



Contribution ID: 47

Type: **not specified**

## The influence of satellites on the development of warps in barred and non-barred galaxies

The interaction with satellites change the morphology of the galaxies. These interactions can induce vertical asymmetries, such as S-shaped warps, which bend one part upwards and the other downwards. If the galaxy is barred, the passage of the satellite also affects the development of bar. In this study, we aim to compare barred and non-barred galaxy models and their susceptibility to warps induced by satellites. We use Gadget-4 simulations of central galaxies interacting with satellites with different masses ( $0.1 \times 10^{10} M_{\odot}$ ,  $0.5 \times 10^{10} M_{\odot}$  and  $1 \times 10^{10} M_{\odot}$ ) and initial orbital radii (10, 20 and 30 kpc). We analyzed warp intensity with qualitative (mean height maps) and quantitative (bending mode and maximum amplitude of the warp) methods. Our results indicated that the same model of satellite induce stronger warps in the barred galaxy compared with the non-barred galaxy. In addition, the mass of the perturber is the main influence on the intensity of the warp. In the barred model, we measured the bar strength, and found that the bar can be preserved, weakened or destroyed, depending on the mass of the satellite. The time the weakening/destruction takes depends on the initial orbital radius of the satellite.

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**Session Classification:** Astrofísica Galáctica e Extra-Galáctica