}/3.9 \times 10^{14})$$
$$+ \gamma_{\rm LM} \ln E(z) - 0.39 \ln(h/0.72) \pm \sigma_{\rm lnL},$$

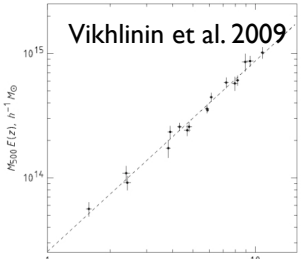


L_X (erg/s)

M_{500} (M_{sun}/h)

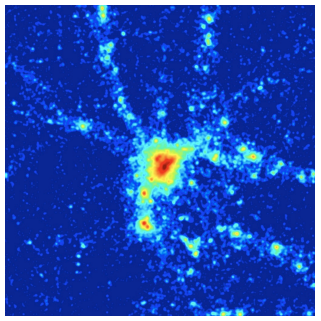
$$P(cts^*|M) = \int dL_X\, dT_X\, P(cts^*|L_X, T_X)\, P(L_X, T_X|M)$$

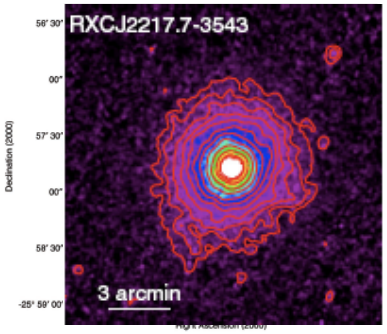
photon counts

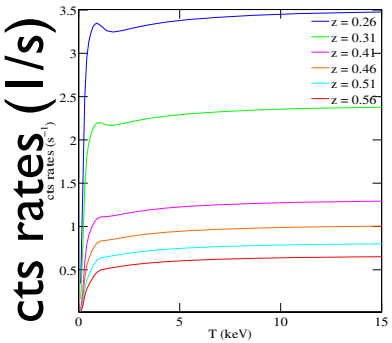


T_X (KeV)

$$\mu_T \equiv \langle \ln T_X \rangle = \alpha_{\rm TM} \ln(M_{500}/\beta_{\rm TM}) + \alpha_{\rm TM} \ln E(z)$$
$$+ \ln(5{\rm keV}) \pm 0.119 \quad (18)$$







cts rates (1/s)

T (keV)

Results with eROSITA: self-calibration

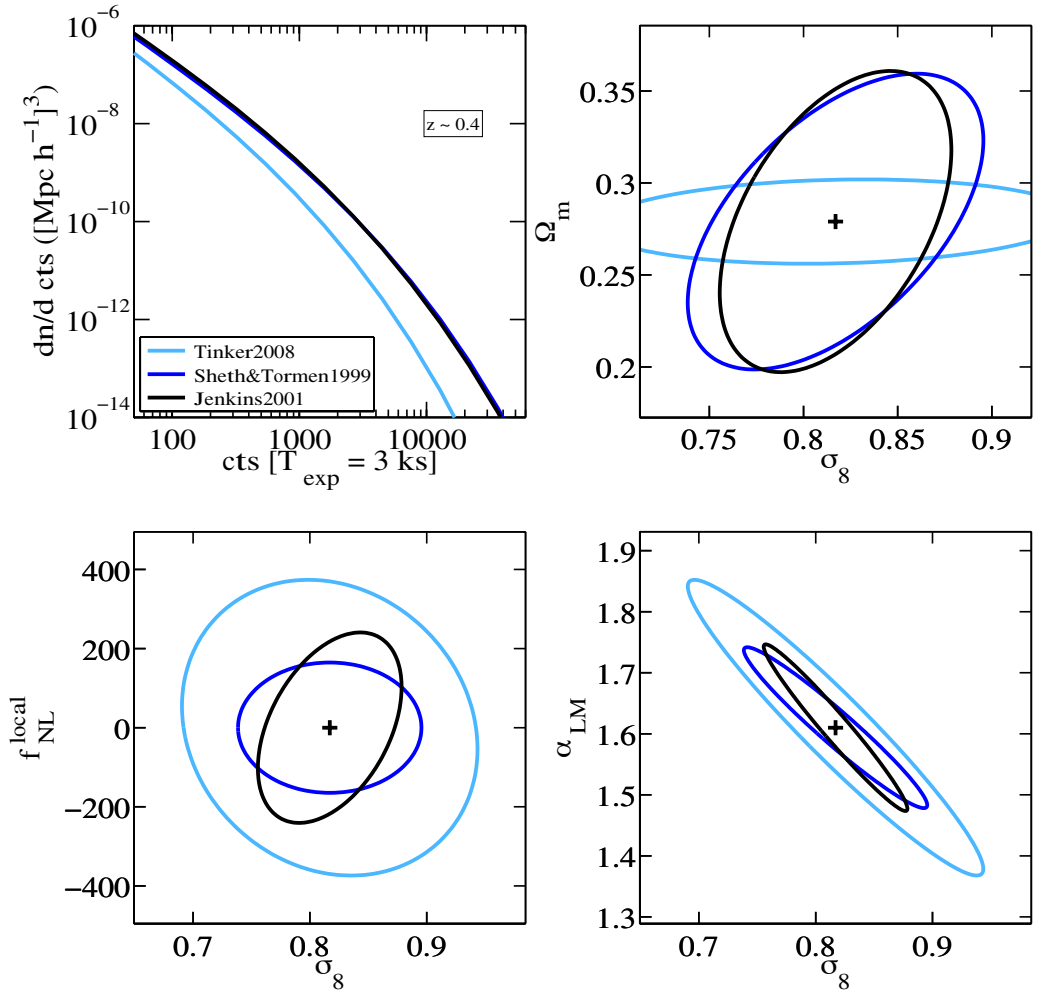
	FoM	$\Delta f_{\rm NL}^{\rm local}$	$\Delta\sigma_8$	$\Delta\Omega_{\rm m}$	Δn_s	Δh
Errors at 2009[a]	-	$-9 < f_{\rm NL}^{\rm local} < +111$[b]	0.026	0.0073	0.013	0.013
Counts	2.2	$\sim 7.6 \times 10^3$	~ 1.6	~ 0.4	~ 2.3	~ 3.0
Counts w/ photo-z	11.9	248	0.084	0.0152	0.402	0.419
Angular Clustering	9.3	22	0.136	0.0389	0.378	0.593
Tomography w/ photo-z	12.8	6.6	0.135	0.0284	0.185	0.213
Counts + Angular Clustering	12.8	21	0.071	0.0315	0.288	0.514
Counts + Tomography w/ photo-z	17.4	6.1	0.034	0.0102	0.071	0.111
Counts + Angular Clustering + Planck	20.5	18	0.006	0.0027	0.022	0.007
Counts + Tomography w/s photo-z + Planck	23.1	5.1	0.002	0.0023	0.006	0.007
Planck Errors 2012[c]	-	-	0.022	0.0027	0.007	0.031

+ Ω_b and X-ray scaling relation parameters ...

With future X-ray cluster surveys, we will get very good constraints on the primordial non-Gaussianity!!!

But...

Adopted prescriptions for the halo mass function (e.g.)



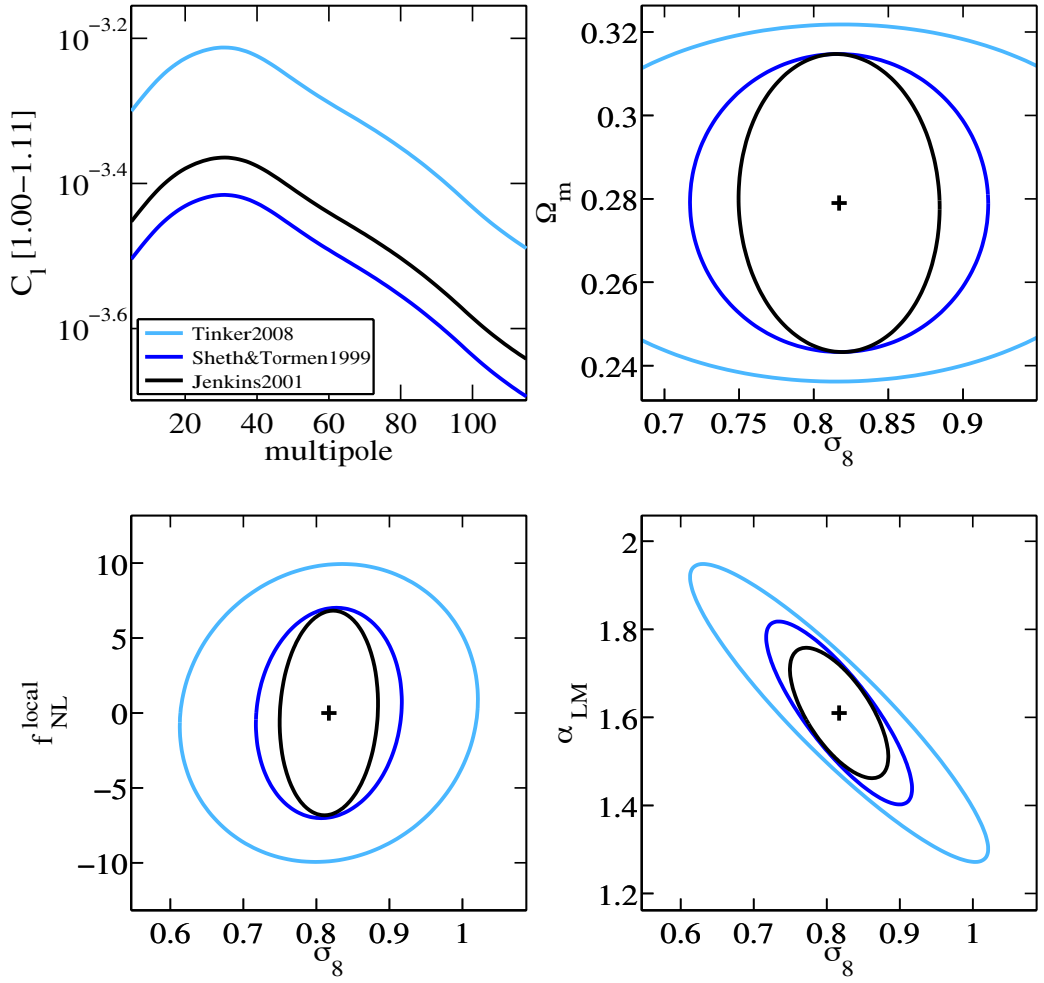
Counts:

$\Delta f_{NL}^{local} = 248$
(Tinker:2008)

$\Delta f_{NL}^{local} = 109$
(Sheth&Tormen:1999)

$\Delta f_{NL}^{local} = 159$
(Jenkins:2001)

Adopted prescriptions for the halo mass function (e.g.)



Tomography:

$\Delta f_{NL}^{local} = 6.6$
(Tinker:2008)

$\Delta f_{NL}^{local} = 4.6$
(Sheth&Tormen:1999)

$\Delta f_{NL}^{local} = 4.5$
(Jenkins:2001)