

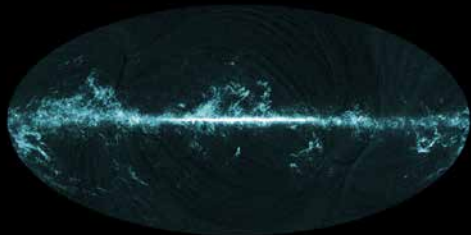
# "Dépoussiérer" le disque Galactique avec la DR2

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Clément Hottier



# The Galactic plane

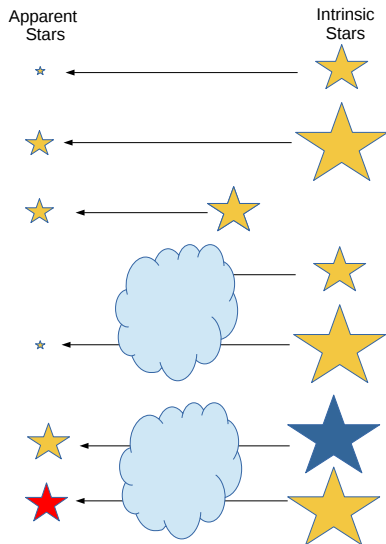


PLANCK :  
INTERSTELLAR CO  
(115GHz)



Gaia Data Release 2 :  
STARS

# Extinction and reddening



- ⊙ Apparent magnitude depends :
  - Intrinsic magnitude
  - Distance
  - Extinction
- ⊙ Star apparent color depends
  - Effective Temperature
  - Extinction

## 2 Approaches, same data

### ⊙ 3D Inversion

- Lallement, Babusiaux, Vergely et al, 2019

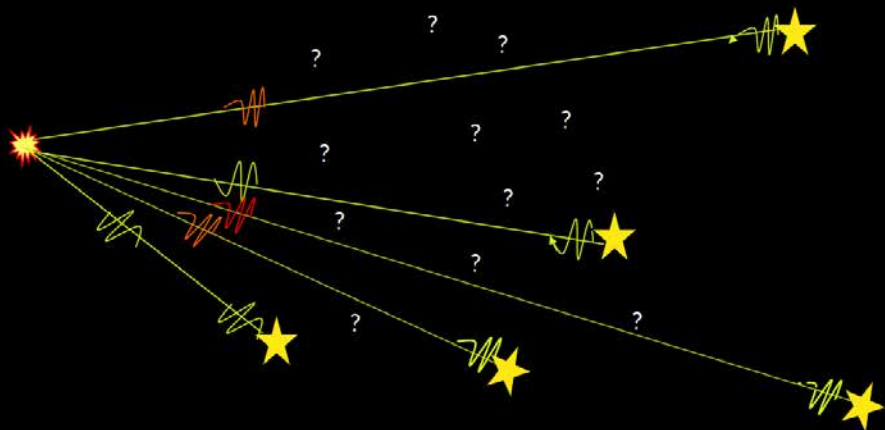
### ⊙ Field of view by field of view

- Babusiaux et al 2020
- Hottier et al 2020 A&A : CDS
- Hottier et al 2021 *in prep*

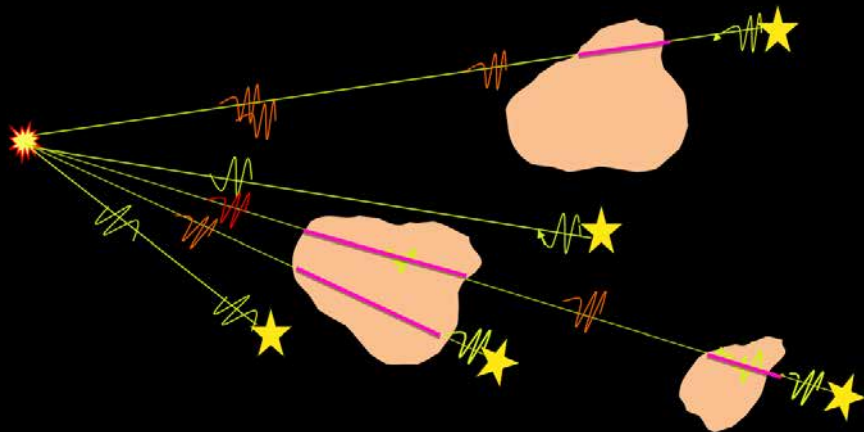
Both based on crossmatch Gaia DR2 and 2MASS

- ⊙ Gaia DR2 : 1.3 billion stars
  - Map : Restriction on relative errors on parallaxes better than 20%:  
about 40 millions objects (20 millions  $<$  2.5 kpc)
- ⊙ Individual stars extinction evaluation :
  - photometric data in visible (Gaia) and infrared (2MASS)
  - comparison with stellar parameter
  - parallactic distance as prior

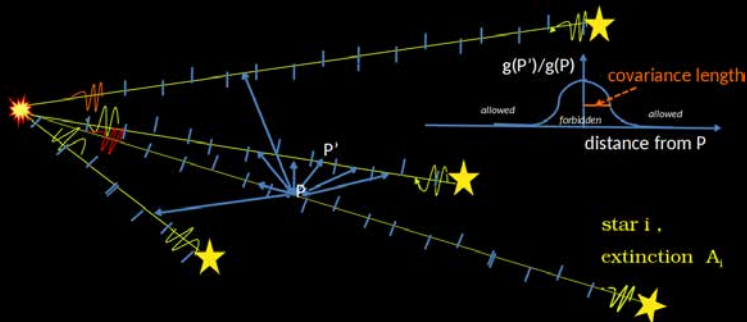
# Inferring dust density



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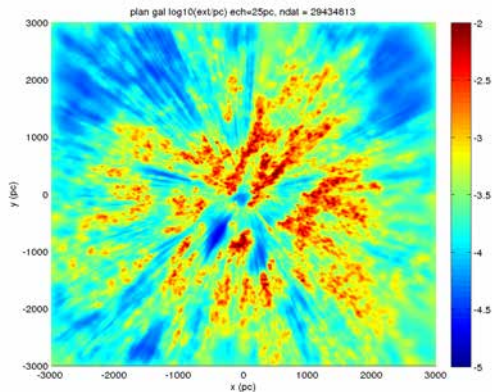
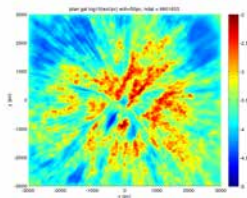
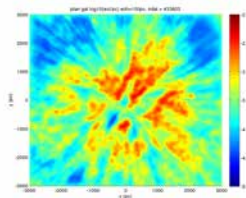
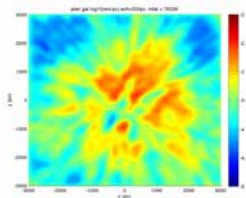
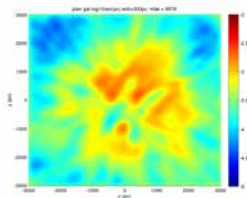


$g(P)$  : reddening per distance (mag/pc) at  $P$

- ⊙ Data: measured reddening/extinction  $A_i = \int g(P)dP$  for each stars  $i$
- ⊙ Prior conditions on the 3D distribution (Bayesian aspect)
- ⊙ 3D covariance kernel(s) => minimum size of structures (regularization) =>  $g(P')/g(P)$  limited

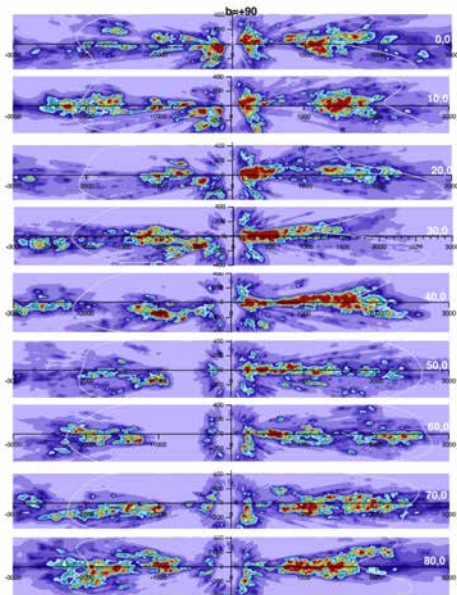
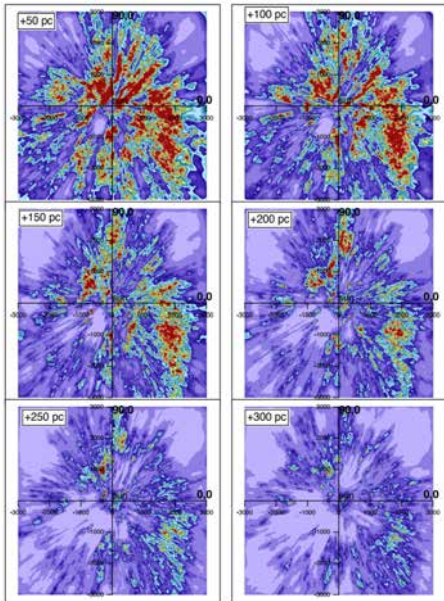


# Hierarchical technique



- ⊙ Hierarchical
- ⊙ Gaussian kernel

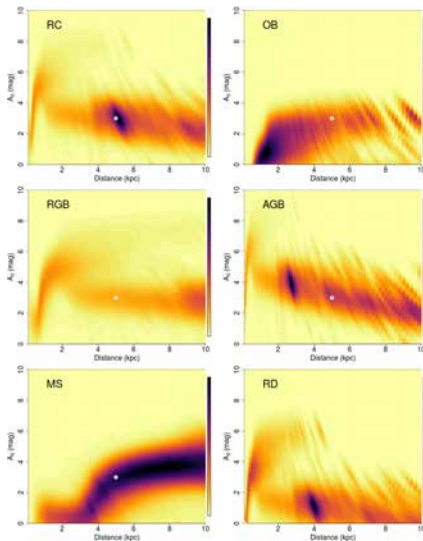
# 3D cube (Lallement *et. al.* 2019)



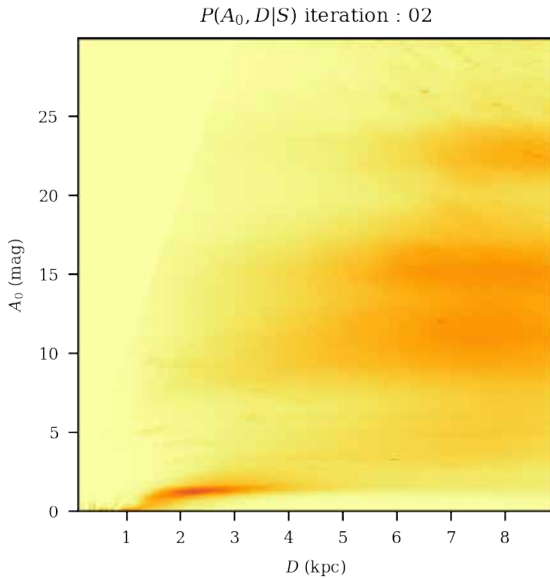
- ⊙ Photometry (2MASS and Gaia) and Parallax
- ⊙ Completeness taking into account
- ⊙ Field of view based methods
- ⊙ Two steps :
  - Analyzes of each stars
  - Deconvolution

# Stars analysis

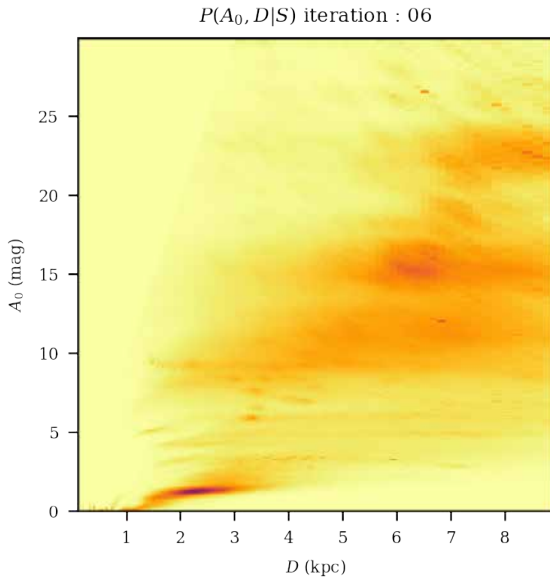
- Processing of  $P(O | A_0, D)$ 
  - Comparing to empirical HR
  - Polynomial extinction law
- Merging result with an iterative deconvolution



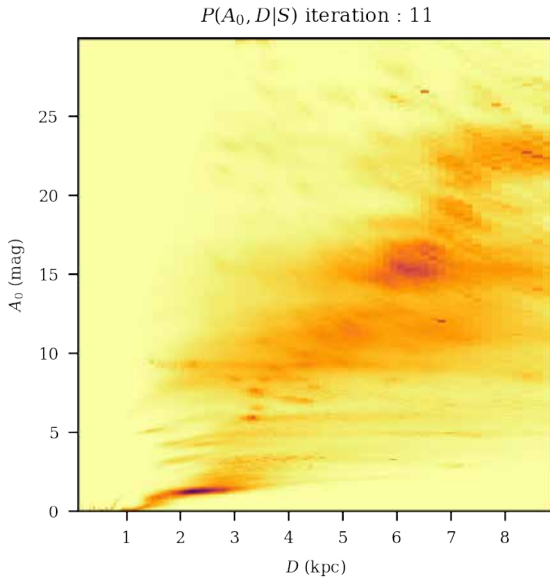
# Bayesian deconvolution



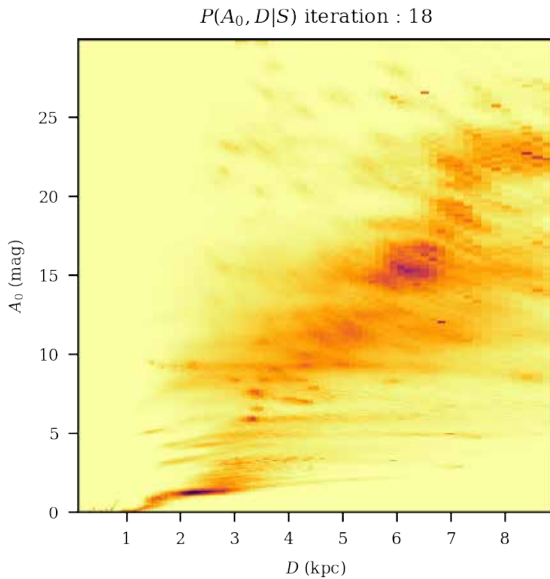
# Bayesian deconvolution



# Bayesian deconvolution

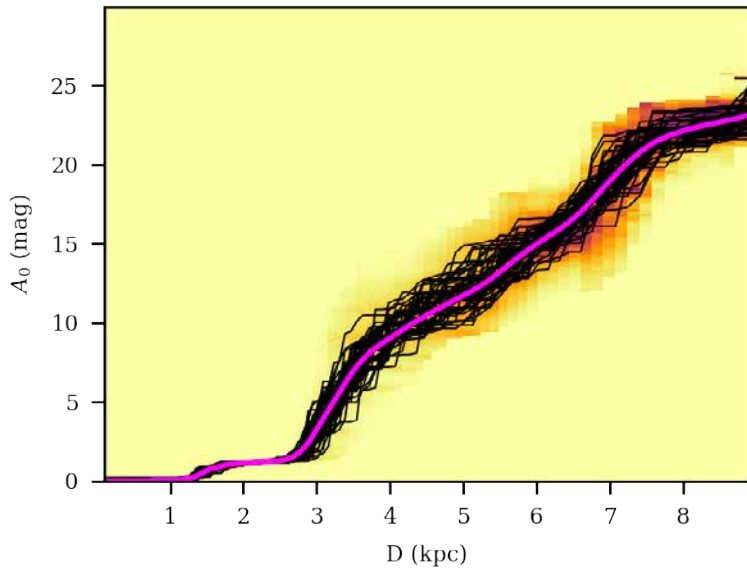


# Bayesian deconvolution

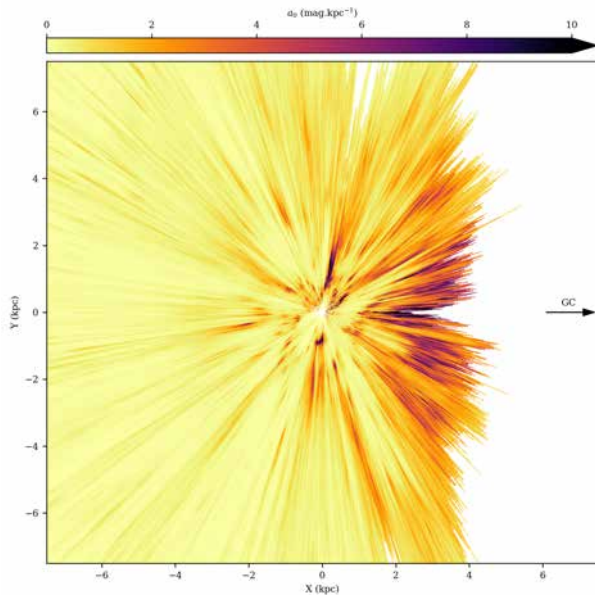




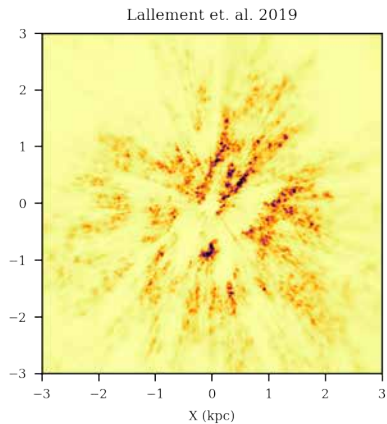
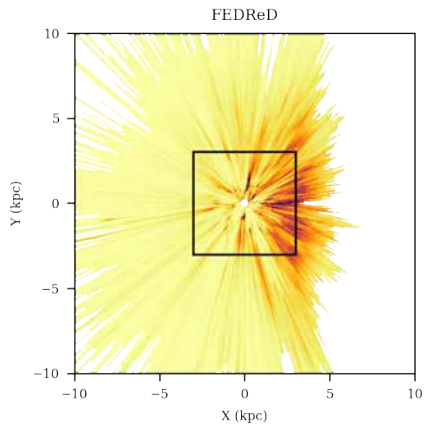
# Bayesian deconvolution



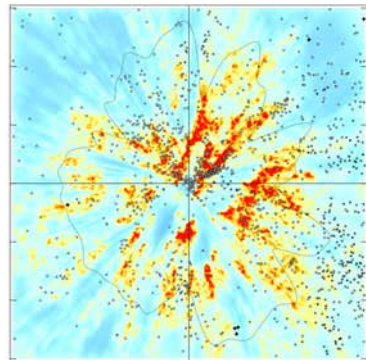
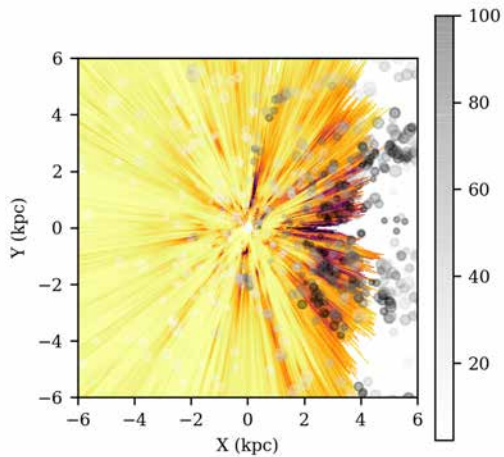
# Extinction map



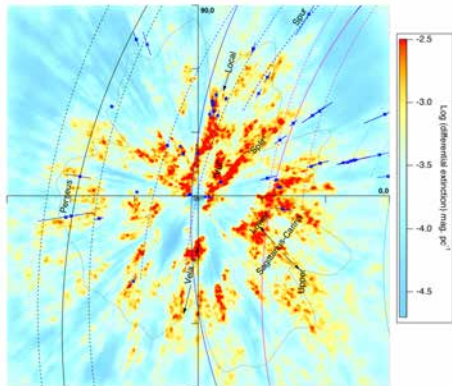
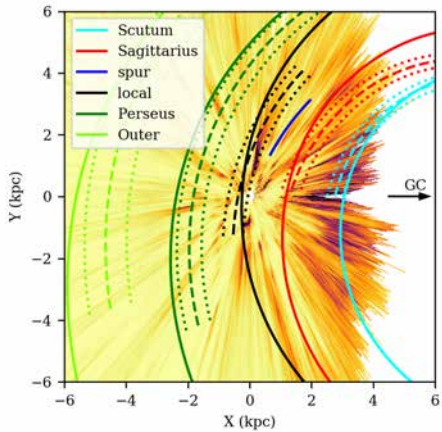
# Results



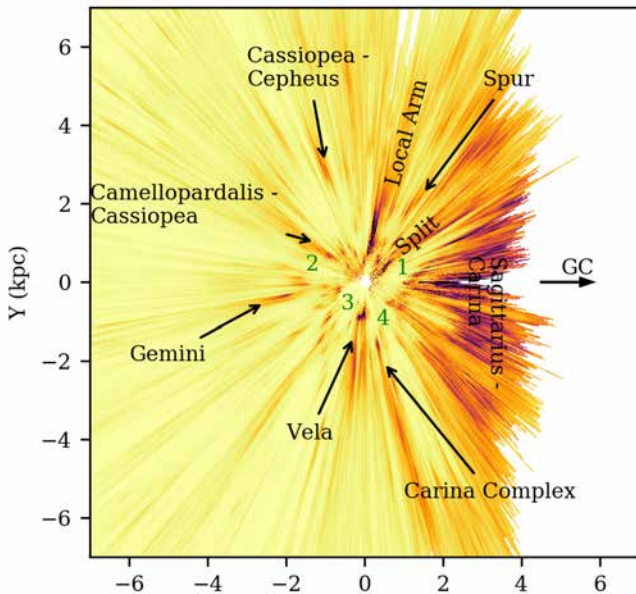
# CO cloud



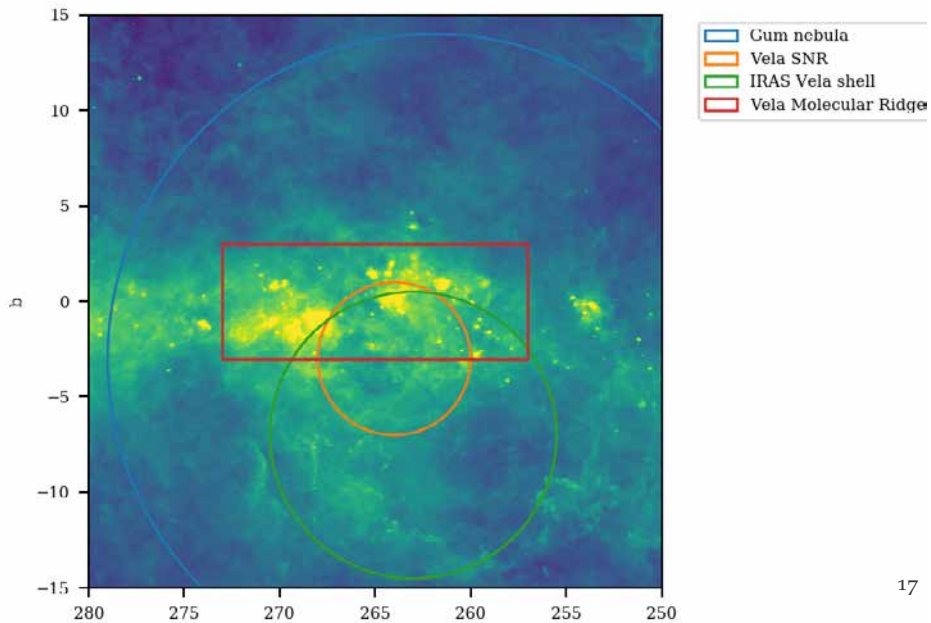
# Spiral arms



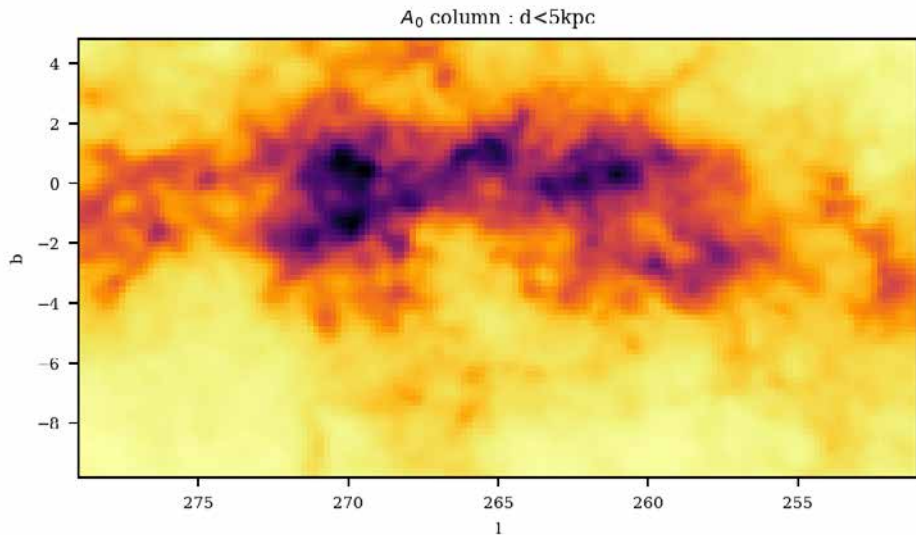
# Structures in extinction



# Vela in infrared



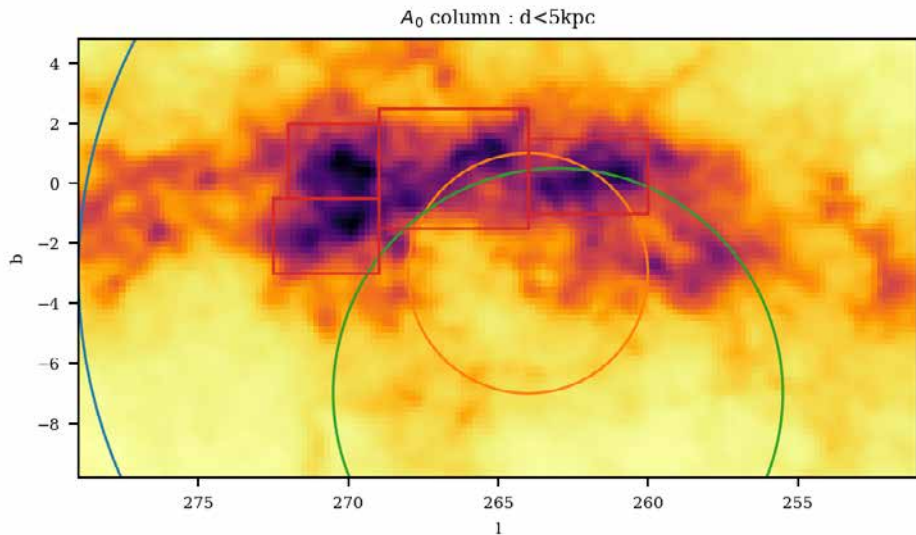
# Column extinction (Hottier *et. al.* in prep.)



Extinction density show same structures than in infrared

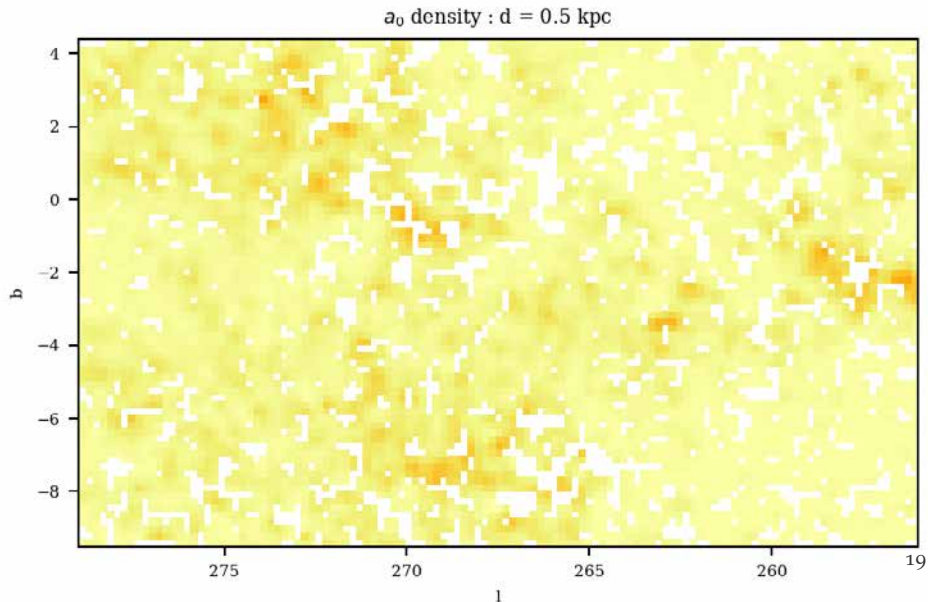


# Column extinction (Hottier *et. al.* in prep.)

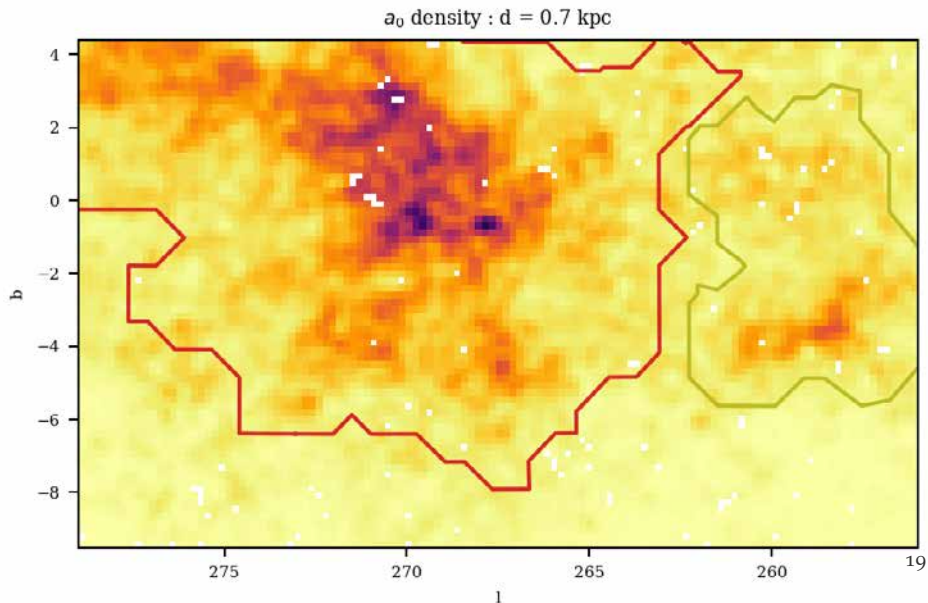


Extinction density show same structures than in infrared

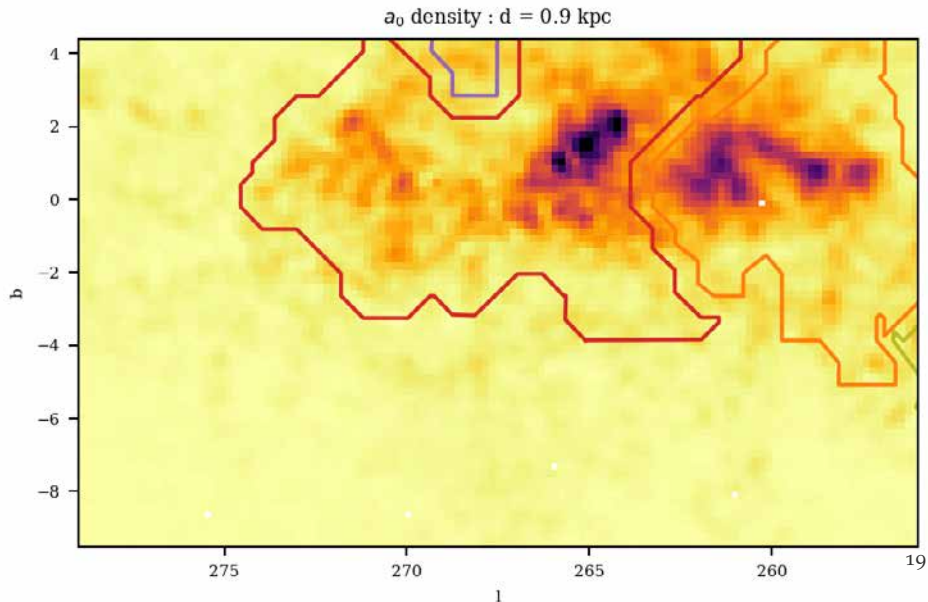
# The Vela clouds unravelled



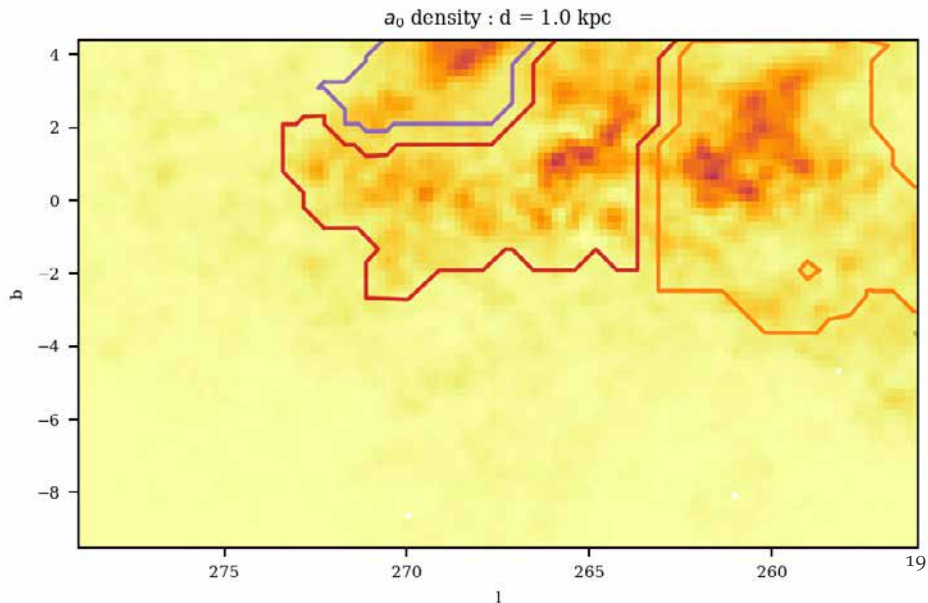
# The Vela clouds unravelled



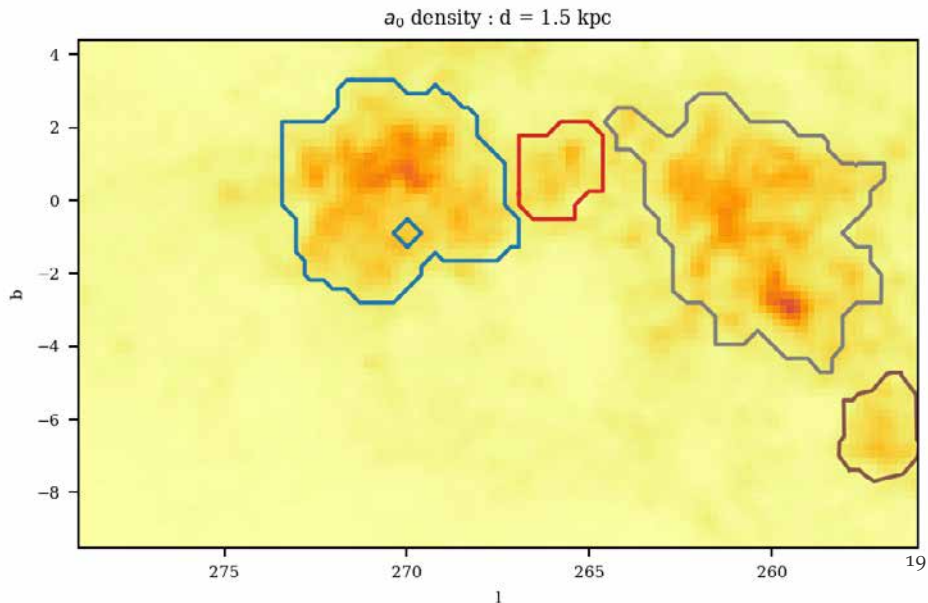
# The Vela clouds unravelled



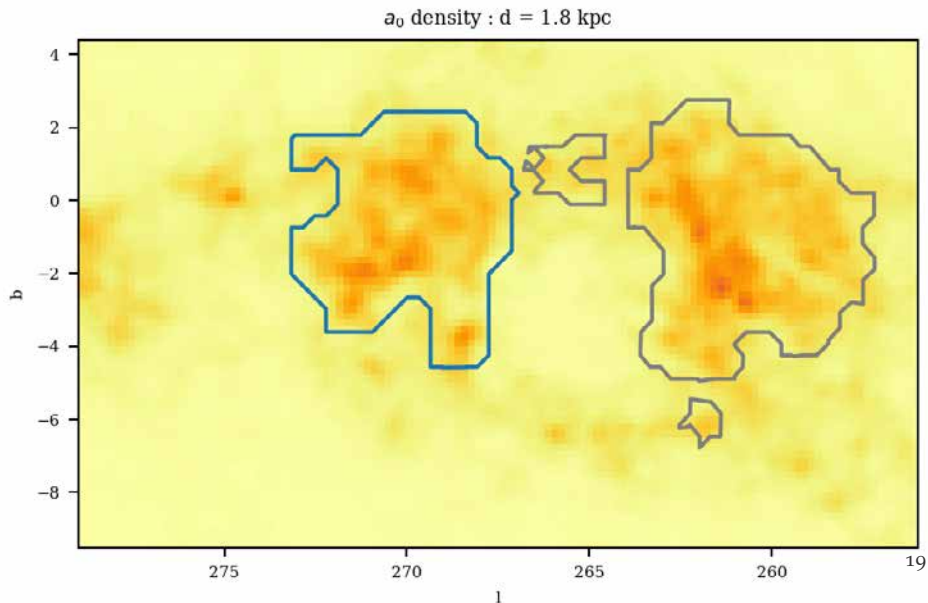
# The Vela clouds unravelled



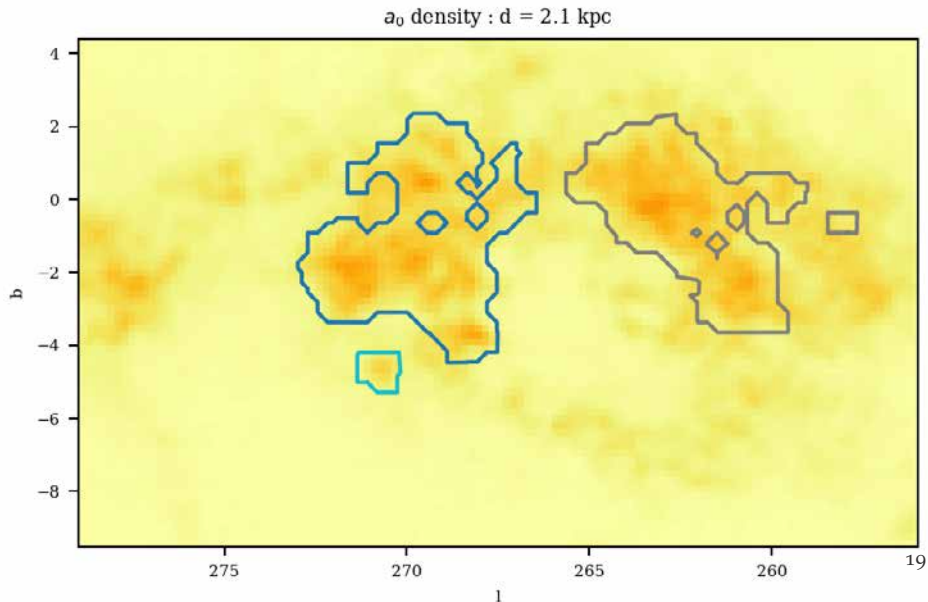
# The Vela clouds unravelled



# The Vela clouds unravelled

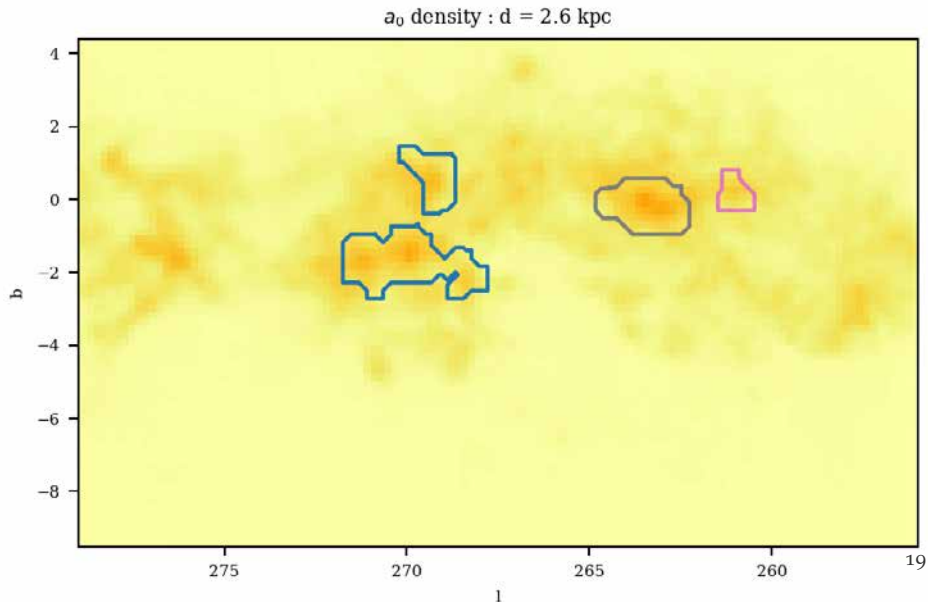


# The Vela clouds unravelled

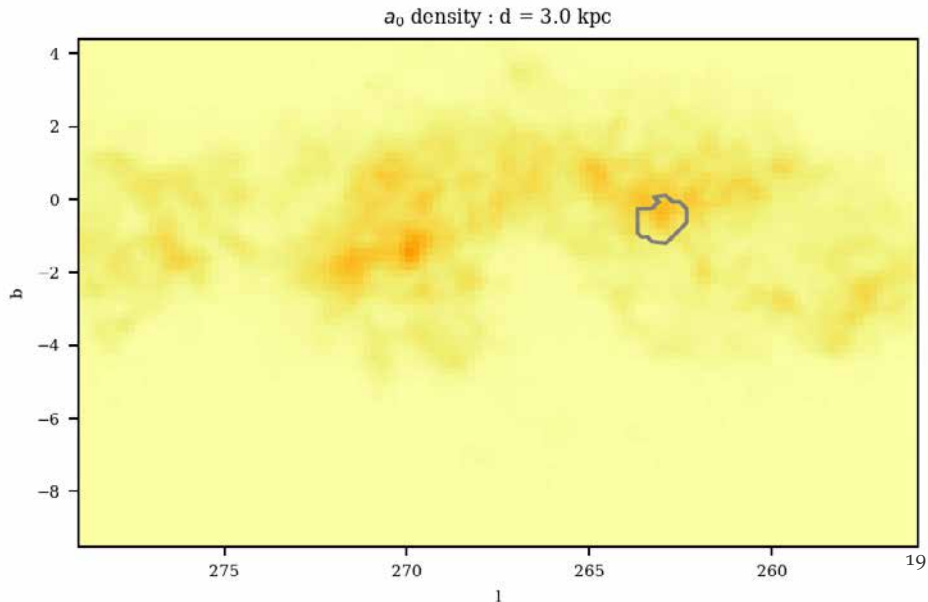




# The Vela clouds unravelled



# The Vela clouds unravelled



# Take home

DR2 :

- ⊙ Extinction Map of "Close area"
- ⊙ Distance and shape of structures (Split, Vela...)

EDR3 Objectif:

- ⊙ Mapping the Galactic Center and beyond
- ⊙ Observe the bar fingerprint in dust

