

## **Title: Kinematics of the Cartwheel galaxy. Confronting numerical simulations to observations.**

**Keywords:** galactic dynamics, kinematics, frontal collisions, analysis of numerical simulations

### **Scientific description:**

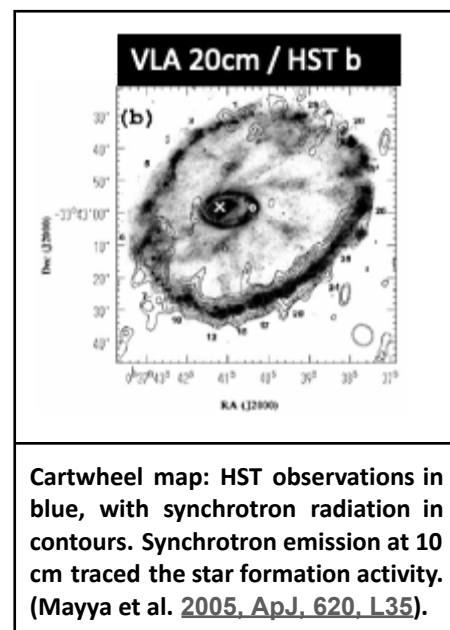
The Cartwheel Galaxy is the prototype of a galaxy formed through a head-on collision, which explains its unusual morphology with two rings. Following Renaud et al. (2018, MNRAS, 473, 585), we are reproducing ramses numerical simulations (Teyssier 2002, A&A, 385, 337), in order to compare with the kinematics extracted from Fabry-Perot (Amram et al., 1998, A&A, 330, 881) and MUSE data (Mondal & Barway, 2024, A&A 681, A53).

The idea is to compare existing numerical simulations with the data. Key\_characteristics will be explored, e.g. the measurement of the expansion velocity of the large ring, the star formation rate, the distribution of the dark matter.

For instance, as seen in the figure, the star formation activity (as traced by synchrotron emission) is completely asymmetric. Is this asymmetry due to the preexistence of a galactic bar? An inhomogeneous original gas distribution in the progenitor? The final geometry of the system?

Similarly, an observable is the expansion velocity of the ring. It would be interesting to study the expansion velocity of the ring as a function of time and its radius, in order to model the observations.

This work will be done in collaboration with Philippe Amram at LAM (in Marseille) and Florent Renaud at Strasbourg Observatory.



**Techniques/methods in use:** analysis tools of the ramses software, python, visualisation

**Applicant skills:** physics background, python and computing skills, experience of numerical simulation or data analysis welcome.

**Industrial partnership:** N

**Internship supervisor(s)** (name, email, phone, ...): Anne-Laure Melchior,  
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**Internship location:** 77 avenue Denfert-Rochereau 75014 Paris  
*Possibility to perform the internship in LAM in Marseille.*

**Possibility for a Doctoral thesis:** Eventually after M2 (through Ecole Doctorale)