Simulated eROSITA observations of the Virgo cluster

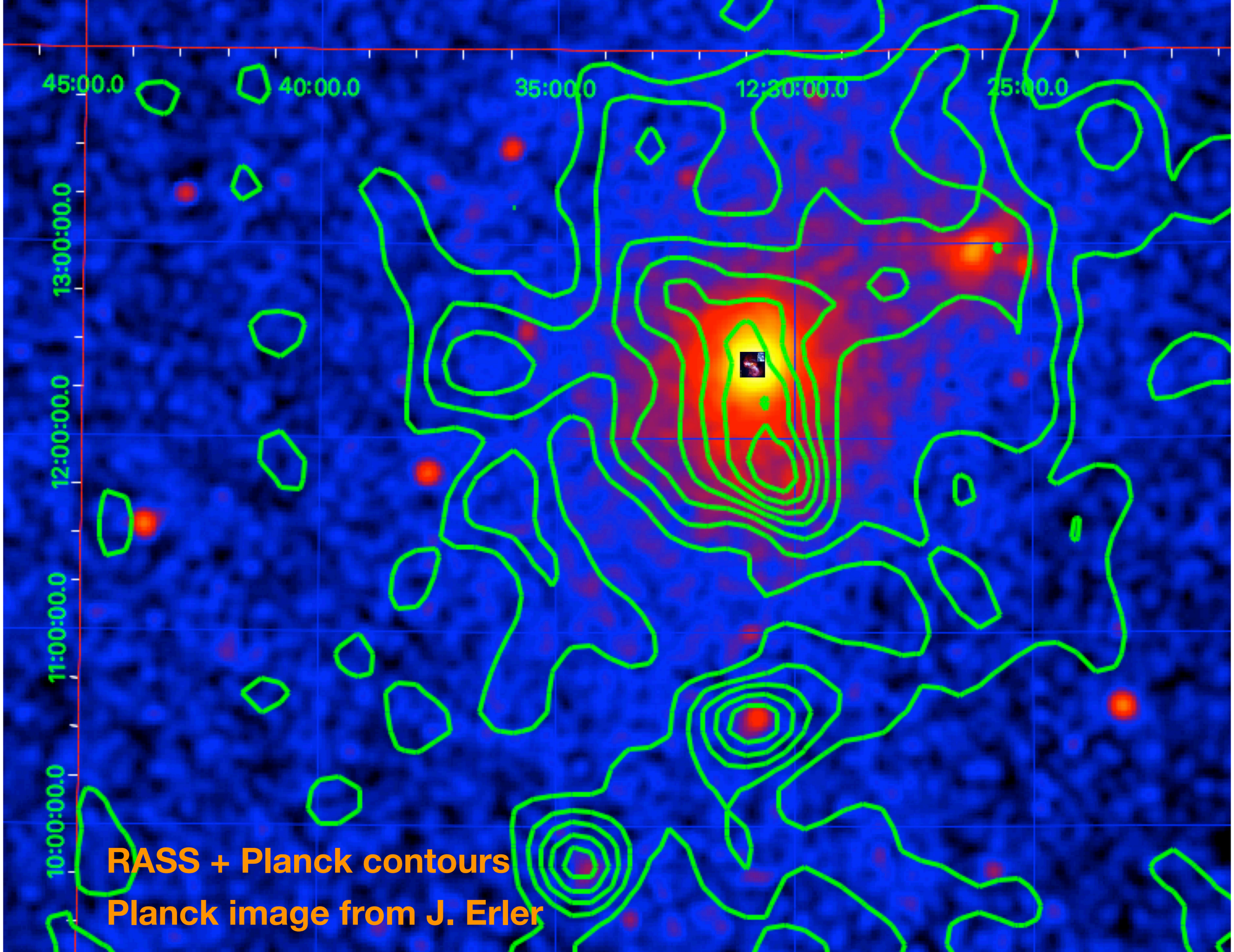
Masterarbeit from Antonio Perez Ibáñez

Talk by **Miriam Ramos-Ceja**

Motivation

Predict how well we will be able to use eROSITA observations to constrain the underlying brightness and temperature distributions in the outskirts of very extended galaxy clusters.

- Virgo cluster
- Use of SIXTE, srctool, and XSPEC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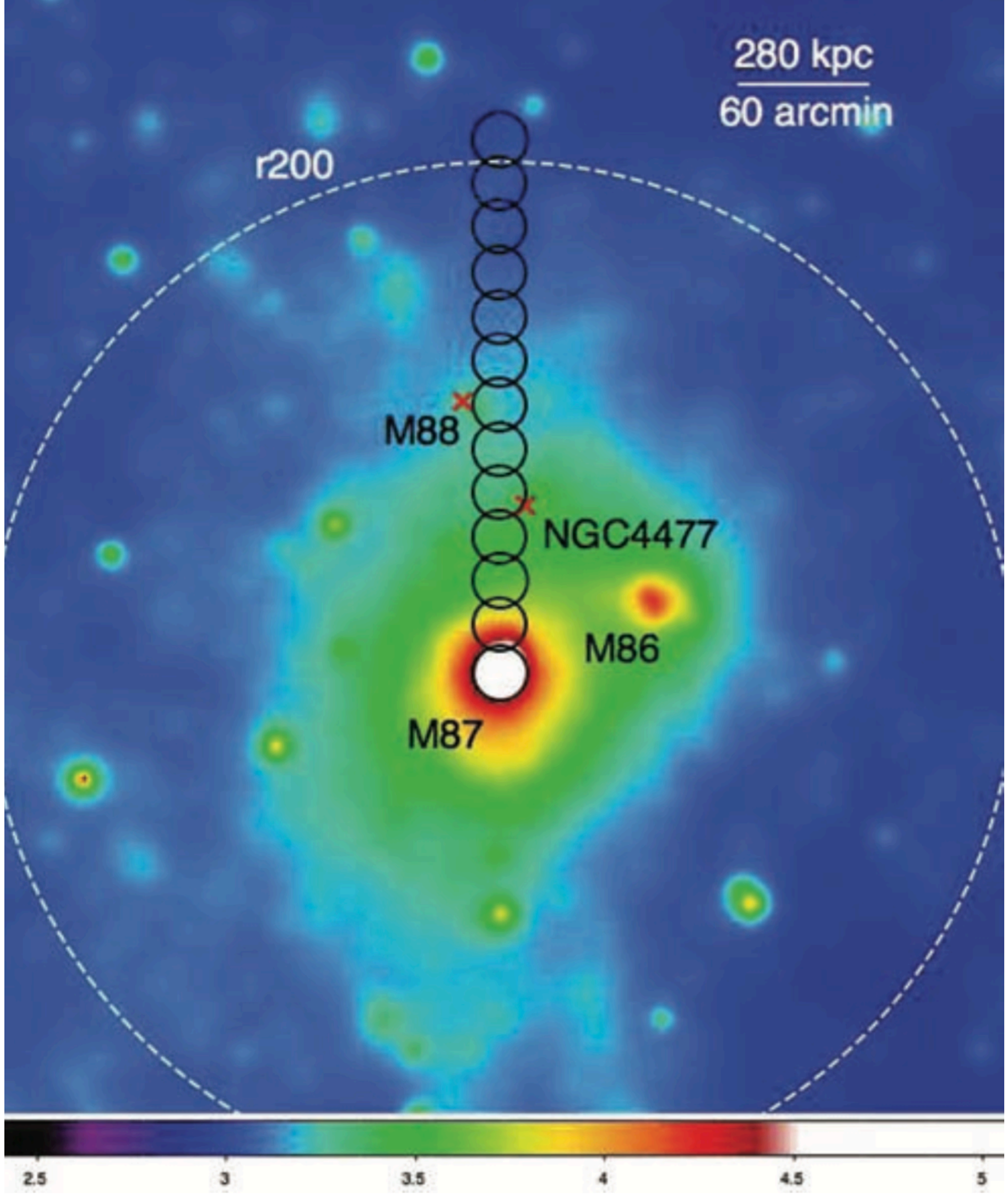
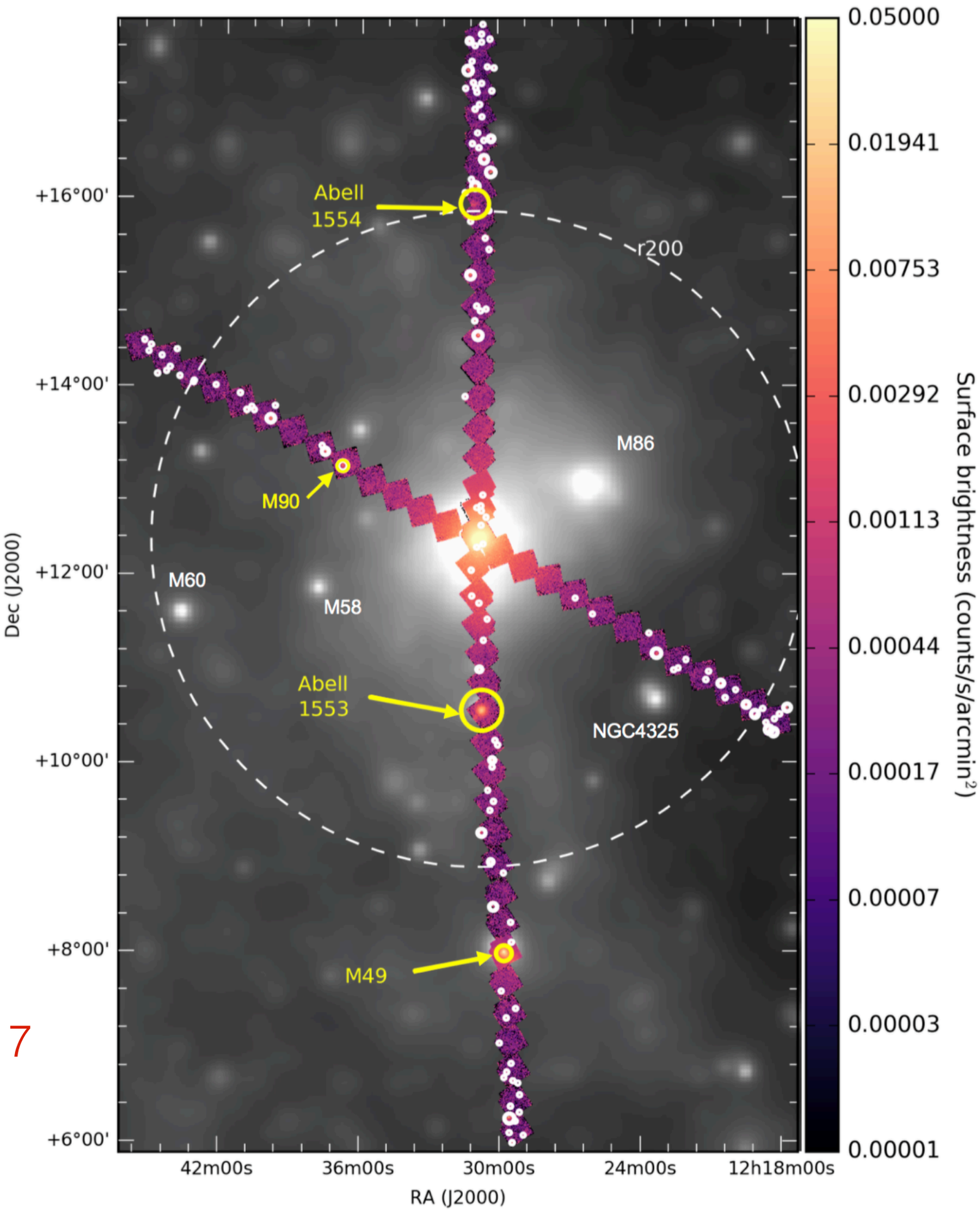
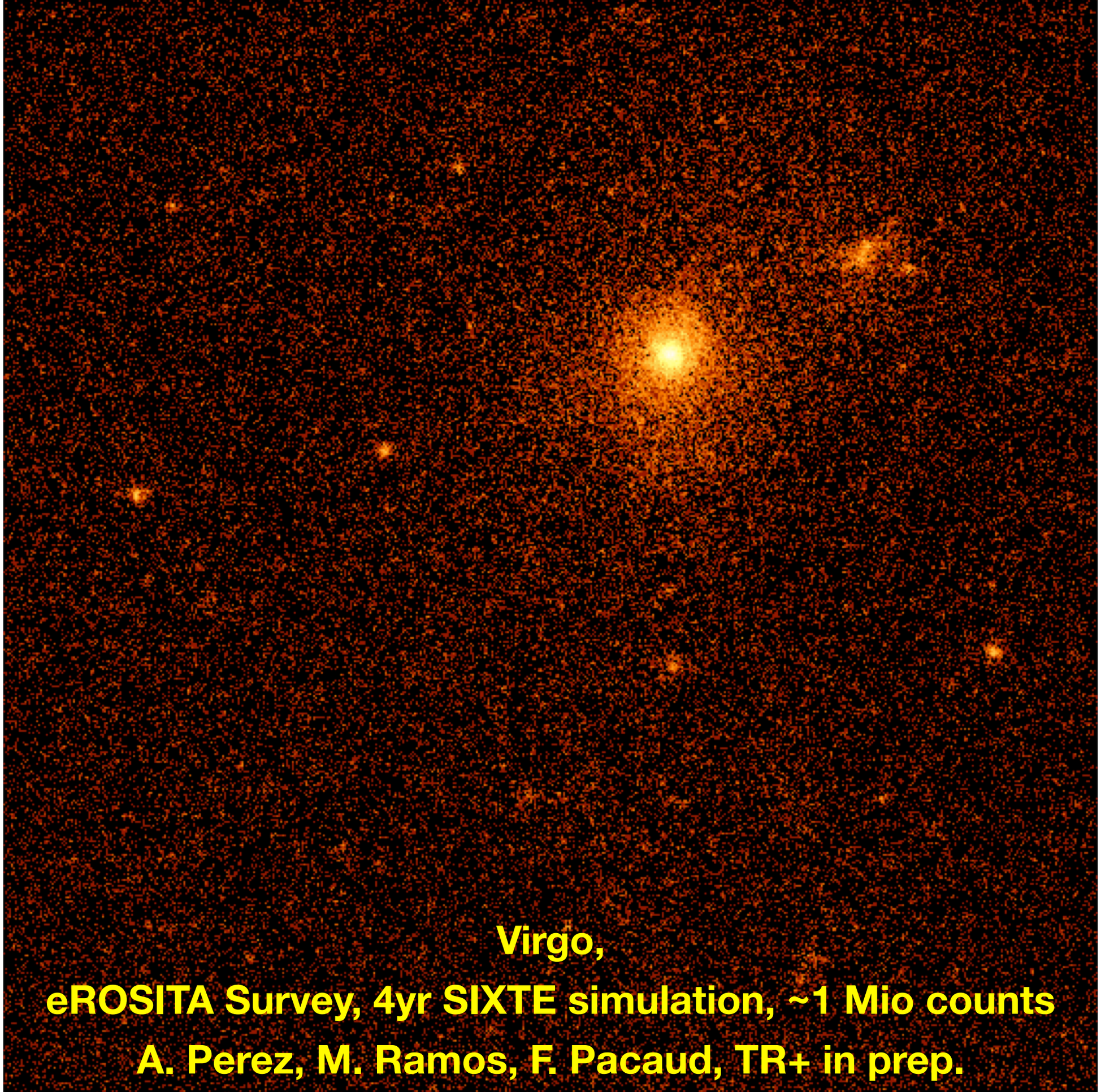
RASS + Planck contours
Planck image from J. Erler



RASS +
XMM-Newton
Urban+11

RASS +
Suzaku,
Simionescu+17

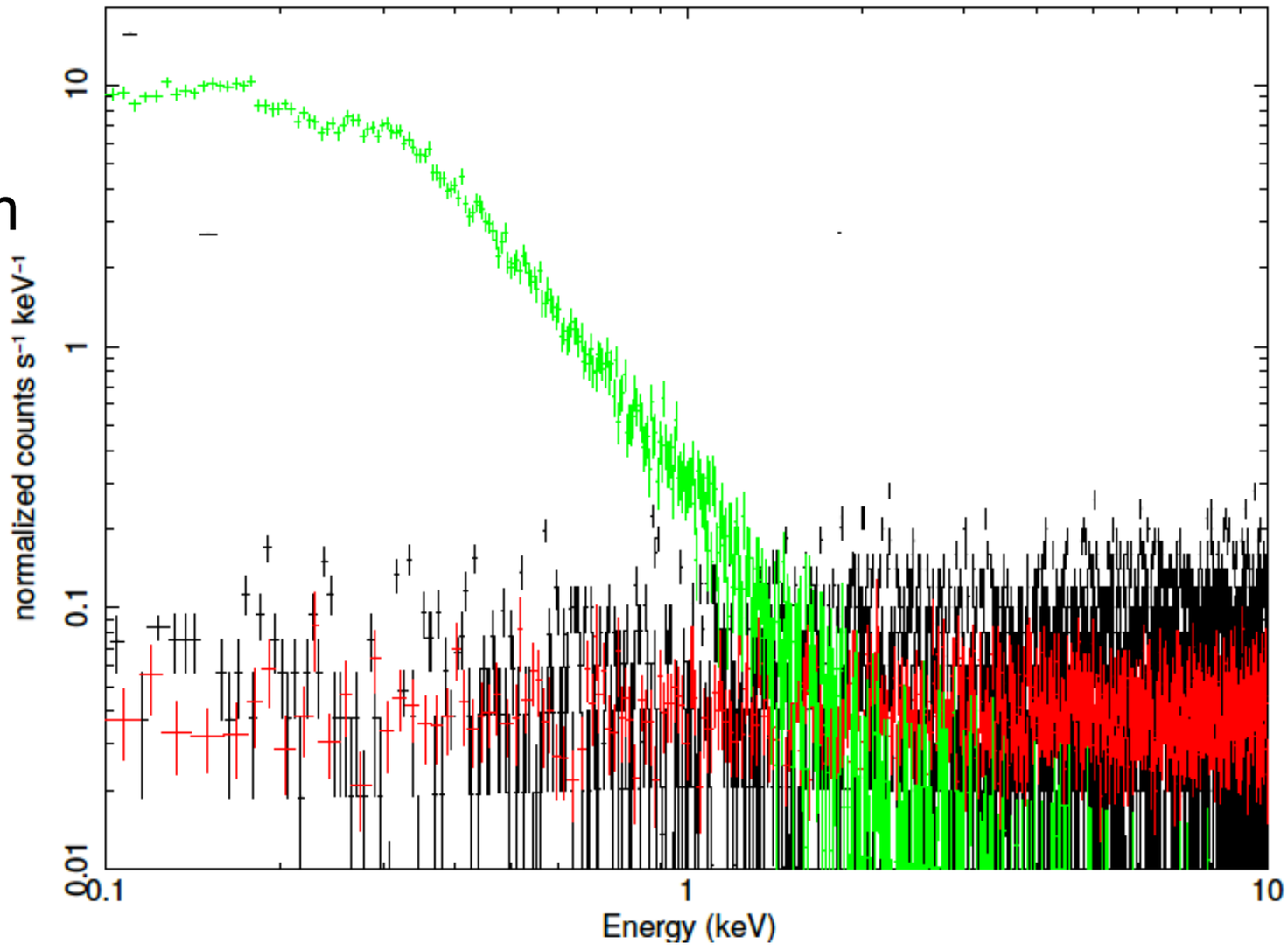



Virgo,
eROSITA Survey, 4yr SIXTE simulation, ~1 Mio counts
A. Perez, M. Ramos, F. Pacaud, TR+ in prep.

I. Simplified model: Isothermal β-model

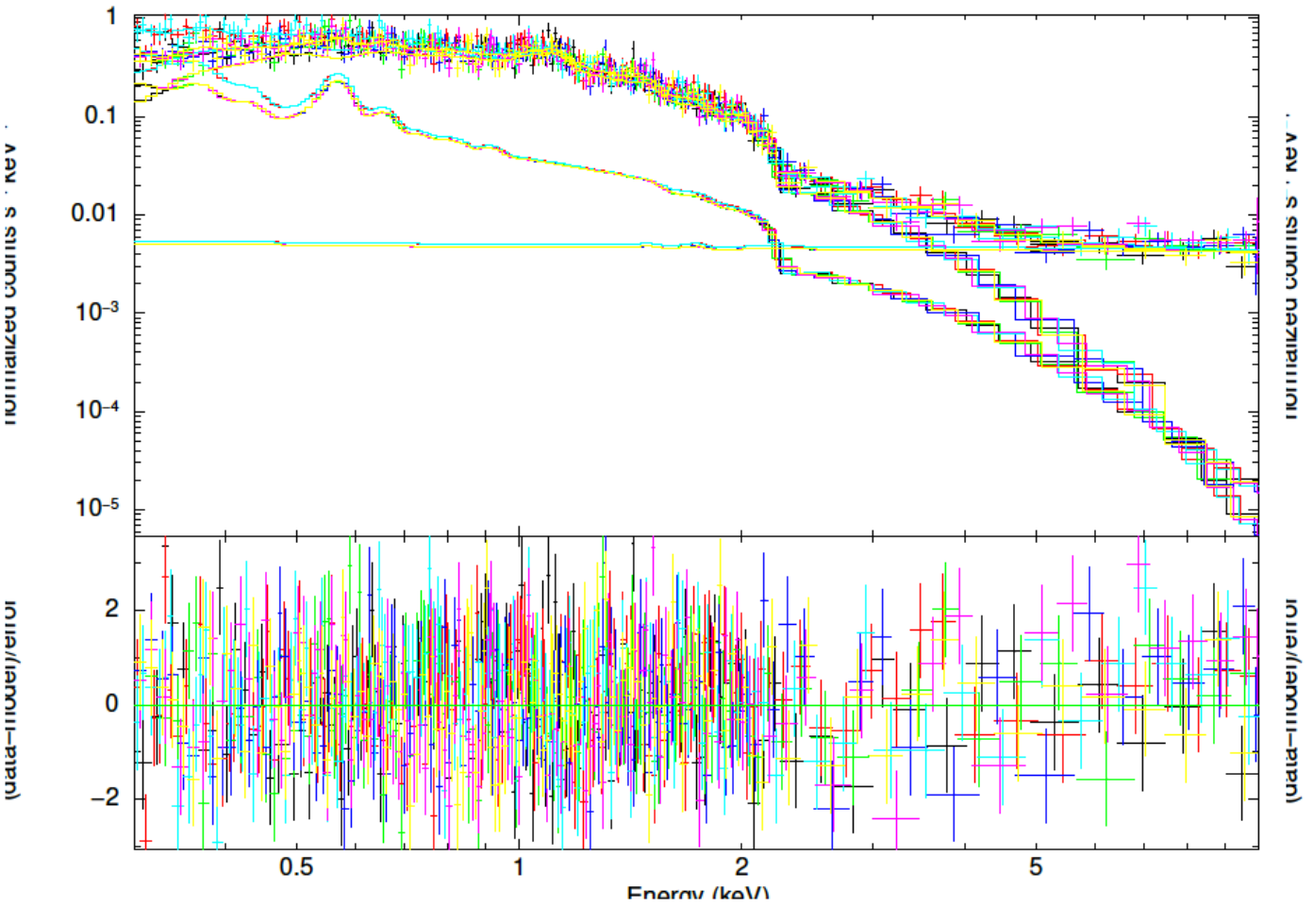
- Particle background:
  - SIXTE 2.1.0
  - SIXTE 2.3.0
    - Reported to SIXTE team
  - SIXTE 2.4.11

- Exposure time: 4 years



I. Simplified model: Isothermal β-model

Annulus 0.7° - 0.8°

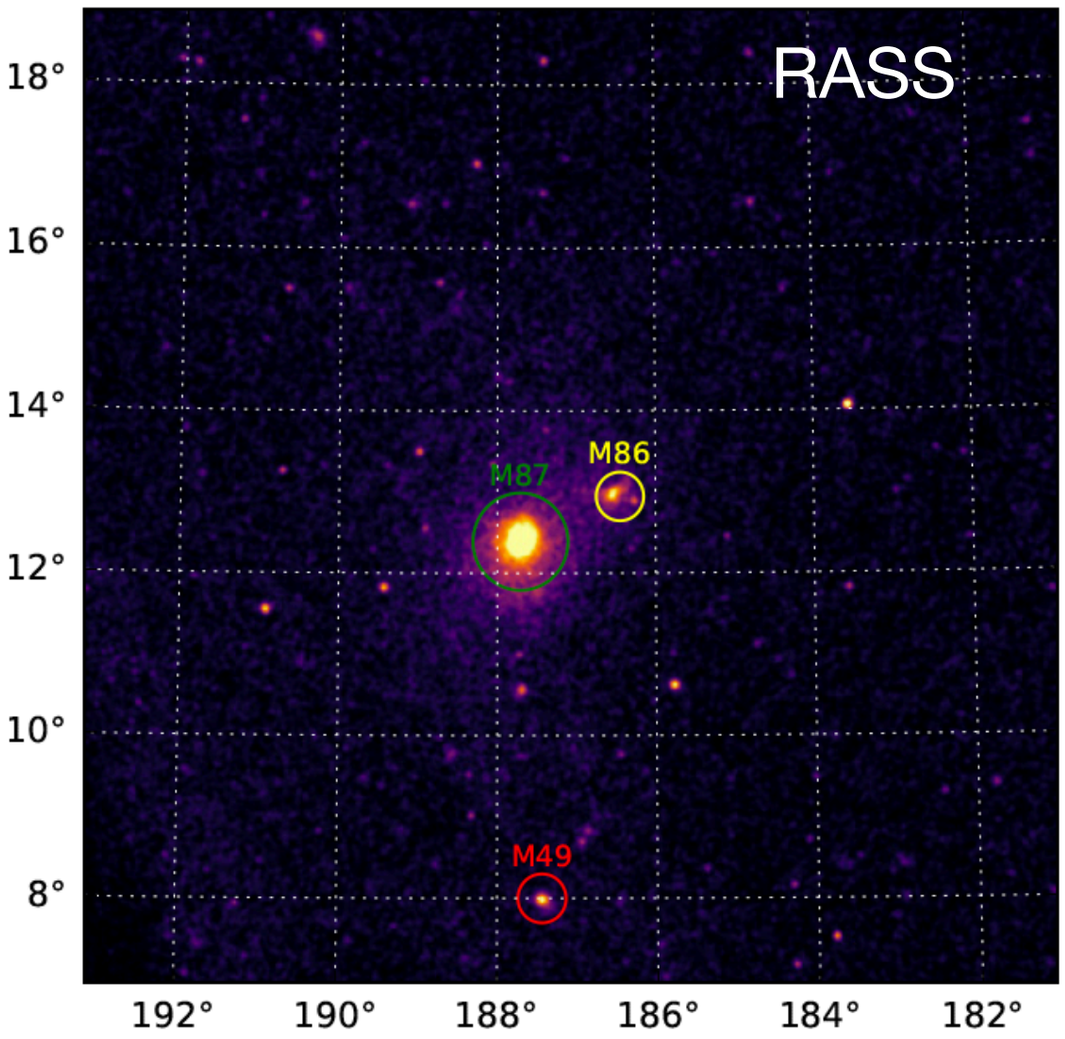


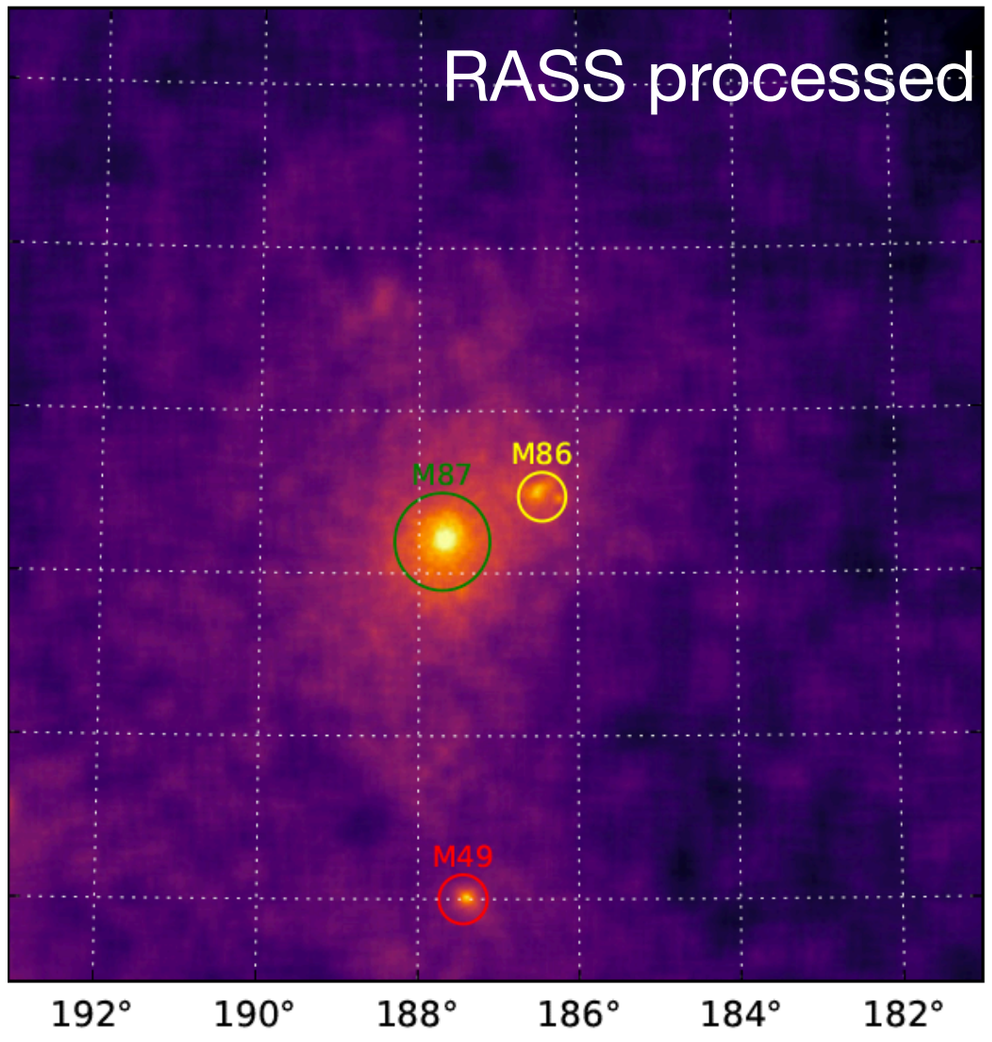
Annulus 2.9° - 3.2°

Only occurs for the outer annuli
—> problem with ARF calculation?

II. Realistic simulation: Virgo cluster

- Source brightness distribution from the RASS image
- Field size: 12x12 deg^2
- Remove point sources, remove XRB, smooth and correct for exposure map





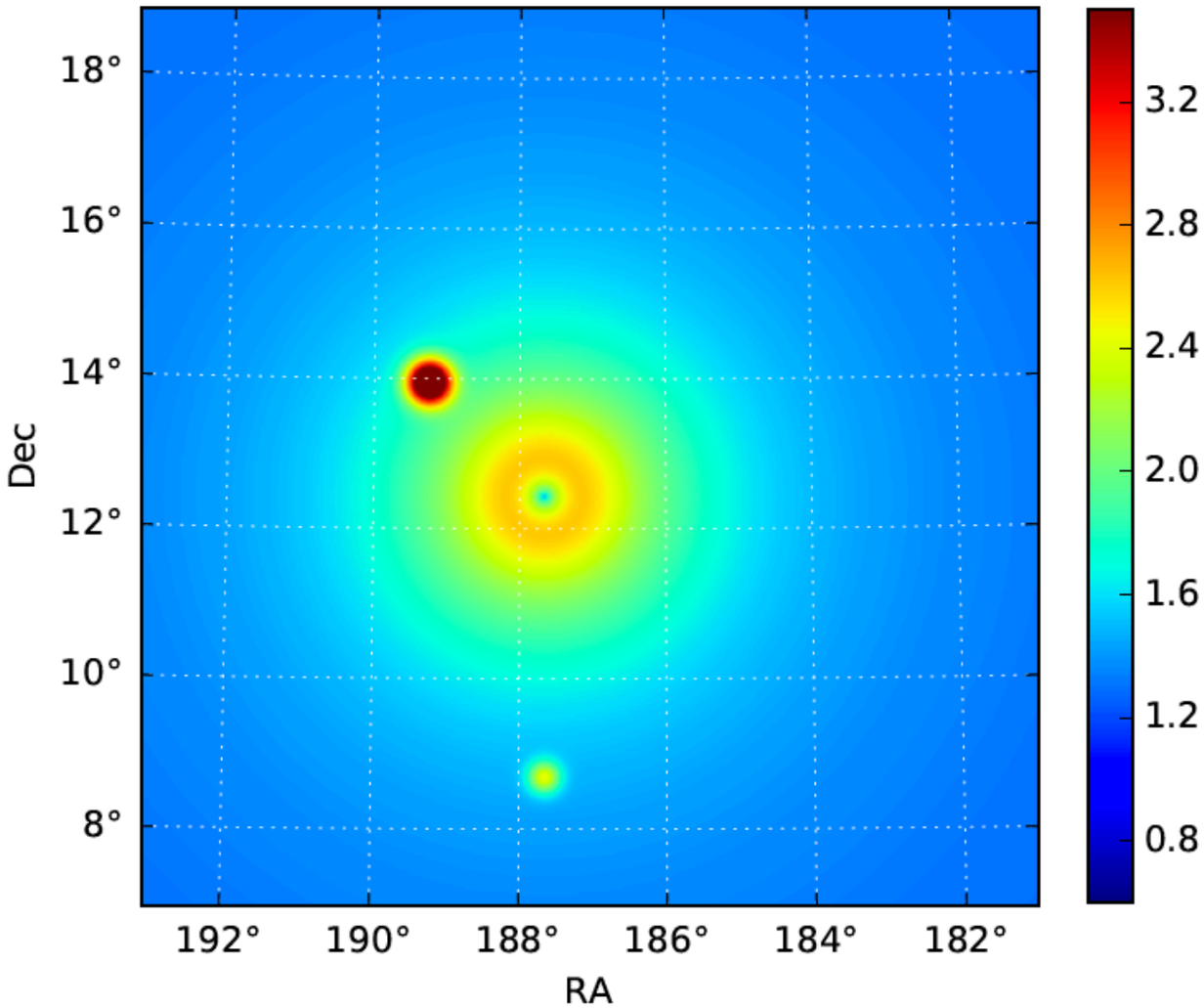
II. Realistic simulation: Virgo cluster

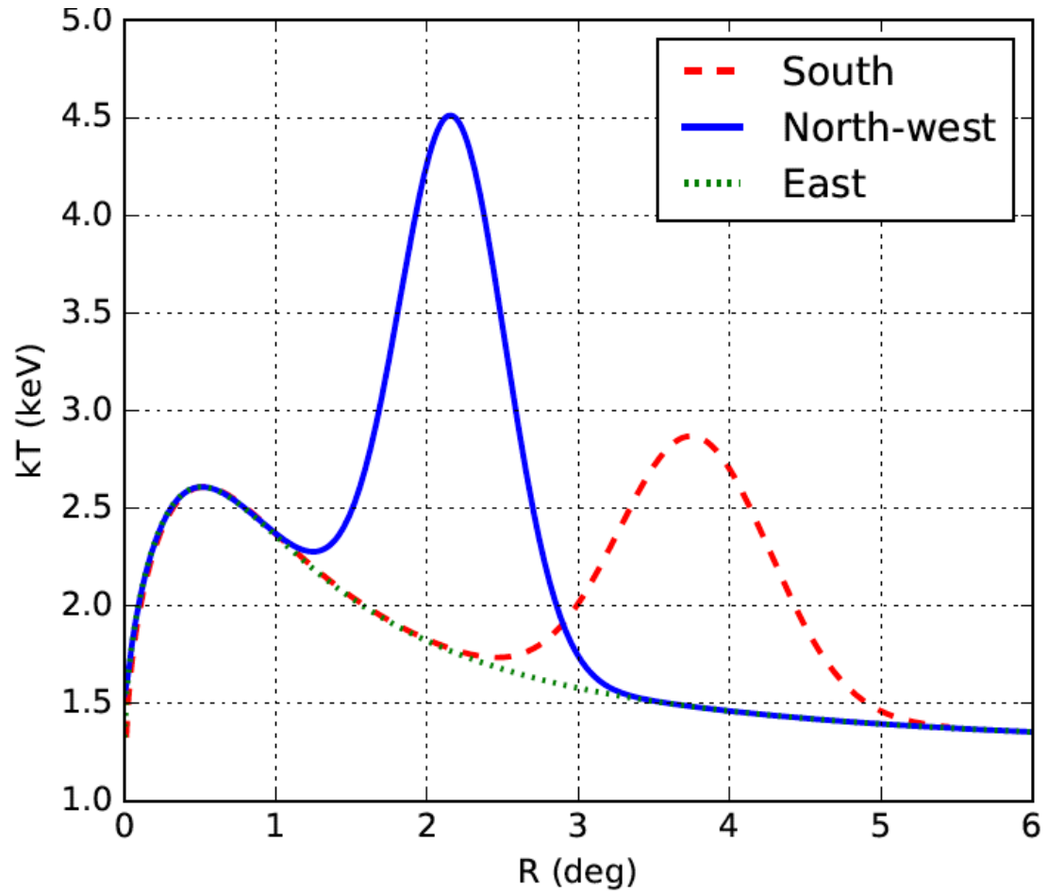
- Temperature model: Durret+05

$$T(R) = T_0 + 2T_0 \frac{(R/r_t)^{1/2}}{1+(R/r_t)^2}$$

Plus two “temperature jumps”

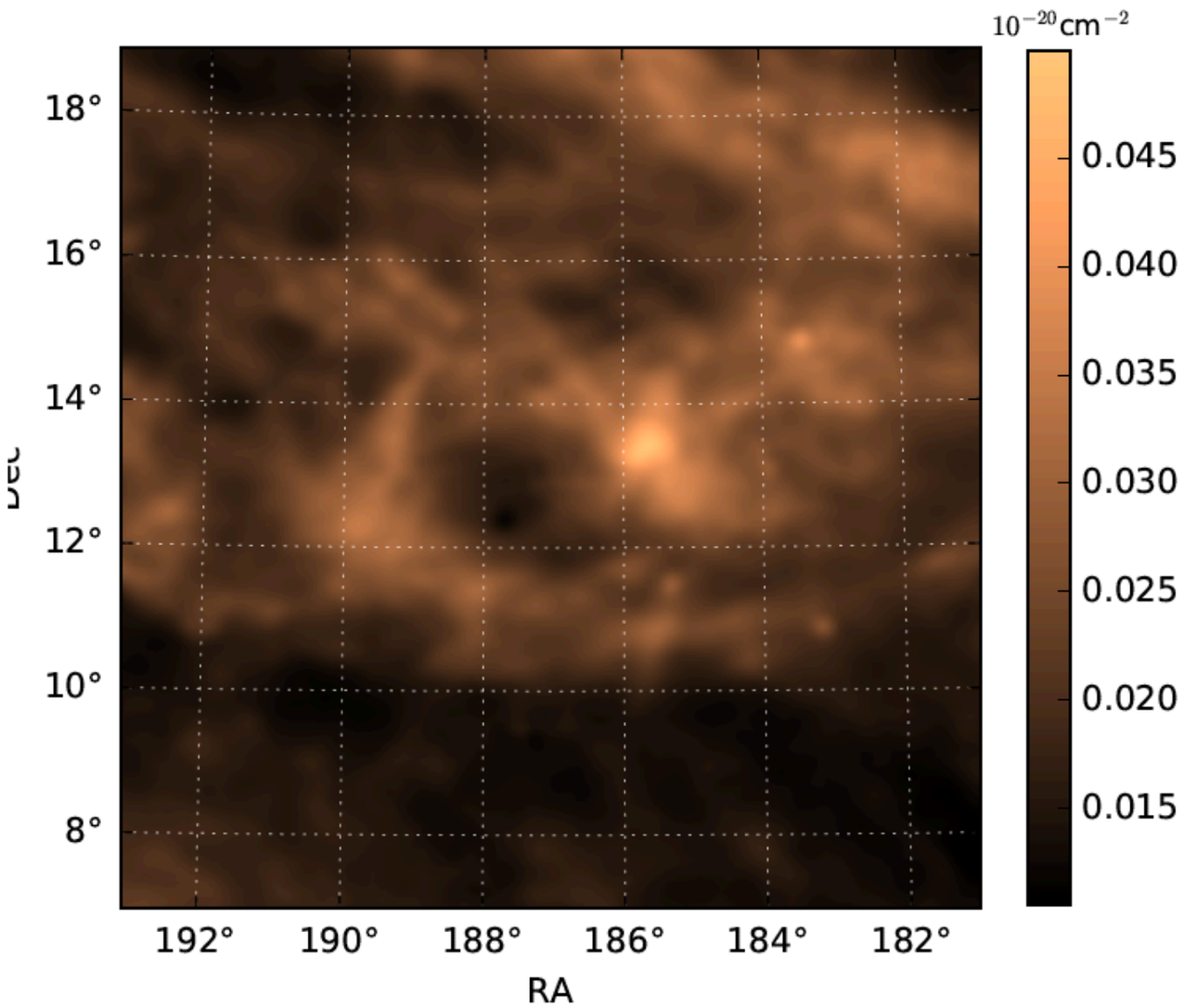
$T_0 = 1.22 \pm 0.04$ keV, $r_t = 53 \pm 7$ arcmin



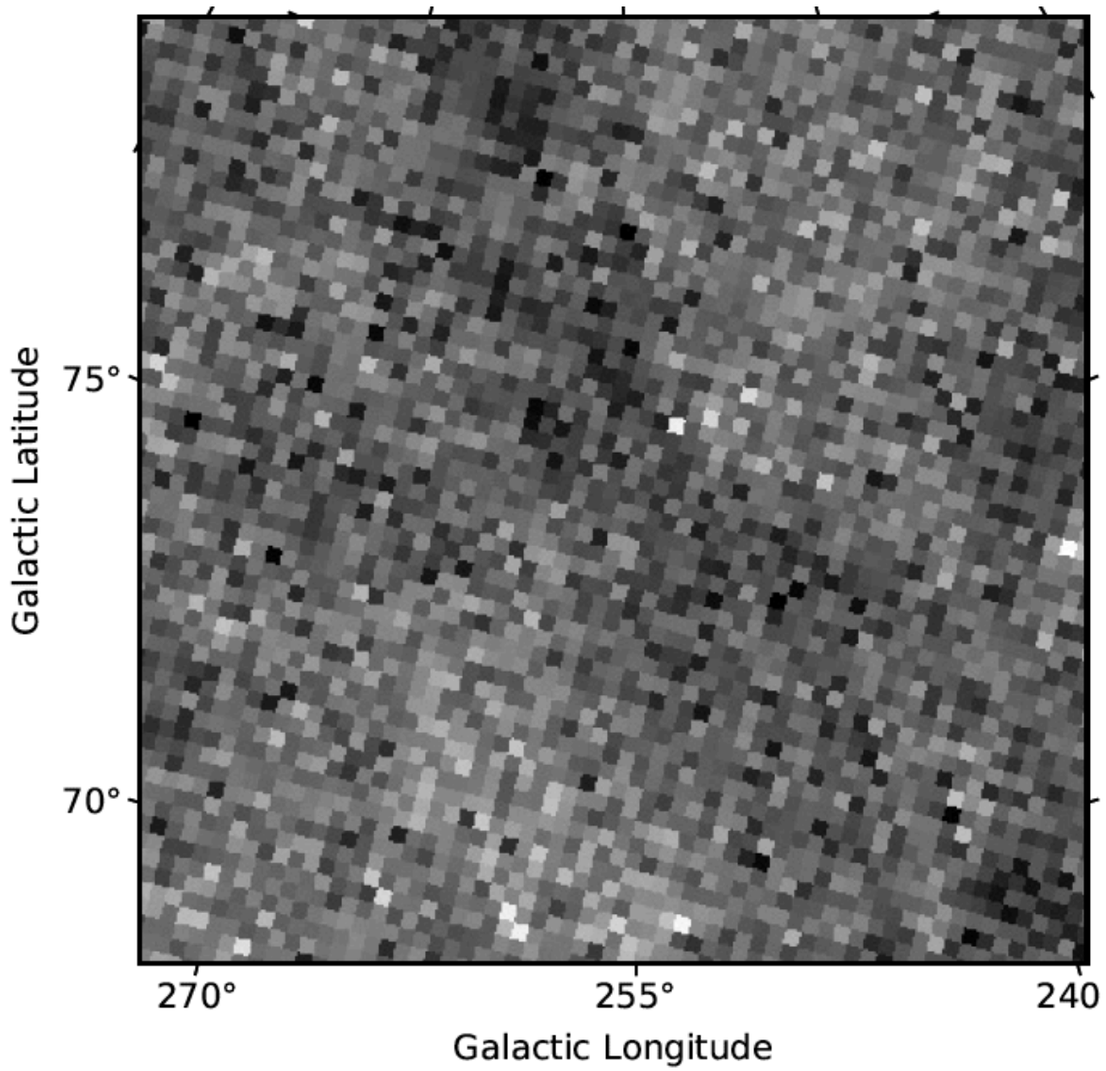


II. Realistic simulation: Virgo cluster

- Include variation in the N_H and in the X-ray background surface brightness distributions:



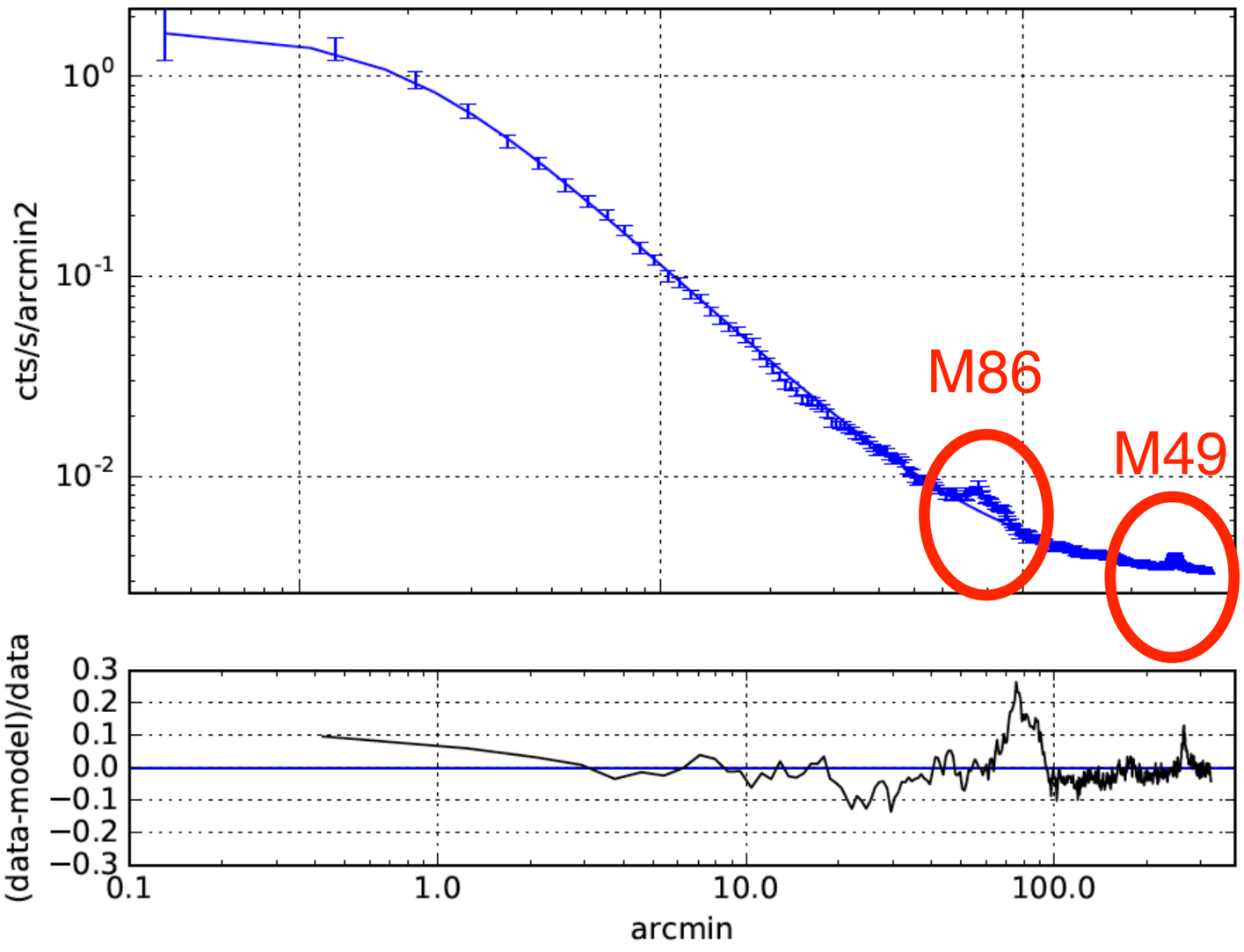
From HI4PI collaboration+16



ROSAT diffuse background map (R2 band) at the same Galactic latitude as the VIRGO cluster

II. Realistic simulation: Virgo cluster

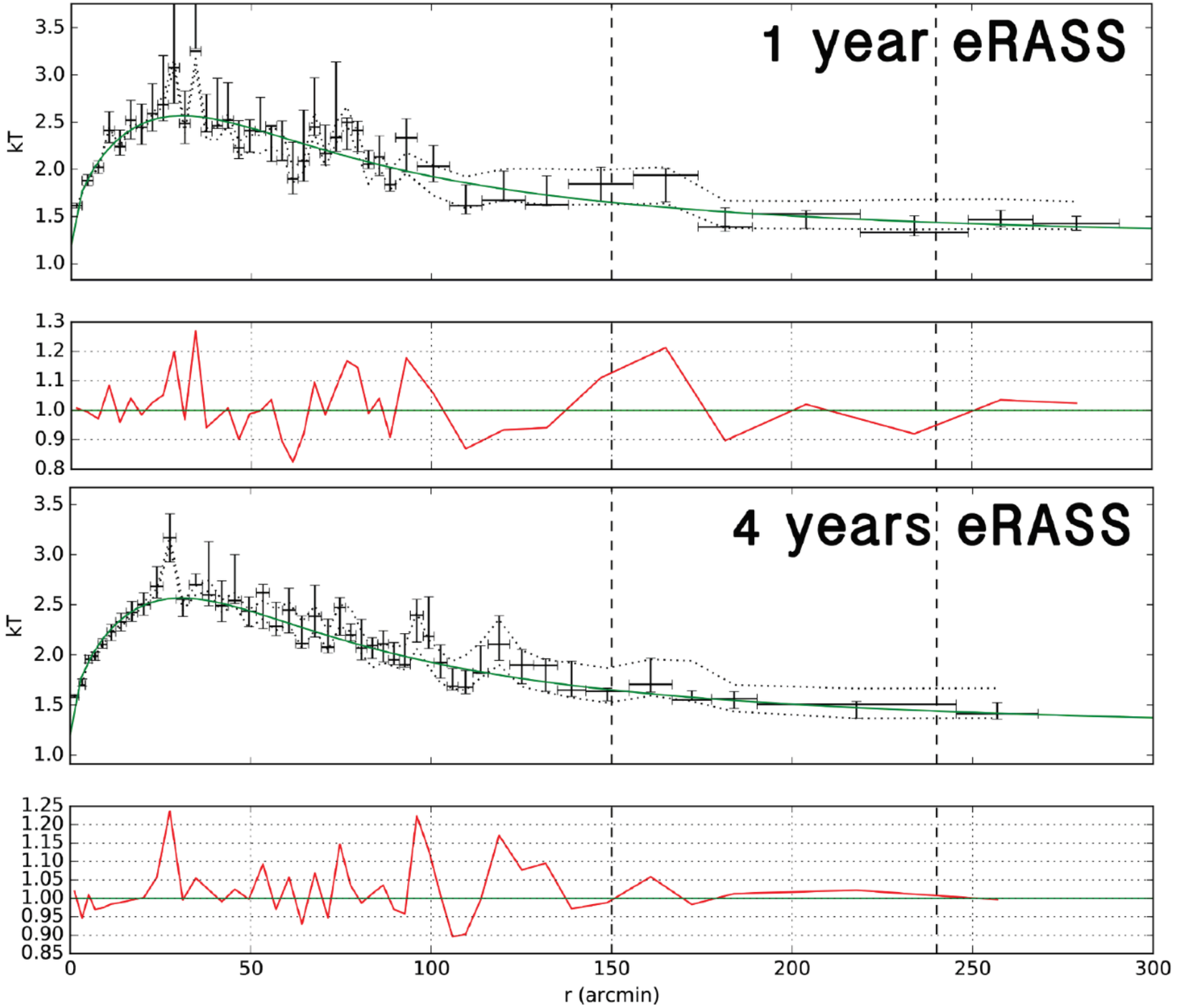
- Surface brightness profile:



- Best fit parameters:
  - $\beta = 0.451 \pm 0.003$ (0.470)
  - $r_c = 2.1 \pm 0.4$ arcmin (2.7)

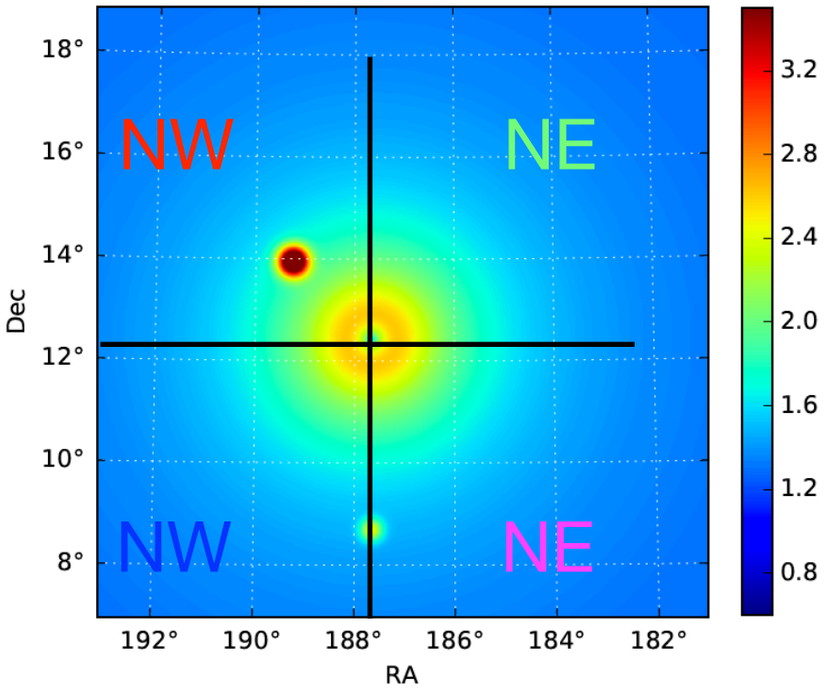
II. Realistic simulation: Virgo cluster

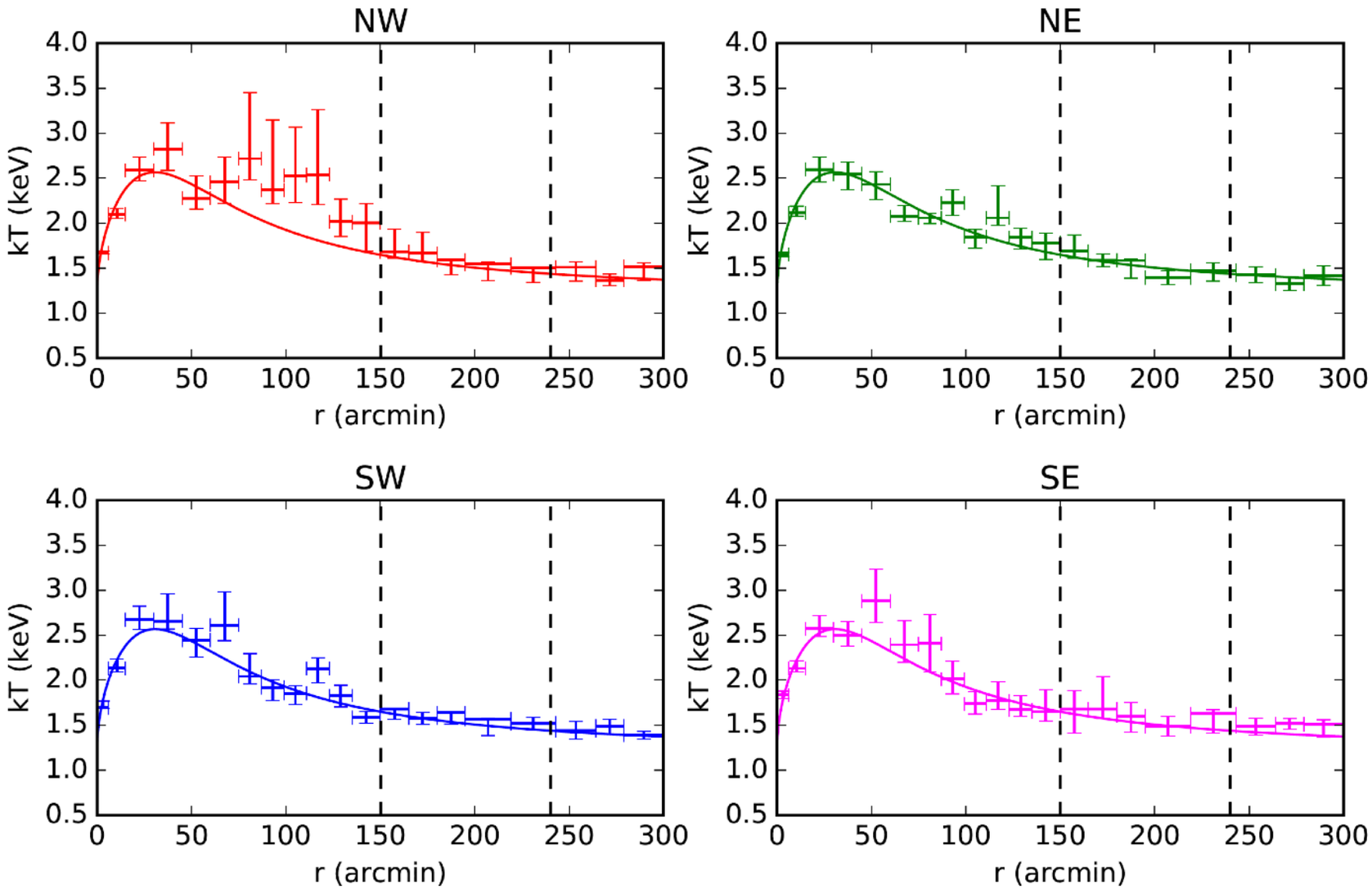
- Temperature profile:



II. Realistic simulation: Virgo cluster

- Temperature profile:





Conclusions

- Temperatures on Virgo will be accurately measured with eROSITA up to r_{200}
- Temperature jumps around r_{200} can be recovered in sectors
- Future eSASS (full band) and SIXTE (more accurate particle background, low energy counts) should improve results
- More realistic simulations:
  - Addition and removal of point sources
  - Flare exposure time decrease
  - Metallicity distribution