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Test of Clausius' Virial Dynamical Theory of Fundamental Plane By Homogeneous + γ-Free Two Component Galaxy Model

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Abstract. To test the extension of the theory of the Fundamental Plane (FP) proposed by Secco (2000, 2001, 2005) to an higher order (*non-linear*) we explore the effect on an homogeneous stellar component due to a DM halo with a density profile characterized by an inner slope γ free and an outer slope -3, according to high resolution RCs of Sps (Garrido *et al.*, 2004). The aim is to investigate the role of the dark to bright mass ratio m and of the halo concentration C_D in order to produce the maximum of Clausius' Virial potential energy (CV). Particular attention is devoted to the slope of the density halo profile at the maximum location, to its height in comparison with the CV value when the two components coincide, $\mathbf{V}_n$. For all models we choose $\gamma = 0$. We follow the general method proposed by Caimmi, 1993 for two striated ellipsoidals with Zhao-density profiles. Virial equilibrium is described by tensor virial equations extended to two components (Caimmi & Secco, 1992). Sequences of CV as function of the ratio baryonic to halo virial semi-axis, numerically performed for different values of m and C_D, are taken into account.

1. Results

The special configuration at the CV maximum appears if m is greater than a given threshold at fixed C_D. A threshold also appear for C_D at fixed m. The slope (in absolute value) at which the maximum falls on the DM profile decreases either as m increases at fixed C_D or as C_D decreases at fixed m. A conspiracy between m and C_D appears also in order to obtain the highest values of $\mathbf{V}_n$. To see if the results could be an artefact of the special model considered we take into account the trend of the quantity $\mathbf{V}_n$ as function of the DM slope d in the *linear* model. The maximum value of $\mathbf{V}_n$ is reached when the slope of DM density profile goes to 0 no regarding to bright density profile and to mass ratio. A similar trend is found here. The value of $\mathbf{V}_n$ increases as the slope decreases either when m changes, at fixed C_D or C_D changes at fixed m. It is remarkable that the values of the slopes, where falls the CV maximum, work as attractors of higher values of $\mathbf{V}_n$ as soon as they are slower. The reason lies in the deep meaning of $\mathbf{V}_n$. The results allow to move the description of main features of the FP by CV theory toward more realistic models.

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