Study of galaxy morphology and merging time of two interacting galaxies under different initial rotation and orientation configurations

2020/4/1
櫛引洸佑

Lopez+ 2020 arXiv:2003.12100

Using the GADGET-2 N-body code, we make a study of the galaxy morphology and merging time due to two interacting galaxies (for the same types and different sizes and masses, 1 : 1 and 1 : 10 ratio masses) merging due to gravity interaction. This is done for different initial relative orientation and rotation of these galaxies (modes of interaction) but with the same relative bulge separation and the same relative initial velocities. It was found that the resulting galaxy morphology resemble many of the observed galaxies in our Universe, and that, in general, a binary galaxy system with 1:10 mass ratio has larger merging time than a binary galaxy system with 1:1 mass ratio. This difference is due to the different evolution of the masses during the interaction in both cases. For the case with a 1:10 mass ratio, the global mass maximum is located at the end evolution, meaning that the second galaxy increases its mass constantly. For the case with mass ratio 1:1, the global maximum is located around $t = 0.35$ Gy, causing a reduction of the merging time.

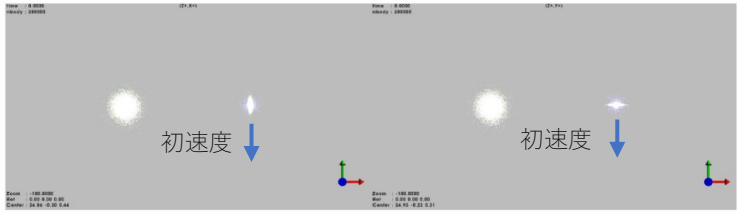

Figure 1: Two interacting galaxies with different modes; (Z^+, X^+) on the left and (Z^+, Y^+) on the right

銀河を色々な回転の向きで相互作用 (GADGET-2 N-body code)
- X+, X-, Y+, Y-, Z+, Z-の6種類のディスク回転
- 質量比 1:10 (minor merger) & 1:1 (major merger)

→ 銀河の形態とmerging timeの変化を調べる

Minor merger
- 時間がかかる(~4 Gyr)
- バルジと歪んだ非対称ディスクをもつディスク銀河になる
- 質量の最大は最後に来る

Major merger
- より短い時間でmergeする (~ 0.5 – 0.7 Gyr)
- minor mergerと比べてディスクが広がらない
  second galaxyがZ+の時は歪んだ非対称warpディスクになる
  その他はbulge/ellipsoidになる
- 質量は~ 0.35 Gyrにピークが来る
  (半径R_d, 高さ$2z_0$内の円柱内の質量なので、二つの銀河が密集する瞬間に対応)

$$\mathcal{M}(R,z) = M_* \tanh\left(\frac{z}{z_0}\right)\left[1-\left(1+\frac{R}{R_d}\right)\exp\left(\frac{R}{R_d}\right)\right]$$