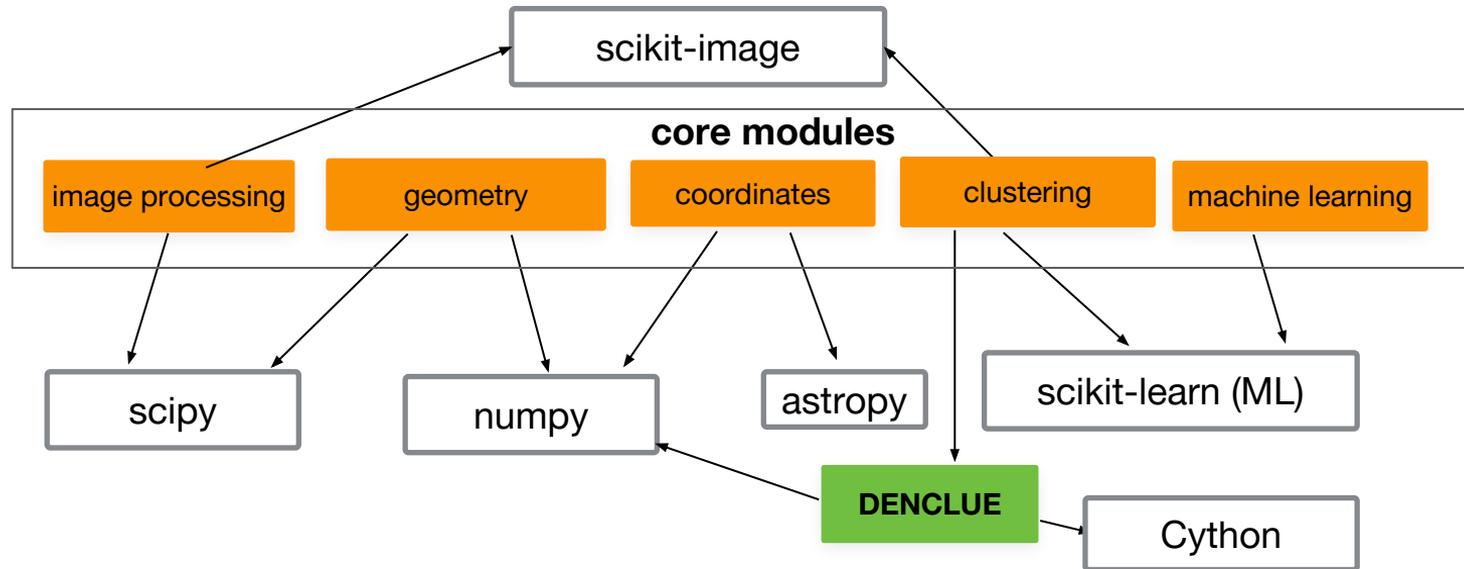


# ASTERISM

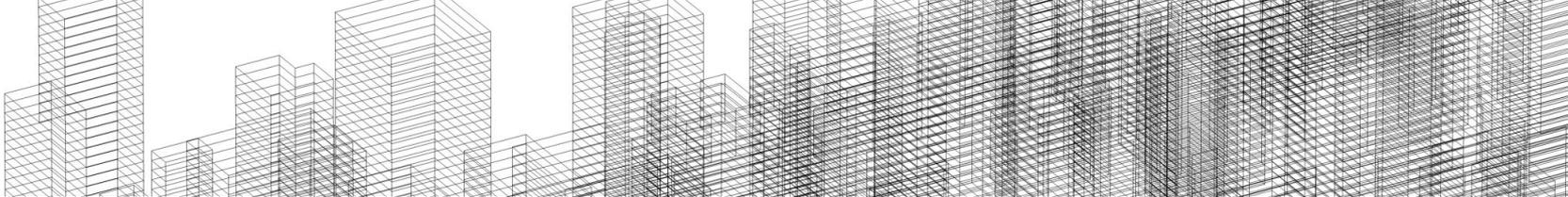
python Astronomical Tools for clustering-based dEtection and Morphometry

ASTERISM is a python framework for application of topometric clustering algorithms in automatic source detection morphometry and classification

Pipeline manger



**works both on images and photons lists (MW/MM)**  
**Currently used in the EUCLID MER Pipeline for Deblending**

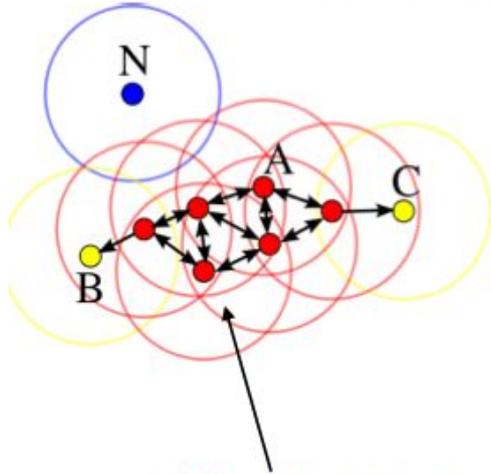


## **disclaimer**

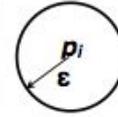
The following application to Fermi-LAT data does not mean a substitution of the official Fermi-LAT science tools, it provides a use case as a companion tool to find seeds or to have a quick look detection or morphological measurement

# clustering methods: DBSCAN (per event analysis)

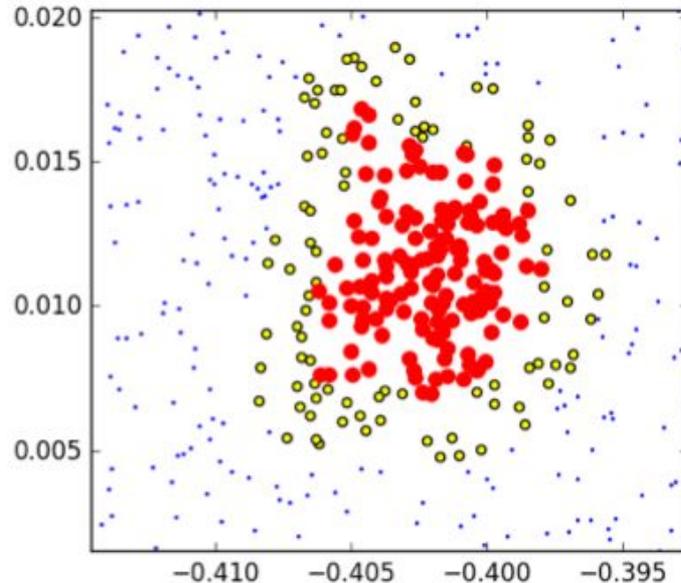
A cluster is a set of **density connected points**



$K \sim$  Noise level  
 $\epsilon \sim$  PSF

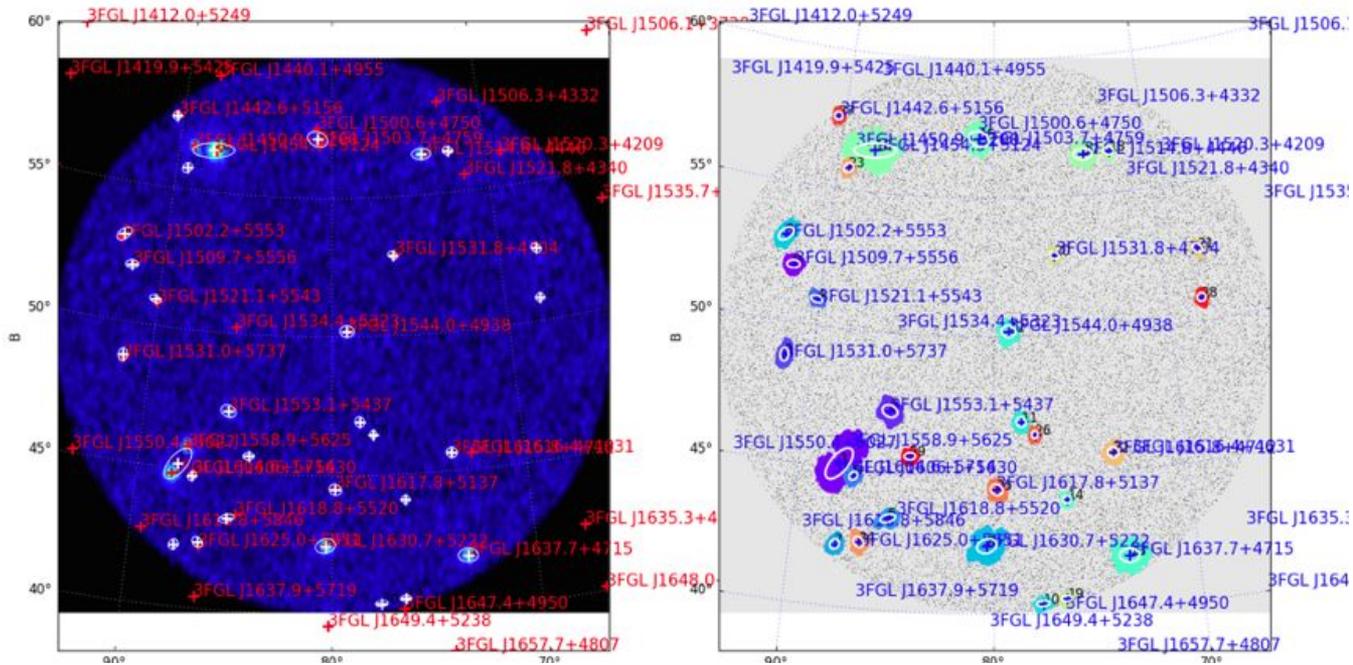
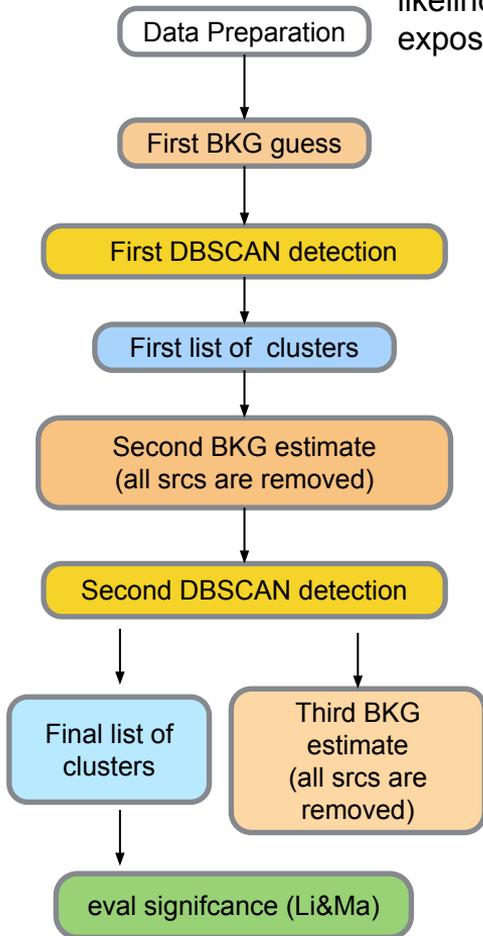


- **core points**  $|N_\epsilon(p_i)| \geq K$
- **density connected** are points connected through a chain of core points
- we use geodesic distance



same as prescribed for P8  
likelihood except  
exposure

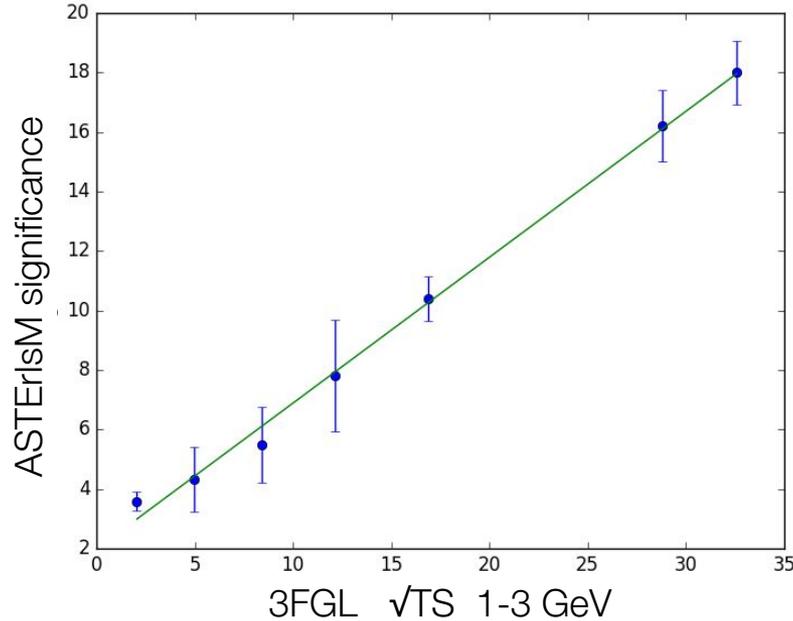
## $\gamma$ -ray detection (DBSCAN)



Application to Fermi data, using the same 3FGL time span, and the P8R2 calib.  $E > 1$  GeV, and the DBSCAN is applied with the following configuration  $\epsilon = 0.2$  deg,  $K = 5$

# $\gamma$ -ray detection (DBSCAN)

DBSCAN Significance vs 3FLG  
3FGL time span,  $\sim 80$  sources binned in TS,  $L > 15$



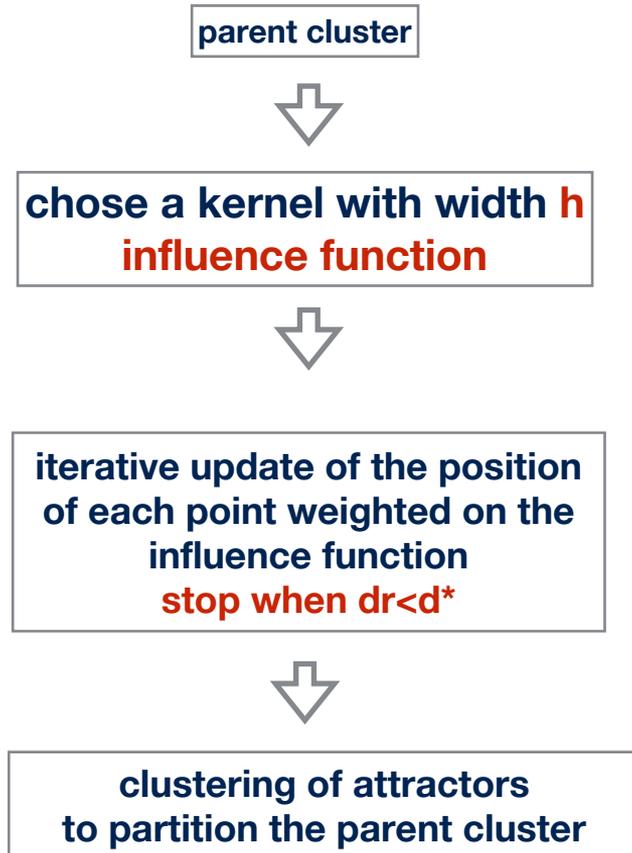
• Significance  $\sim 0.5 \sqrt{TS}$  3FGL

• pos err  $\sim$  3FGL poss err

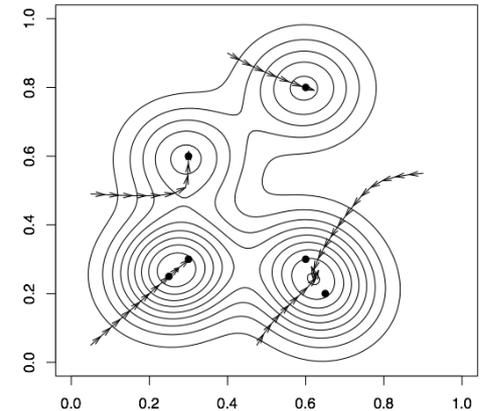
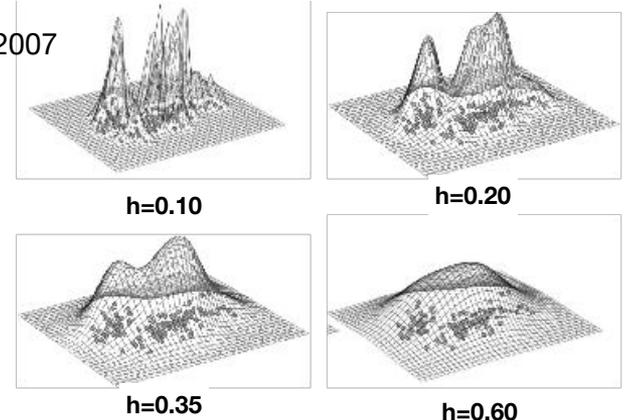
Same as in

Tramacere&Vecchio 2013 A&A...549A.138T

# $\gamma$ -ray deblending of confused sources: DENCLUE (per event analysis)

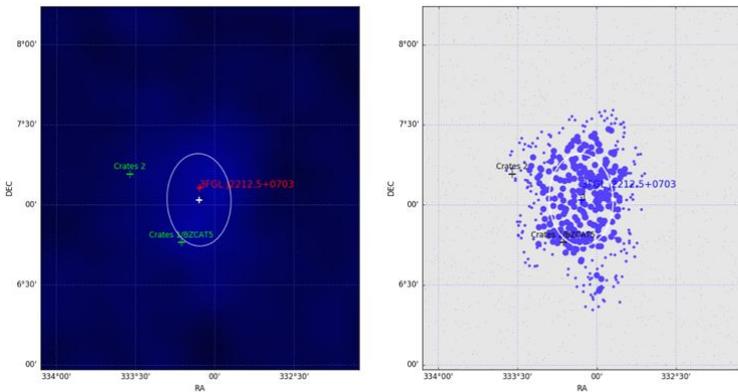


Hinneburg & Gabriel 2007

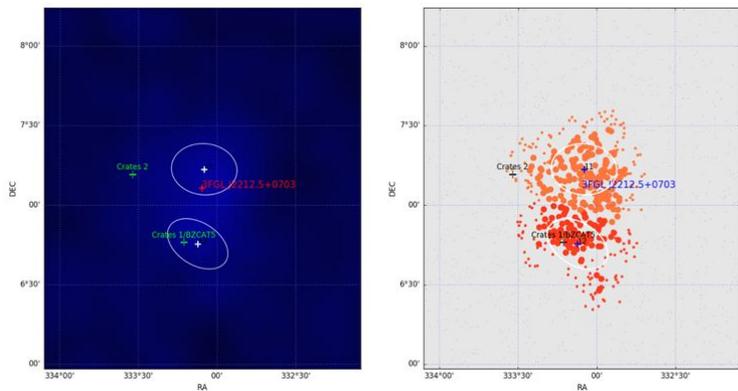


# $\gamma$ -ray deblending of confused sources (DENCLUE)

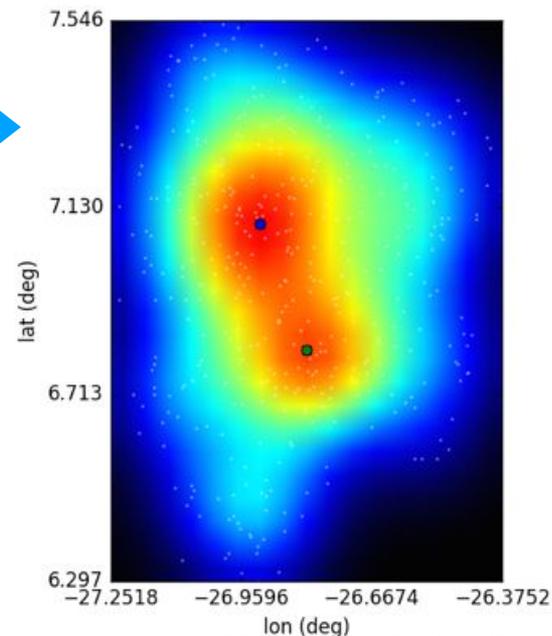
3FGL J2212.5+0703 (DBSCAN alone)



3FGL J2212.5+0703 (DBSCAN+DENCLUE)



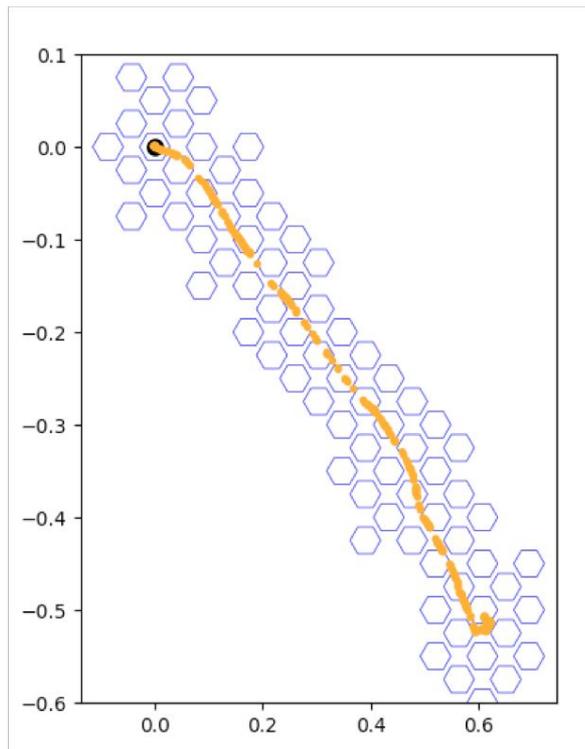
DENCLUE



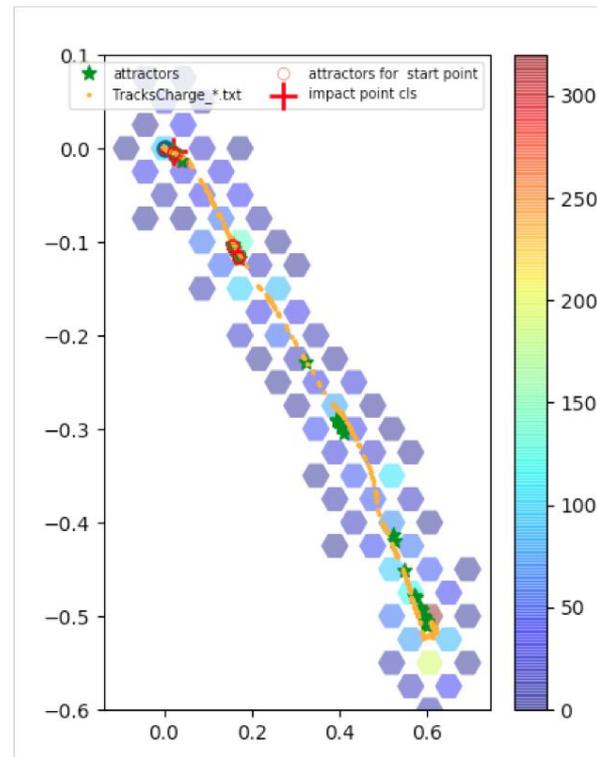
The two resolved sources. Note how both the separated sub clusters are positionally coincident with an astrophysical counterpart, the 3FGL J2212.5+0703 source and a blazar reported in the BZCAT5, respectively.

# X-ray polarimetry: reconstruction of the photoelectron path

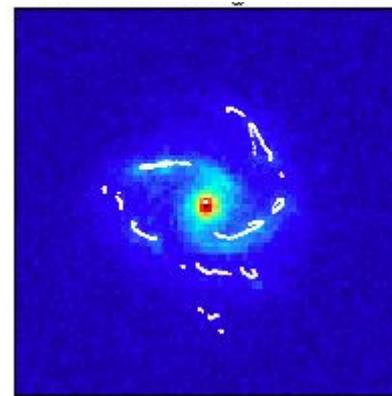
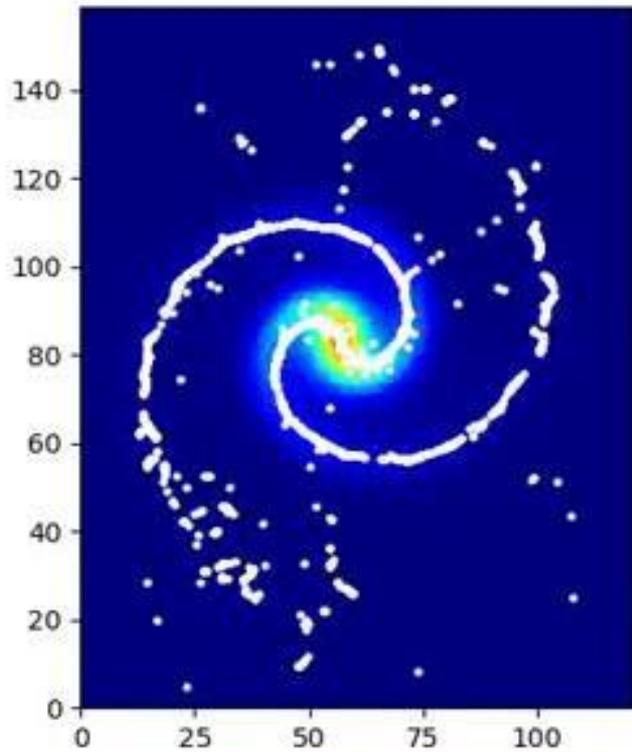
Simulated



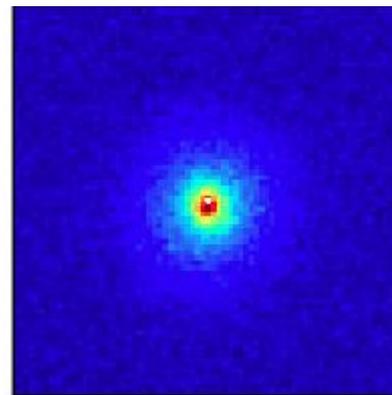
DENCLUE result



# DENCLUE application to optical images: spiral arms detection



Spiral



Elliptical