

¿Es posible reconocer fusiones de galaxias usando mapas de velocidad en $z \sim 2$?

Resultados preliminares de experimentos controlados con observaciones sintéticas



Juan Carlos Basto Pineda

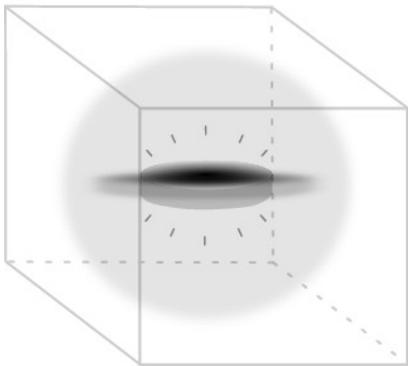
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Juan Manuel Pacheco Arias



Marzo 16 de 2021

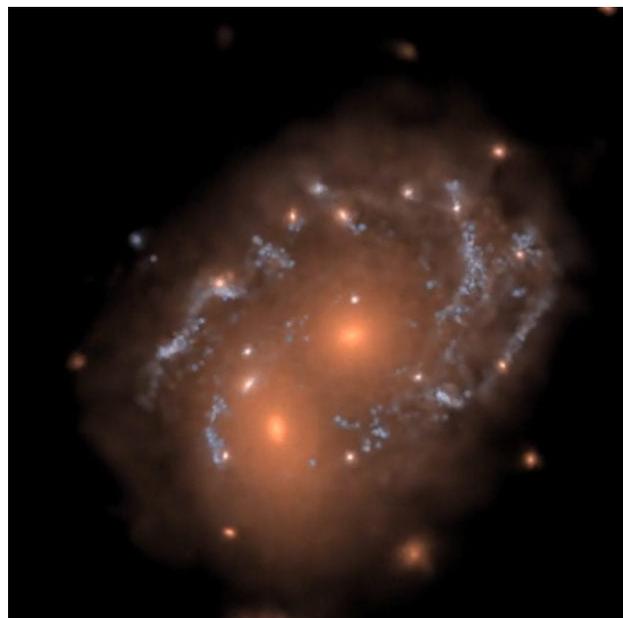


Simulaciones



**Observaciones
sintéticas**

Observaciones

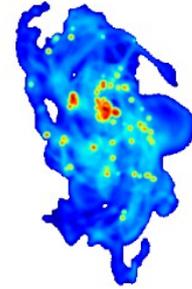
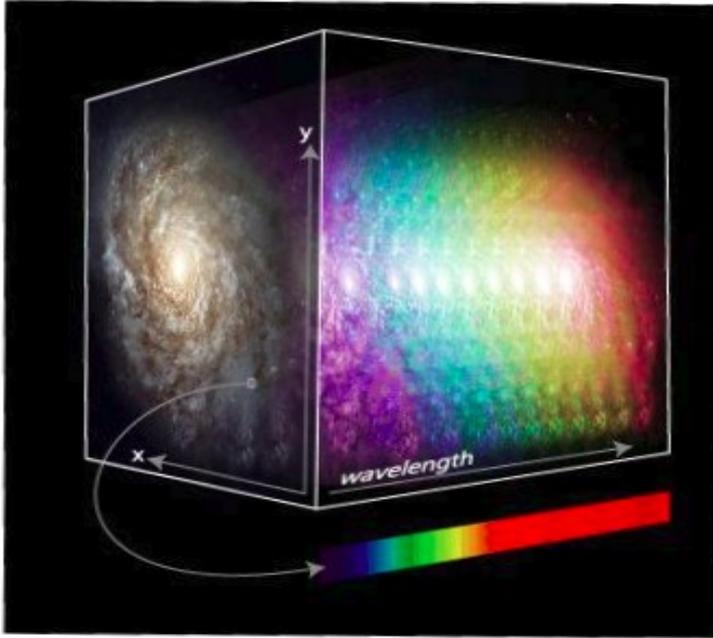




<https://github.com/juan-pineda/Aurora>

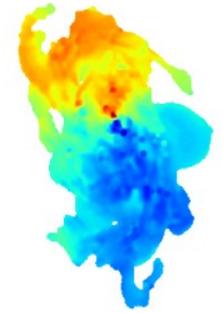


Observaciones IFU

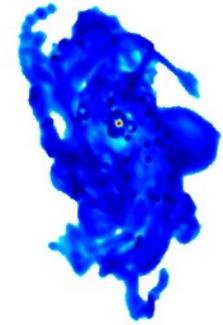


Mapas de intensidad

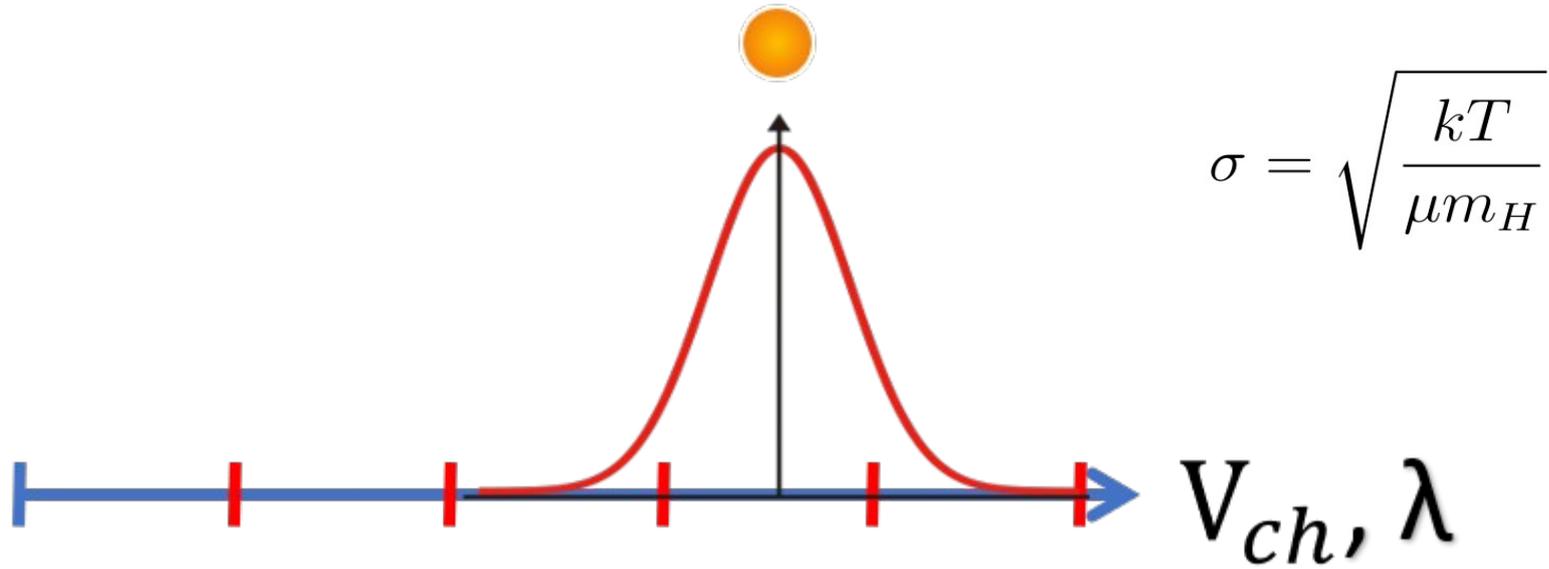
Mapas de velocidad



Disp. de velocidades

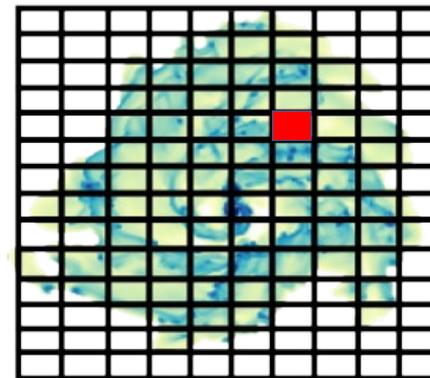
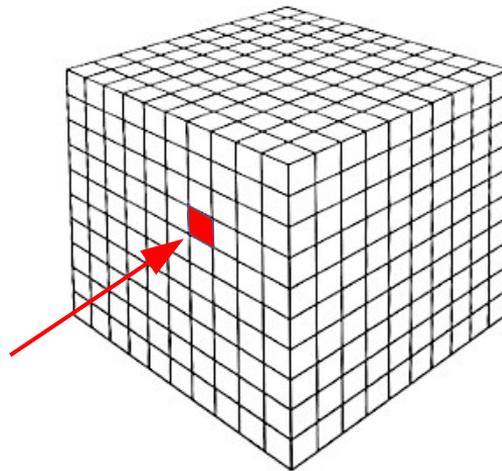
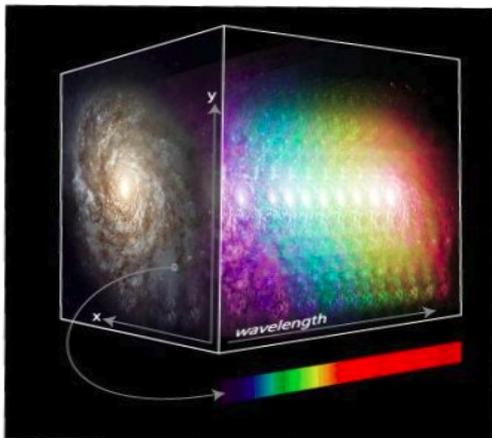


Cómo funciona:

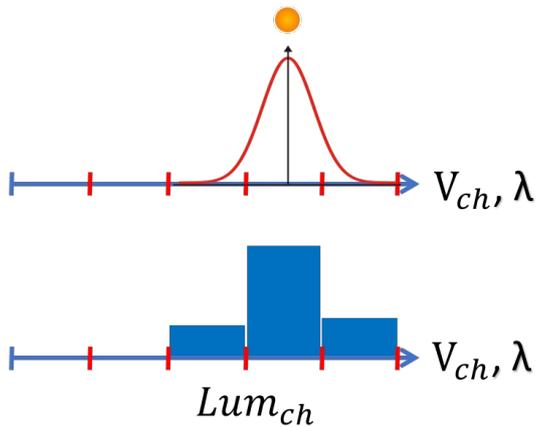


$$\frac{\Delta\lambda}{\lambda_0} = \frac{V_{los}}{c}$$

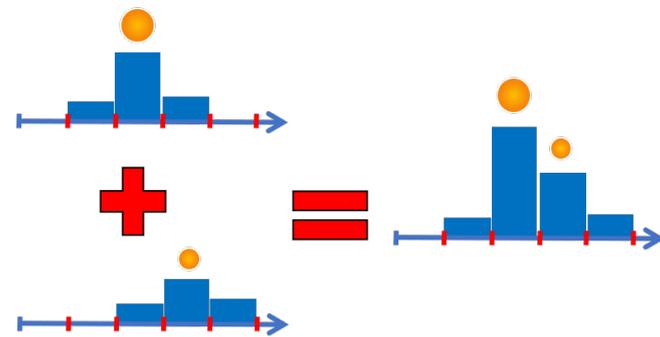
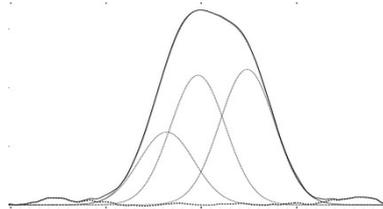
$$Lum = h\nu \cdot \eta_{ions}^2 \cdot \alpha_B \cdot \text{smooth}^3$$

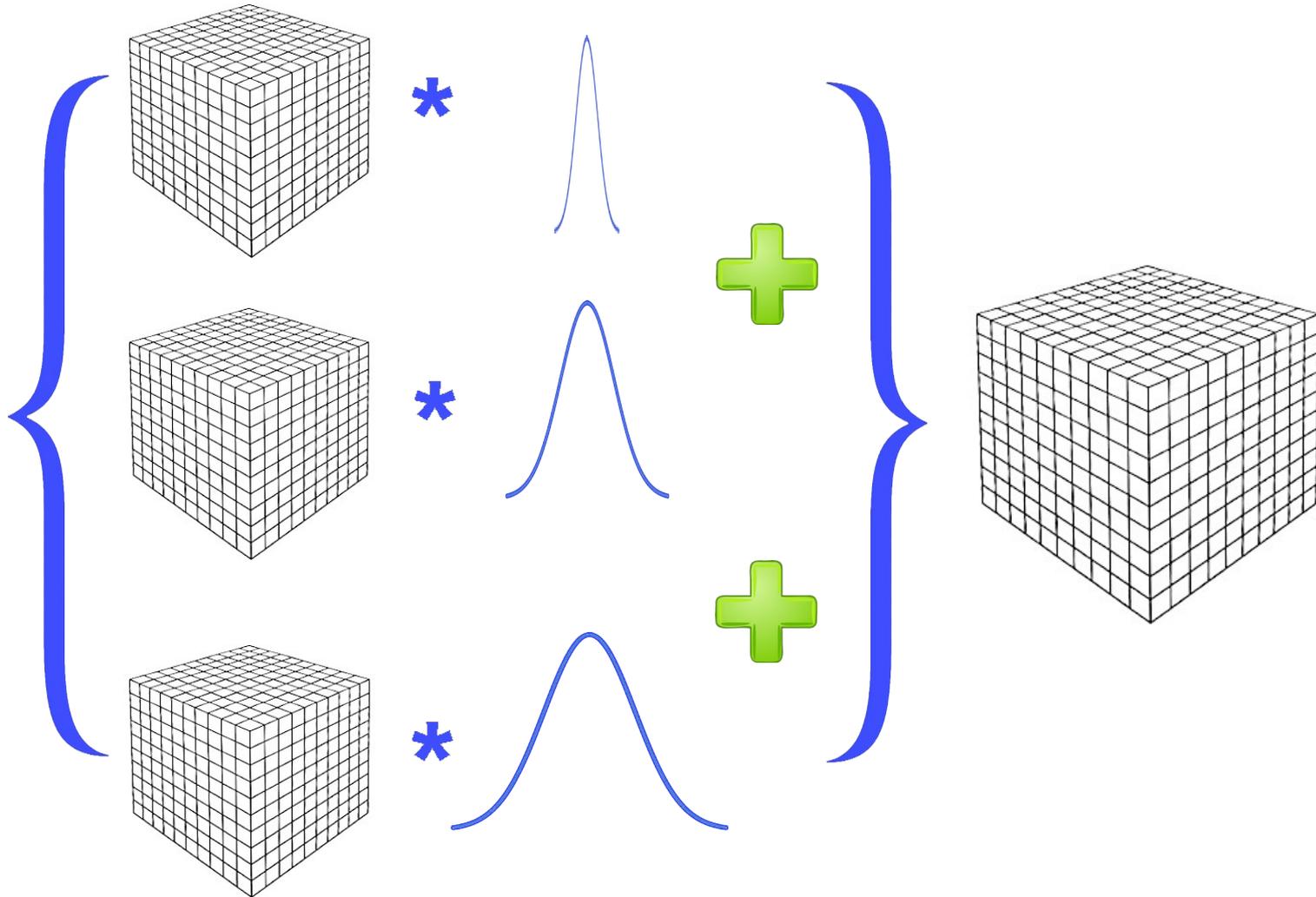
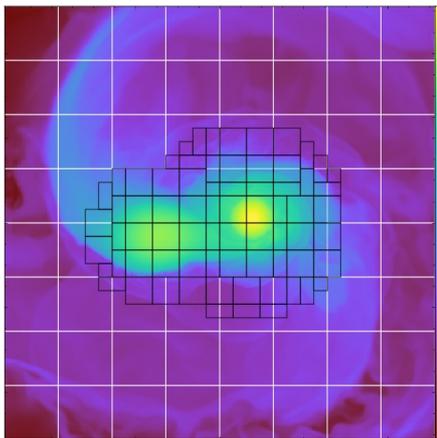
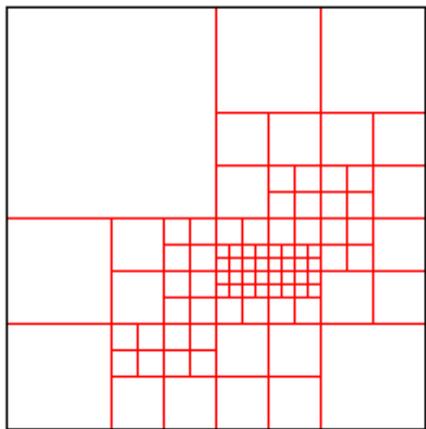


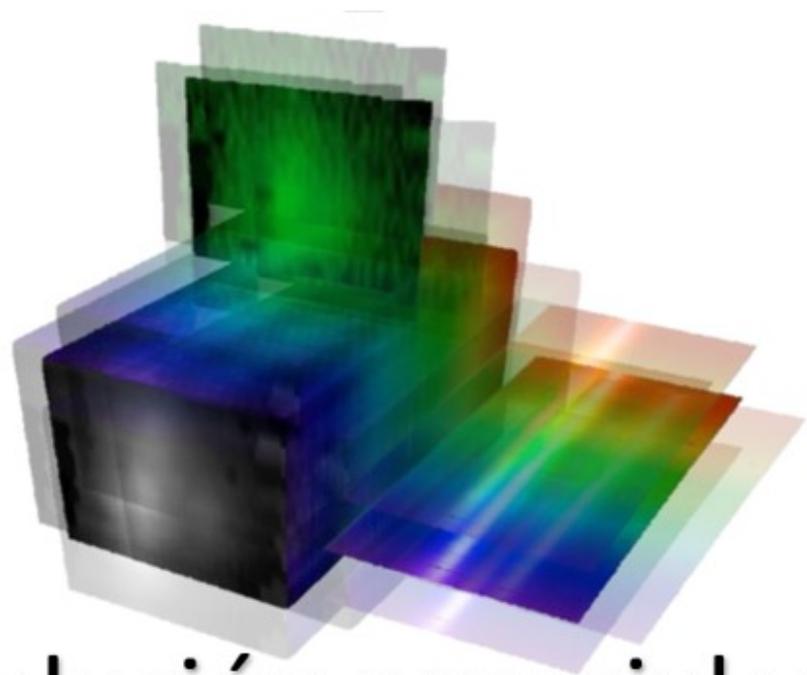
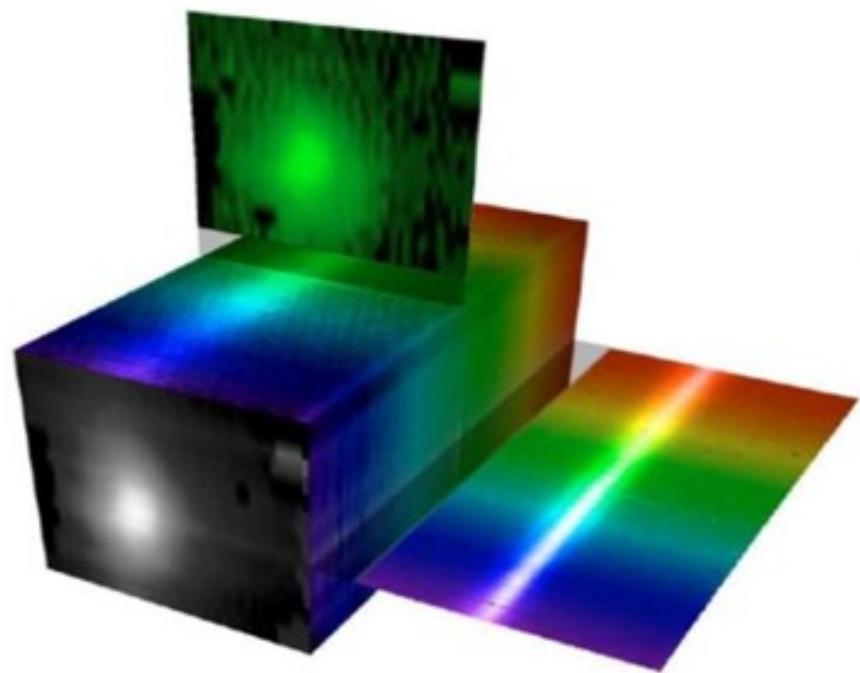
Proyección de las líneas de emisión en los canales



Suma de las contribuciones en luminosidad

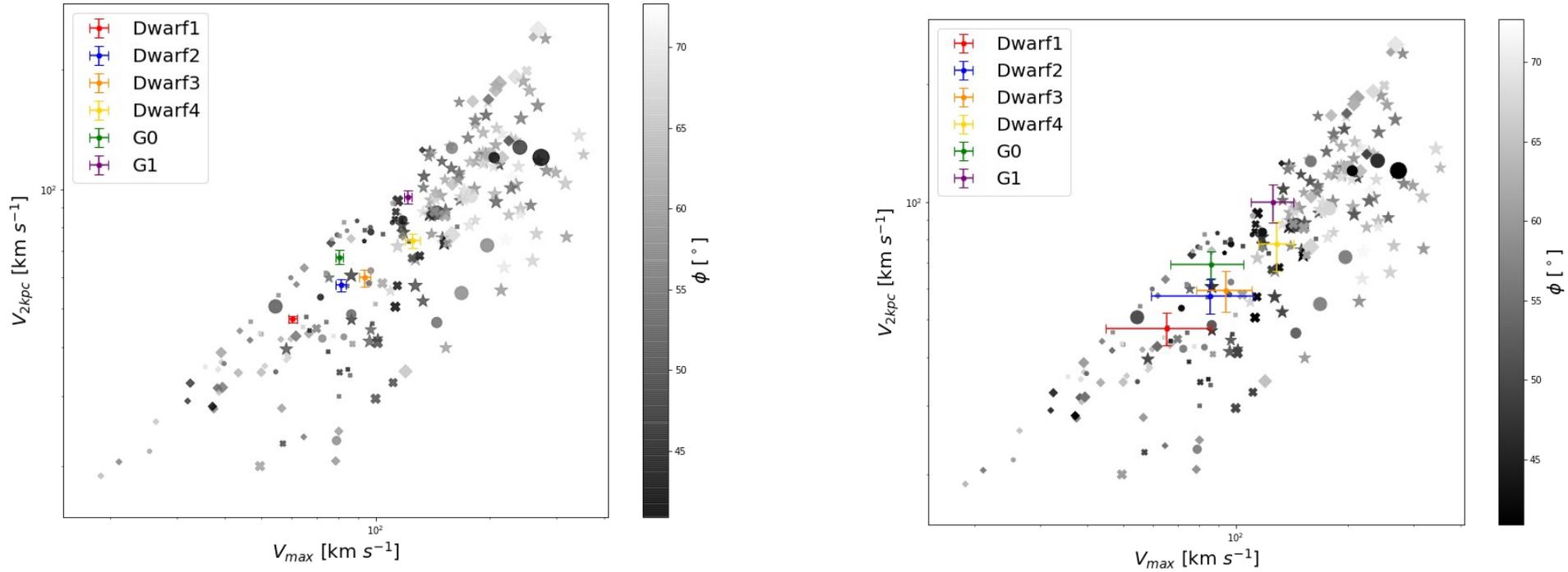






Resolución espacial y
espectral

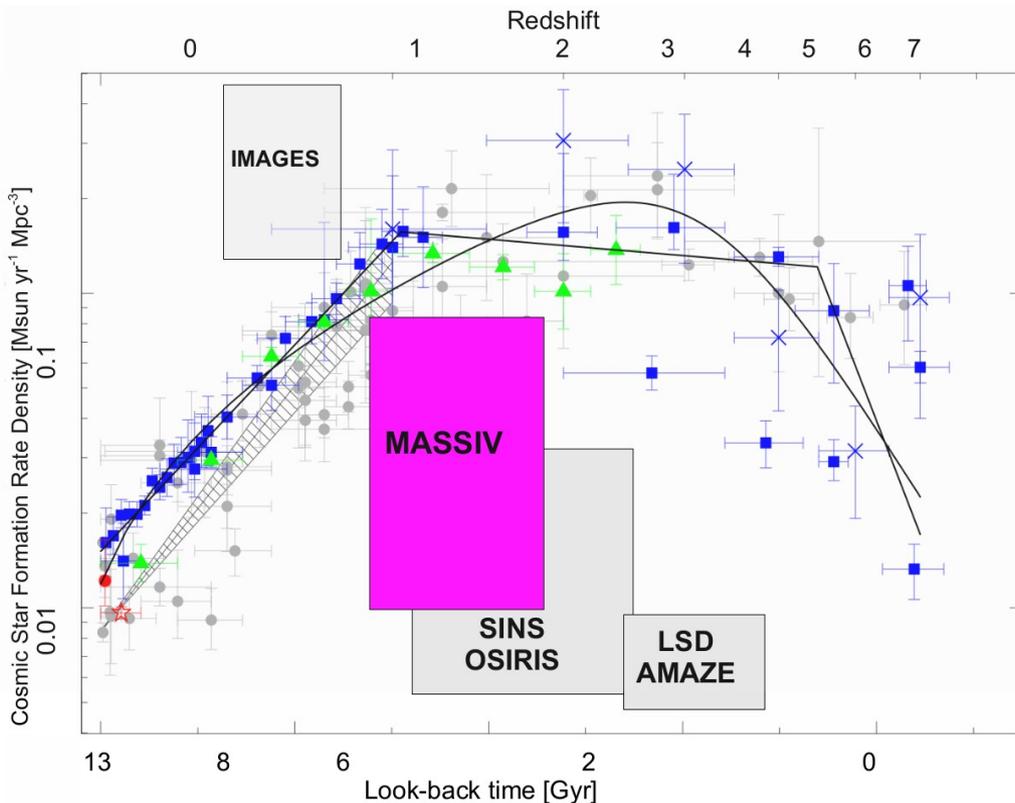
Aplicaciones



The diversity of dwarf galaxy rotation curves

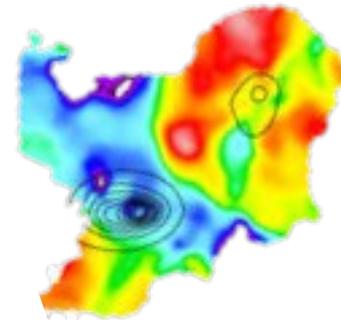
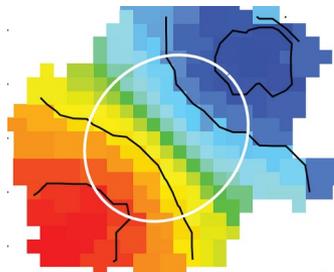
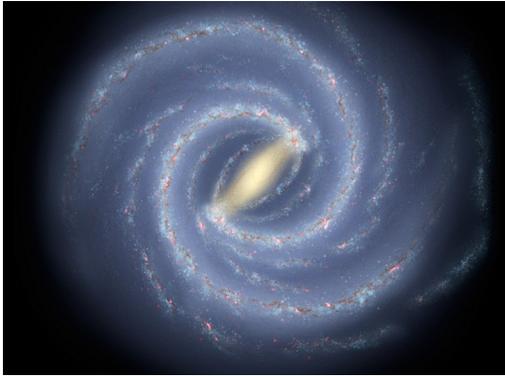
¿Es posible reconocer fusiones de galaxias usando mapas de velocidad en $z \sim 2$?

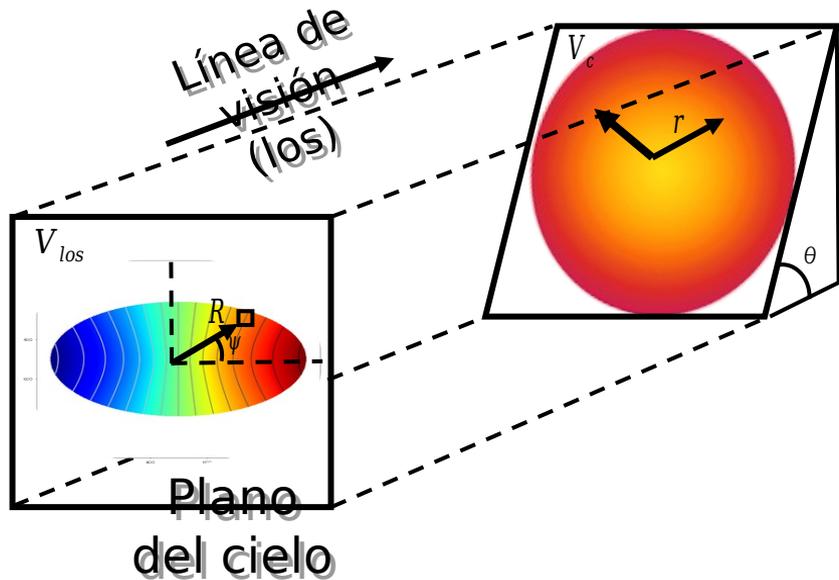
En $1 < z < 3$
ocurrió el pico
en la historia
cósmica de
formación
estelar



Mecanismos posibles de aprovisionamiento de gas:

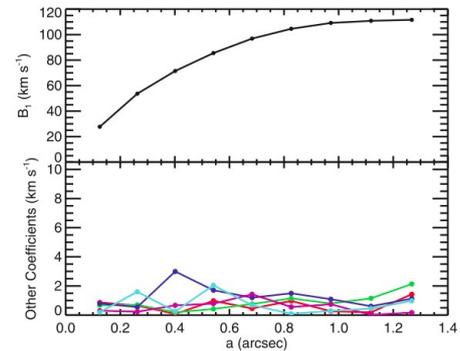
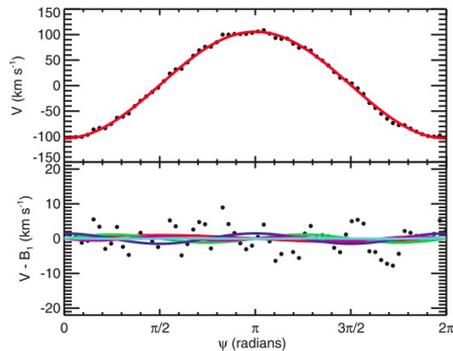
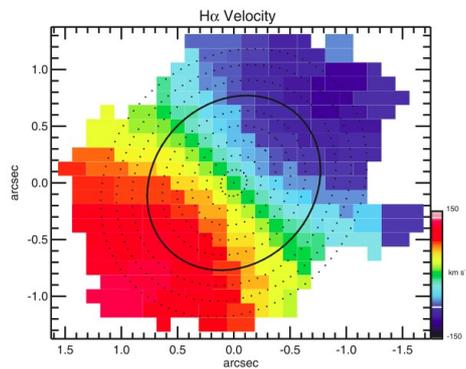
Acreción de gas desde filamentos cósmicos Vs fusiones de galaxias



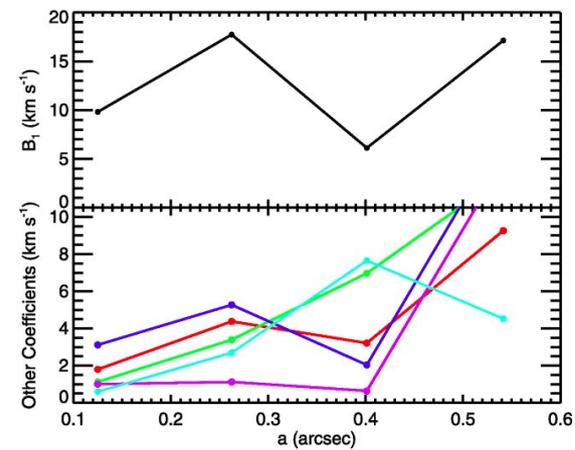
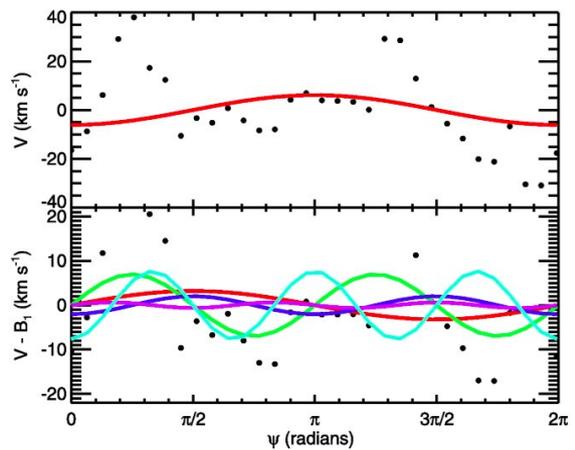
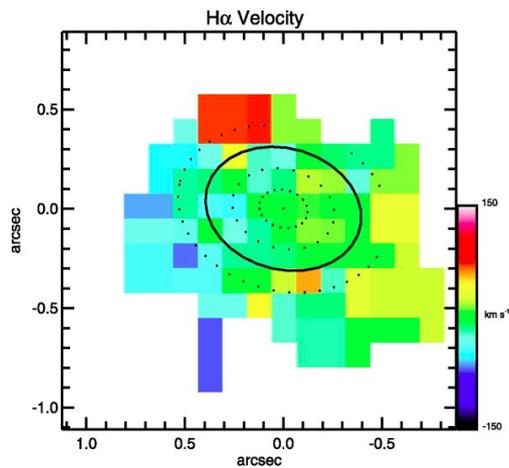


$$V_{los}(R, \psi) = V_0 + V_c(r) \sin(\theta) \cos(\psi)$$

$$V_{los,n}(\psi) = A_o + \sum_{j=1} A_{j,n} \sin(j\psi) + \sum_{j=1} B_{j,n} \cos(j\psi)$$



$$V_{los,n}(\psi) = A_o + \sum_{j=1} A_{j,n} \sin(j\psi) + \sum_{j=1} B_{j,n} \cos(j\psi)$$

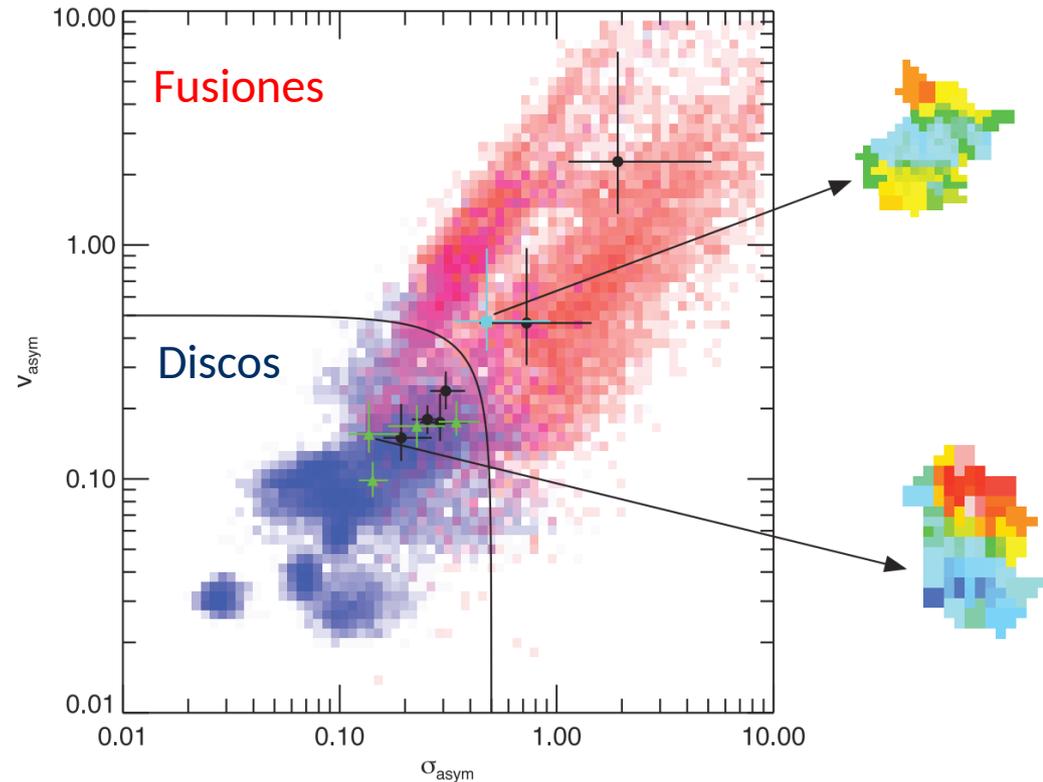


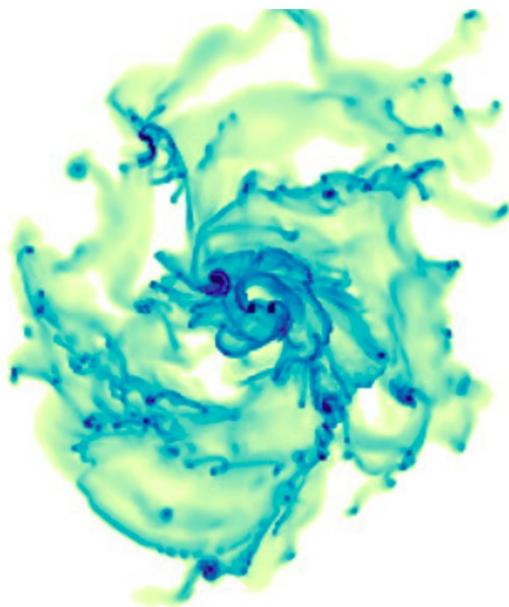
¿Es posible reconocer fusiones de galaxias usando mapas de velocidad en $z \sim 2$?

$$k_{i,v/\sigma} = \sqrt{A_{i,v/\sigma}^2 + B_{i,v/\sigma}^2}$$
$$V_{\text{asym}} = \left\langle \frac{\sum_{i=2}^5 k_{i,v/4}}{B_{1,v}} \right\rangle_r = \left\langle \frac{k_{\text{avg},v}}{B_{1,v}} \right\rangle$$
$$\sigma_{\text{asym}} = \left\langle \frac{\sum_{i=1}^5 k_{i,\sigma/5}}{B_{1,v}} \right\rangle_r = \left\langle \frac{k_{\text{avg},\sigma}}{B_{1,v}} \right\rangle$$

Shapiro, K. L. y cols. (2008). In: *The Astrophysics Journal*, 739(1), 45.

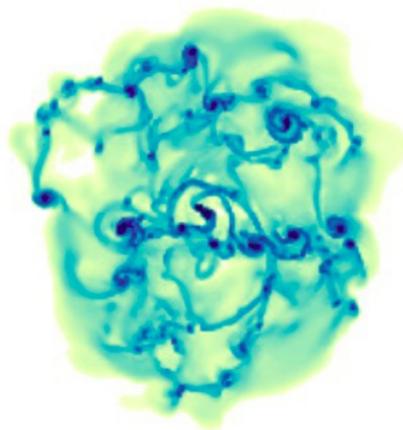
Simons, R. C. y cols. (2019). In: *The Astrophysics Journal*, 682(1), 231.





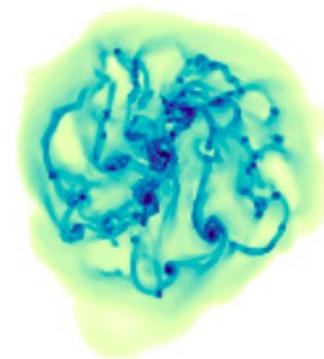
Galaxia G1

- $\text{Log}_{10}(M_{star}[M_{\odot}]) = 10.60$
- $R_{200}[kpc] = 99.8$
- $M_{200}[10^{10} M_{\odot}] = 102.4$
- $V_{200}[km s^{-1}] = 210.1$



Galaxia G2

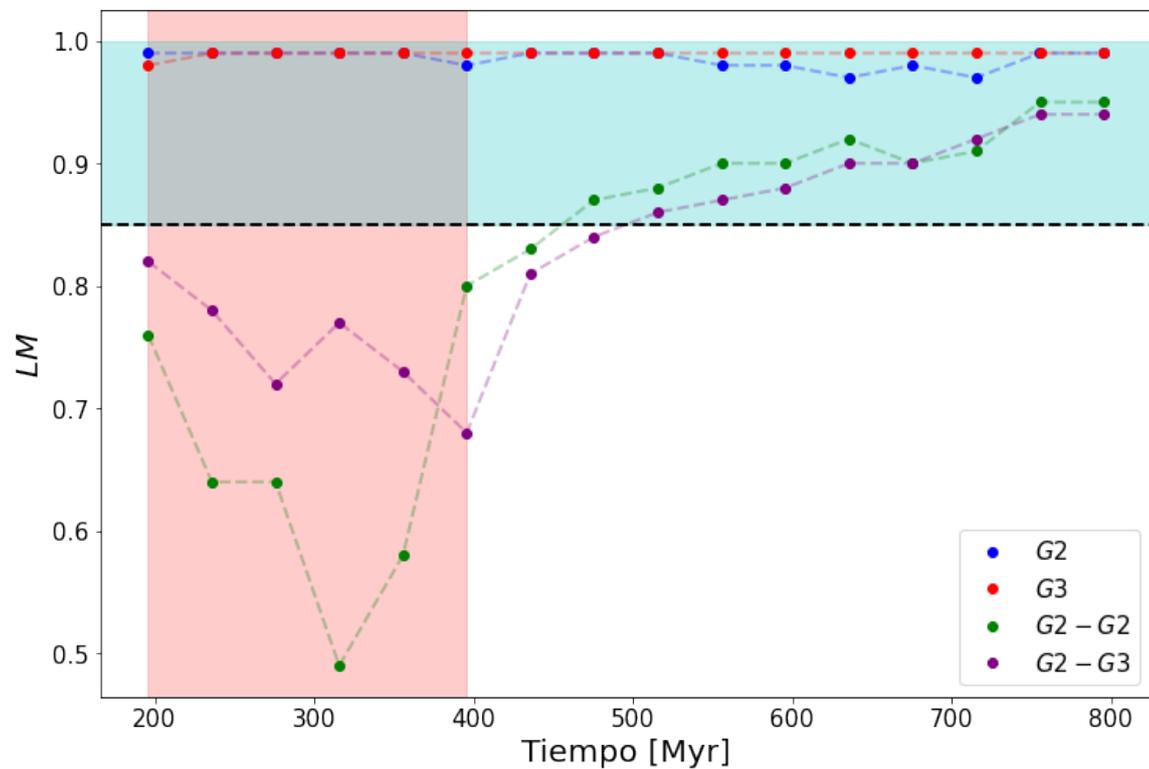
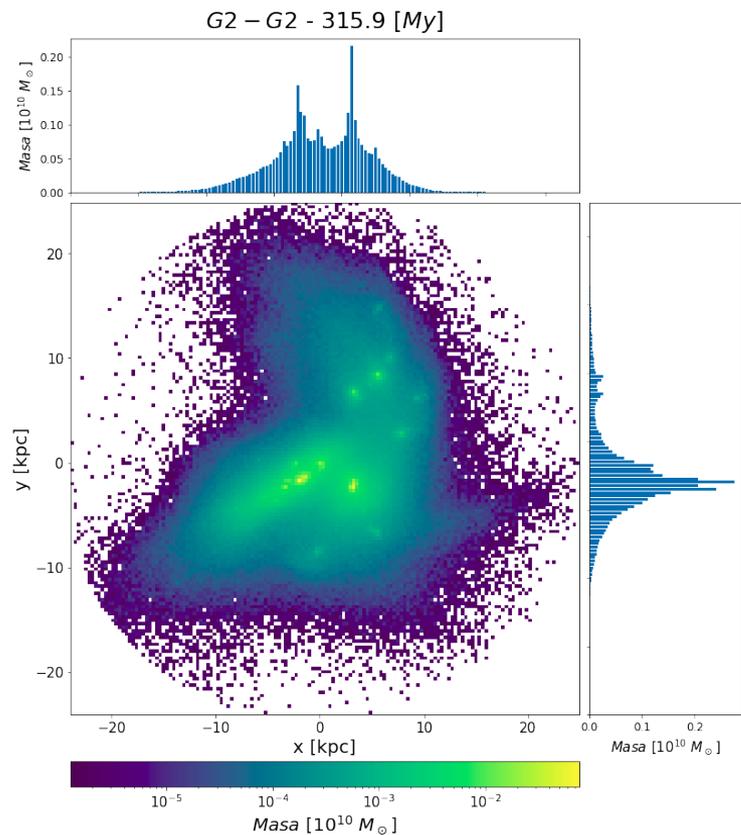
- $\text{Log}_{10}(M_{star}[M_{\odot}]) = 10.20$
- $R_{200}[kpc] = 73.4$
- $M_{200}[10^{10} M_{\odot}] = 40.8$
- $V_{200}[km s^{-1}] = 154.6$



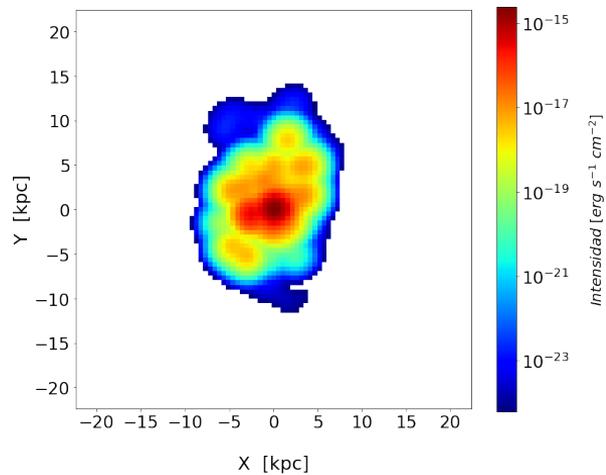
Galaxia G3

- $\text{Log}_{10}(M_{star}[M_{\odot}]) = 9.80$
- $R_{200}[kpc] = 54.0$
- $M_{200}[10^{10} M_{\odot}] = 16.2$
- $V_{200}[km s^{-1}] = 113.7$

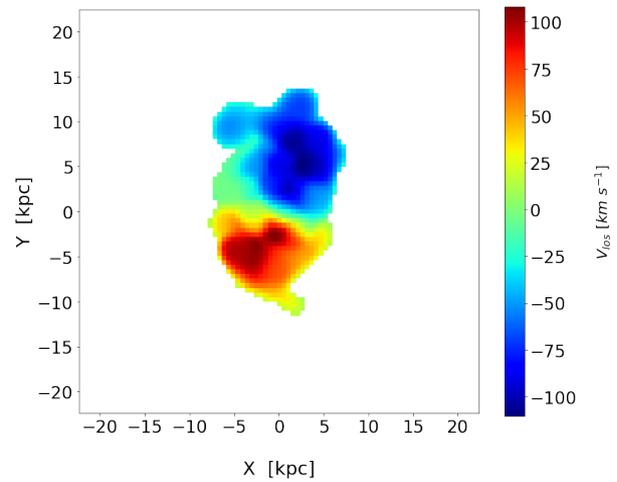
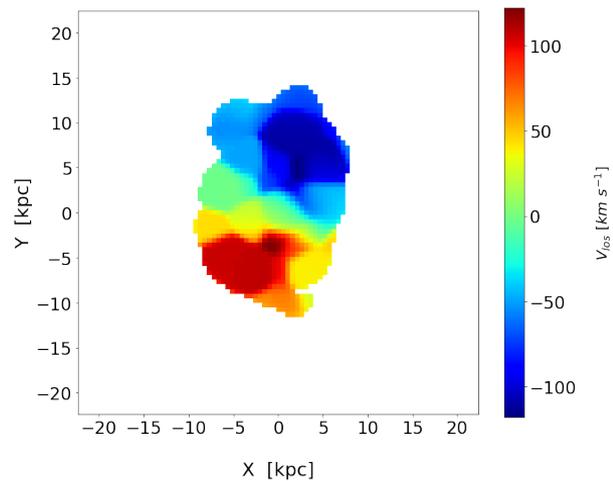
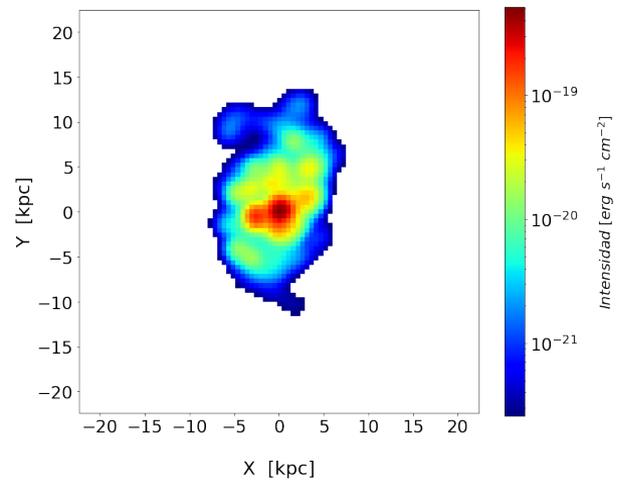
$$LM = \frac{\sum_i m_i \frac{j_{z,i}}{J_i}}{\sum_i m_i}$$



Lum $\propto \rho^2$

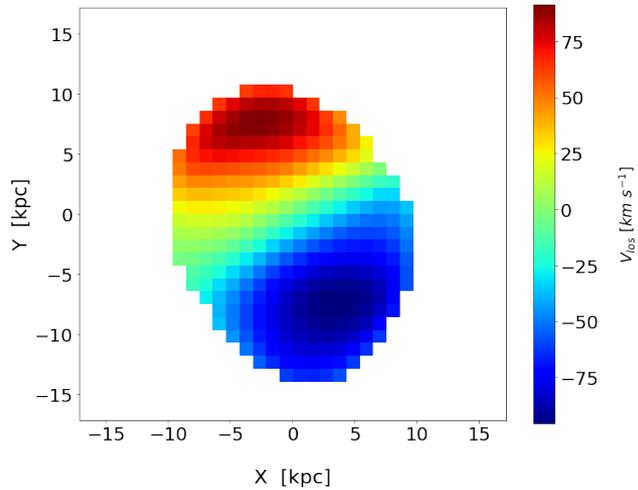


Lum $\propto \rho$

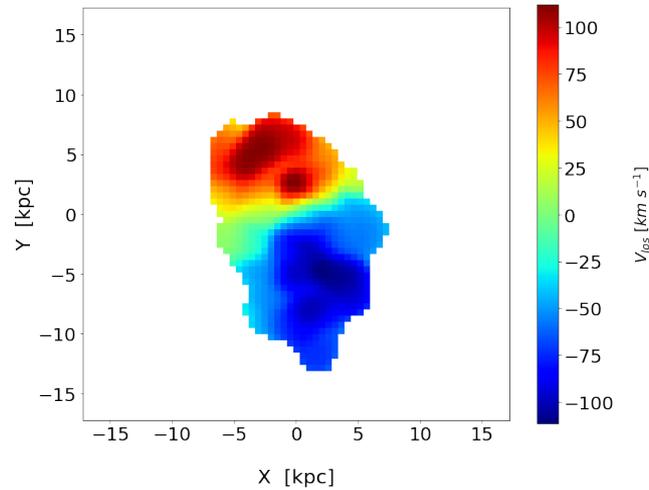


Se generaron 192 cubos de datos a partir de 4 simulaciones

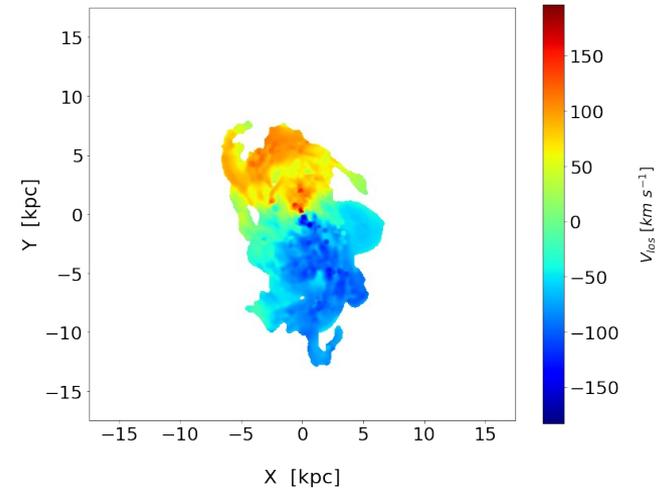
Baja 0,6''



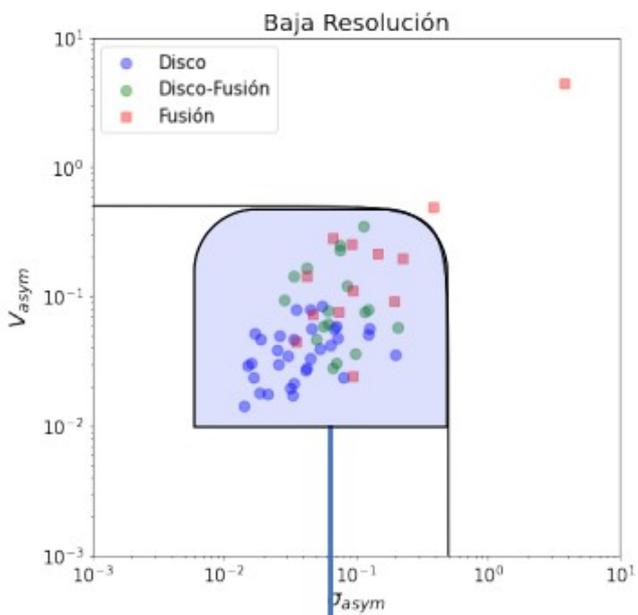
Media 0,2''



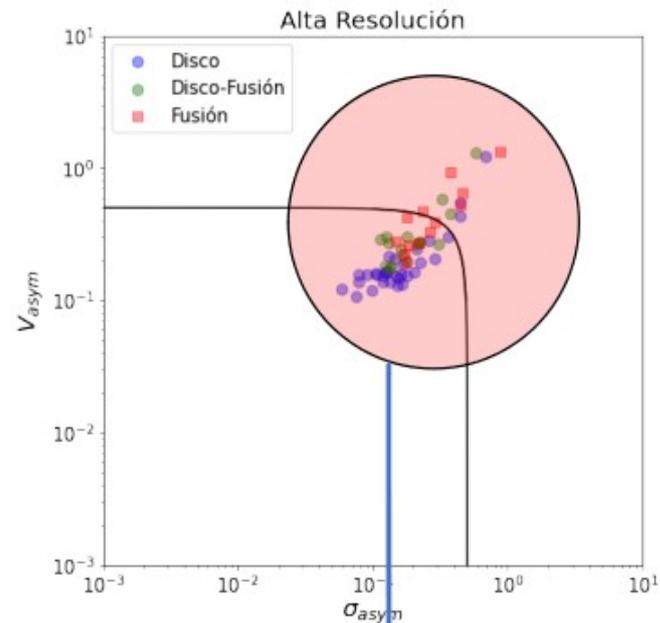
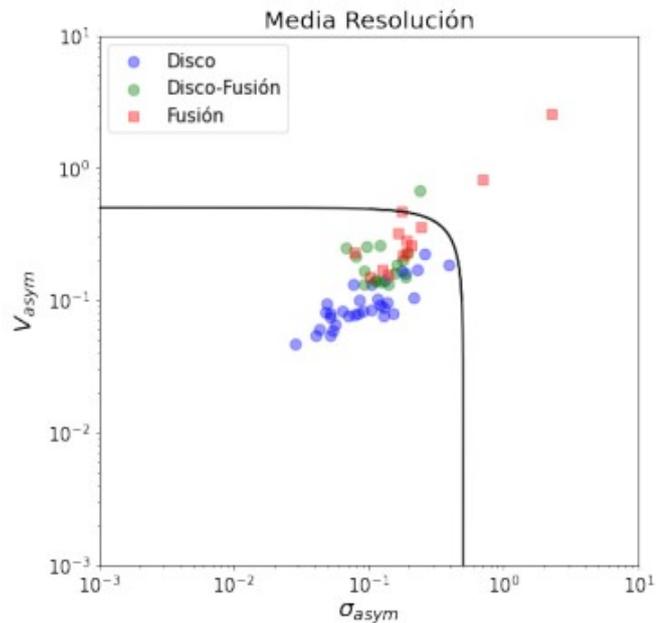
Alta 0,02''



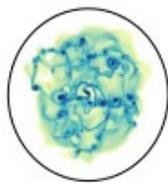
Con el aumento de la resolución aumenta el número de fusiones detectadas correctamente



Se ajustan con mayor facilidad sobre un número menor de píxeles



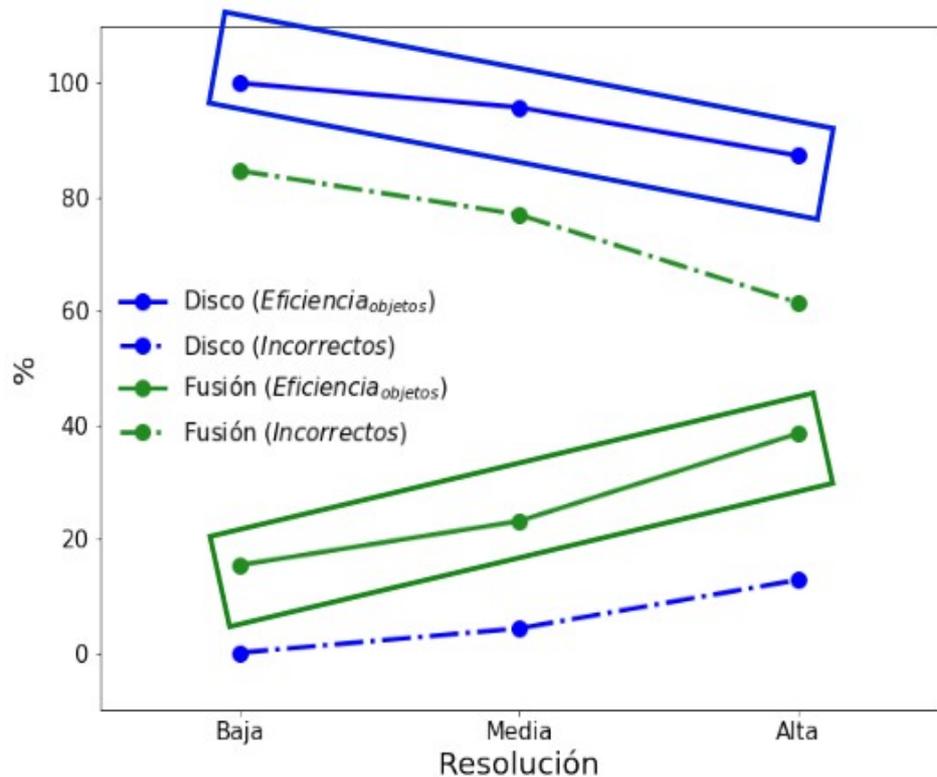
Se resuelve en mayor detalle la cinemática perturbada de las simulaciones



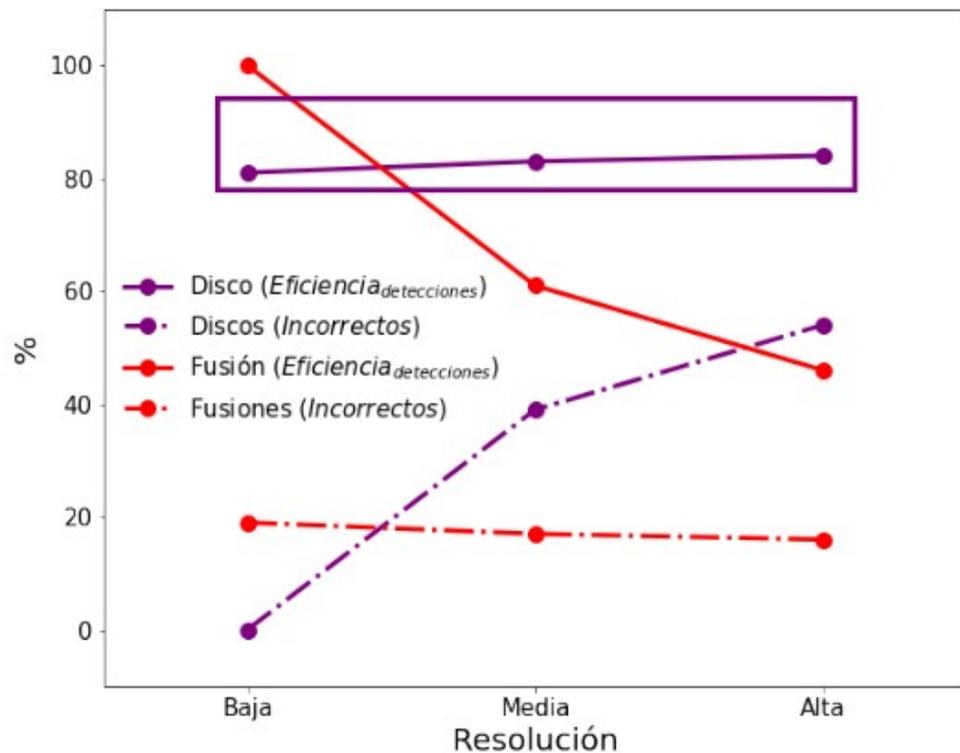
H_{α}



¿Cuántos discos o fusiones son detectados correctamente?



¿Cuántos de los sistemas clasificados observacionalmente como discos o fusiones lo son en realidad?



GRACIAS



*Ilustración
Juan Carlos Basto Pineda*