dobe

EXTENDED SZ EMISSION OF THE MOST LUMINOUS X-RAY CLUSTER, RXJ1347-1145

THE DIABOLO COLLABORATION

- *Institutes :*

LAOG – CESR – CRTBT – IAS

- *People :*

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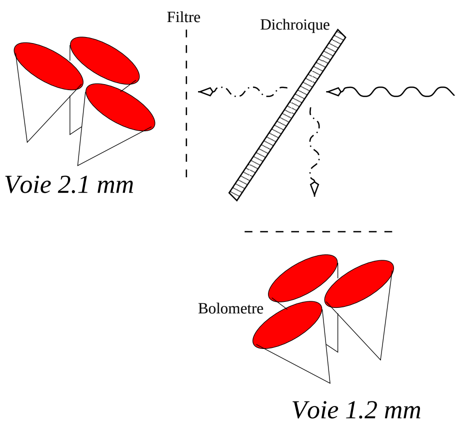
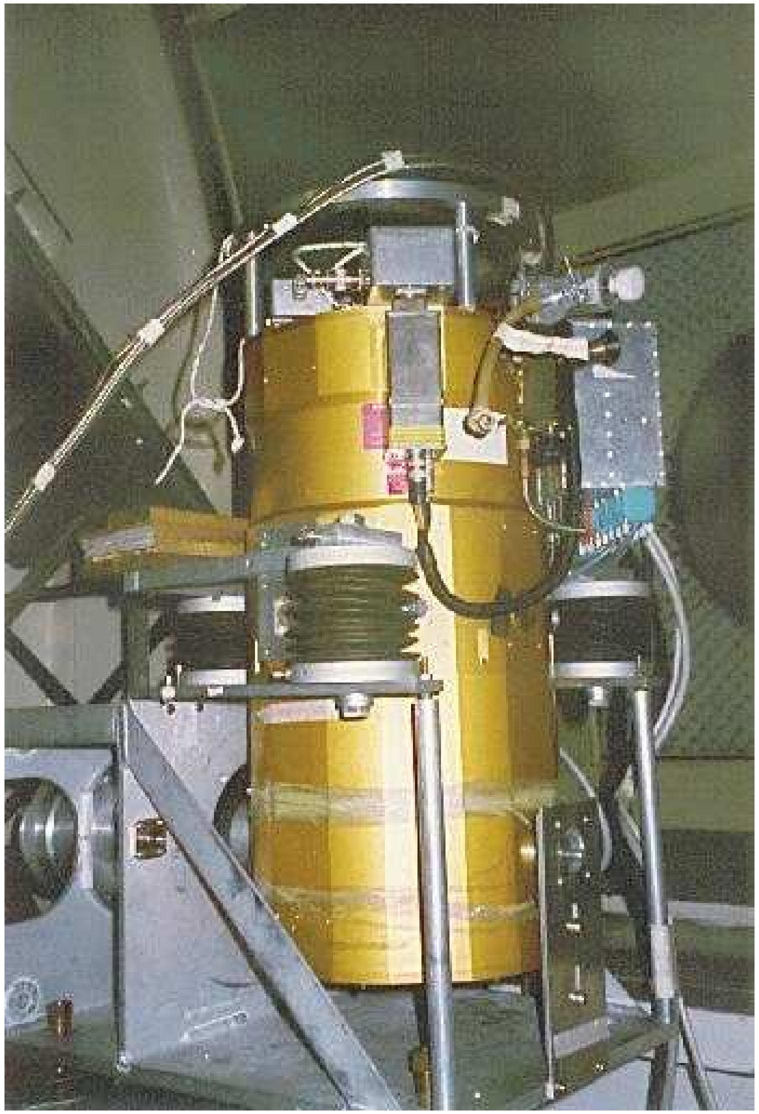
Jean-Michel Lamarre	

Observations with DiaBolo

- Multiband Photometer :
  - 1.2 & 2.1 mm
  - bolometers cooled at 0.1 K
- 3 bolometers per channel

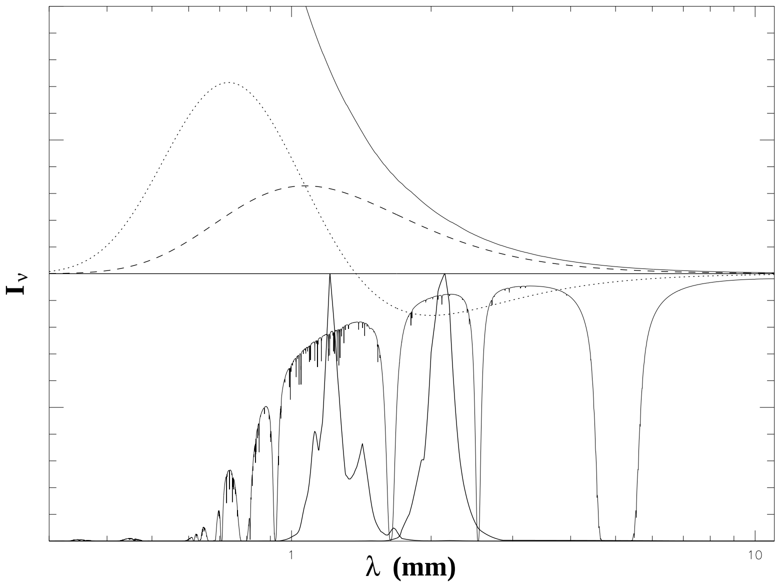


(Benoit et al, 1999, A&AS, in press – astroph/9912385)



DiaBolo Observing at IRAM

- 30 m radio telescope
  - 22" de résolution
  - secondary wobbling mirror (2.5 arcmin amplitude)



(Désert F.X. et al, 1998, New Astronomy, 3, 655)

RXJ1347-1145

- X-ray characteristics :

$z = 0.45$

$L_X(bol) = 21 \pm 4 \times 10^{45}$ erg/s

$r_c = 8.4 \pm 1.8$ arcsec $\quad (57 \pm 12$ kpc)

$\beta = 0.56$

$T_g = 9.3 \pm 1.0$ keV

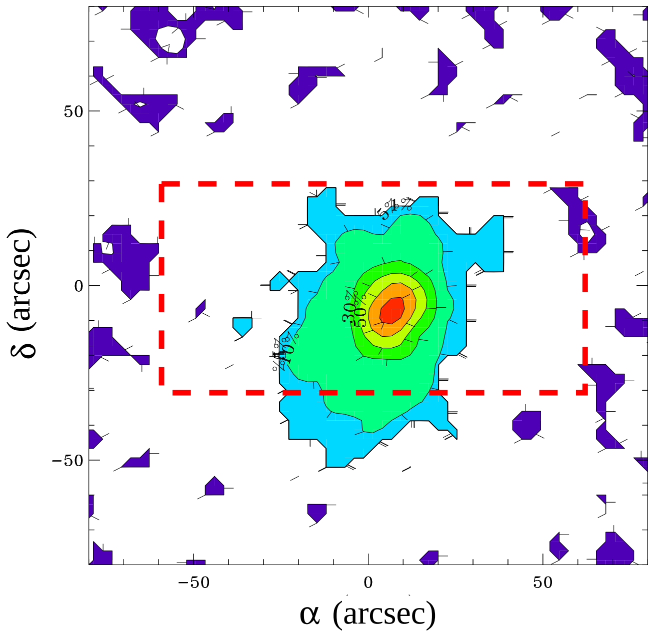
$M_{gas}(r < 1\text{Mpc}) = 2.0 \times 10^{14}$ $M_\odot$

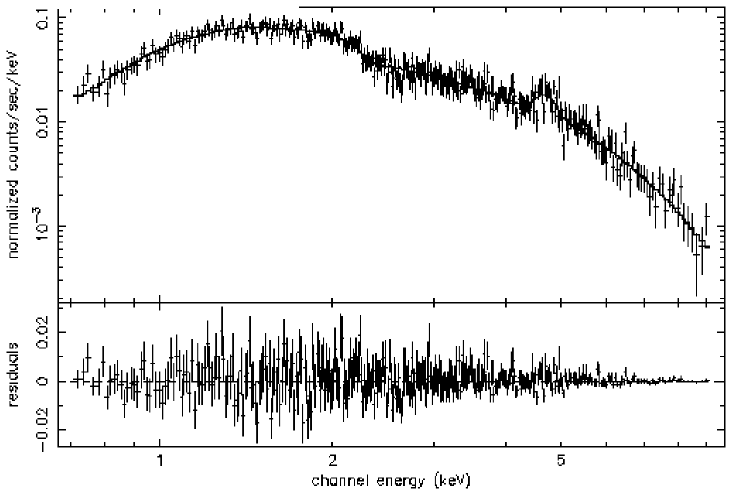
$M_{tot}(r < 1\text{Mpc}) = 5.8 \times 10^{14}$ $M_\odot$

$f_{gas} = 34\%$

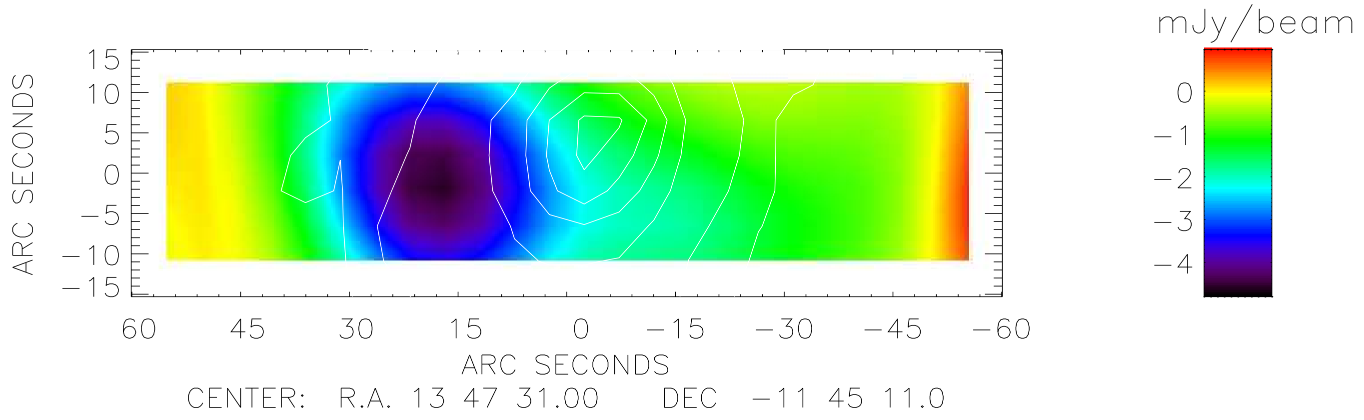
$\dot{M}_{flot} \simeq 3000$ $M_\odot/yr$

(Schindler et al, 1995, A&A 299, L9 ; 1997, A&A 317, 646)





1997 DiaBolo data



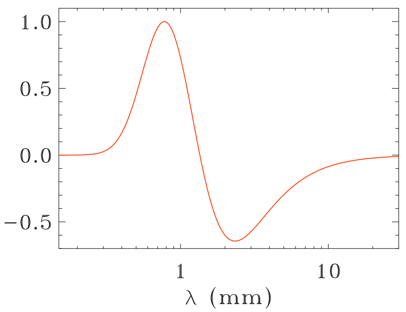
$$1\ \sigma = 1\ \text{mJy/beam} \Longleftrightarrow y = 3 \times 10^{-4}$$

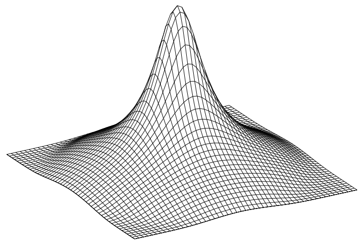
- Strongest SZ decrement observed to date
- Shift between the SZ and the X-ray center
- A radio source near the X-ray center

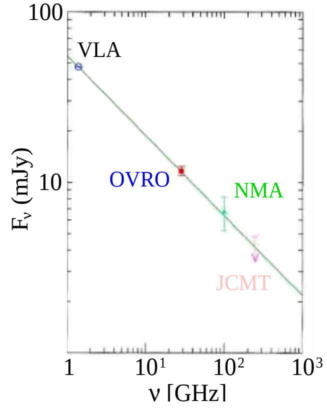
(Pointecouteau et al, 1999, ApJ 519, L115)

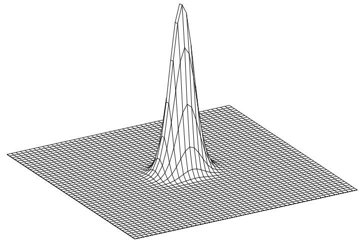
RXJ1347-1145

- Cluster ▶ β-profile
- Radio point source ▶









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Simulation of observations Data processing	$\Big\}$	200 maps (277 s/maps $\Rightarrow T_{tot} = 16$ hours)

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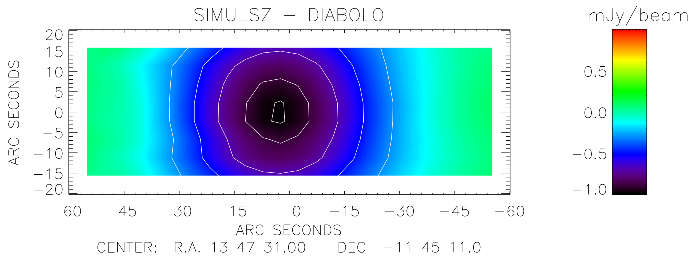
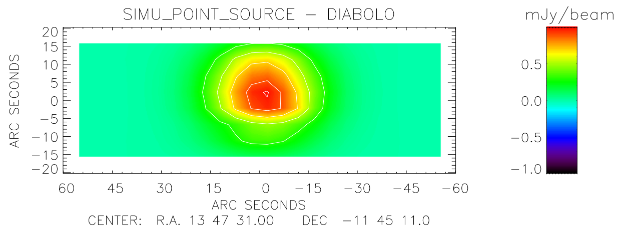


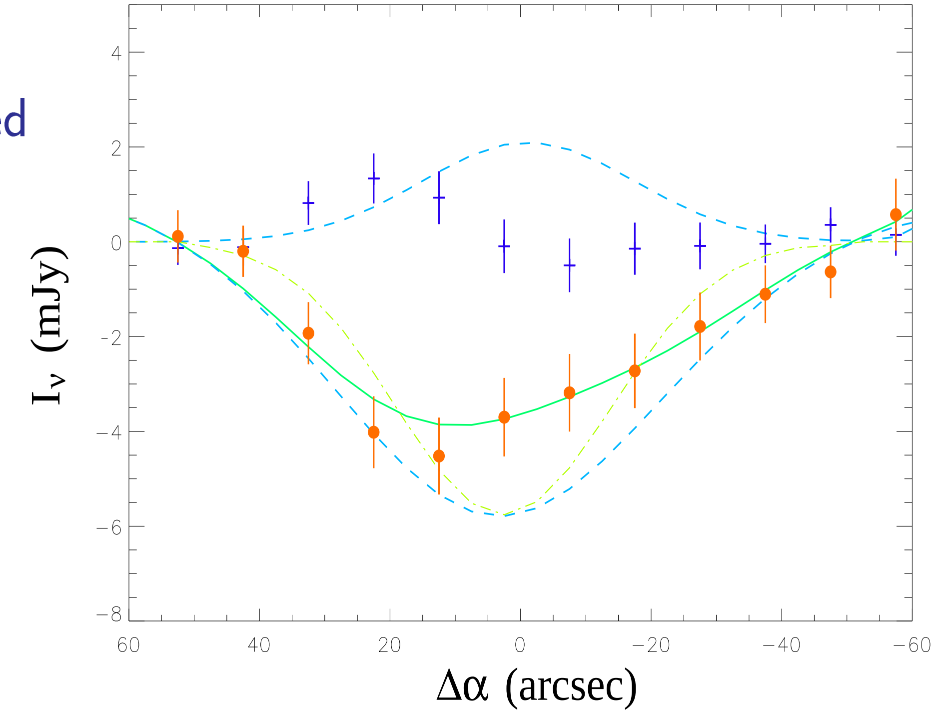


RXJ1347-1145

- Parameters : y & F_ν free, θ_c fixed

  ▶ maximum likelyhood

  ▶ $$\begin{cases} y = 12.7^{+2.9}_{-3.1} \times 10^{-4} \\ F_\nu(2.1\ \mathrm{mm}) = 6.1^{+4.3}_{-4.8}\ mJy \end{cases}$$



- $y_{SZ} \simeq 2\ y_X$ & $y \propto n_e\ T_g\ r_c$

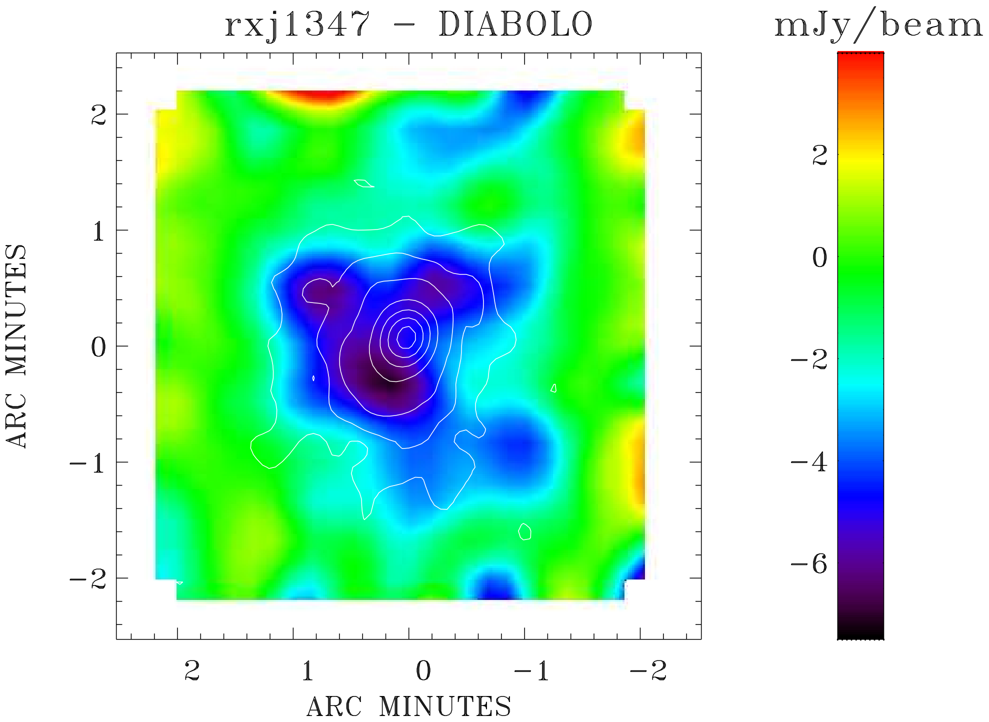
  ▶ temperature $T_g \simeq 16$ keV $\Longrightarrow$ $\mathrm{M}_{tot} = 1 \times 10^{15}\ \mathrm{M}_\odot \simeq 2 \times\ \mathrm{M}_{tot}(X)$

  (Allen & Fabian 98) (hydrostatic + isothermal)

  $\Longrightarrow f_{gas} = (19.5 \pm 5.8)\%$

RXJ1347-1145

$1\sigma = 1$ mJy/beam $\iff y \simeq 10^{-4}$



- 1999 DiaBolo's run :
  - $4' \times 4'$ map (17 hours)

$$\begin{cases} y = 8.0^{+0.6}_{-0.3} \times 10^{-4} \\ 10'' < r_c < 30'' \end{cases}$$

($\chi^2 = 1.04$, dof$= 696$)

- Mass estimations ($r < 0.6$ Mpc):
  - $T_g = 9.3$ keV $\Longrightarrow$ $M_{gas} = 5.3 \times 10^{14}\ \mathrm{M}_\odot$
  - $T_g = 16$ keV $\Longrightarrow$ $M_{gas} = 3 \times 10^{14}\ \mathrm{M}_\odot$

Conclusion

- A strong SZ effect in the direction of RXJ1347-1145
  - $y \sim 10^{-3}$, $S/N \sim 20$!
  - differences with the X-ray emission
- A detailled modelisation of the 1999 DiaBolo observations
  - simulation of each mapping sequence over the cluster model
  - radio point sources flux at mm wavelengths
- DiaBolo @ IRAM 30 m
  - high angular resolution
  - SZ extended emission of very distant clusters
    (Two z=0.83 clusters : MS1054, WARP0152)