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The 3D Topology of the Clausius Virial for Two Component Dynamical Models of Elliptical Galaxies

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Abstract. As found in Secco (2000, 2001), the presence of a (non-baryonic) dark halo in large-scale celestial objects, can induce a scale length on the luminous spheroid through the occurrence of an unexpected maximum in the virial potential energy (Clausius Virial, CV). The above mentioned investigations were grounded on two cored power law density profiles, but the same result is shown to hold for more refined and realistic models.

Keywords. Elliptical Galaxies, Galactic Dynamics, Galaxy Formation, Galaxy Evolution

1. Results and conclusions

In all our models the presence of the Clausius Virial maximum depends on the path chosen in its 3D surface. The maximum appears for unreasonably high values of $\mathcal{R} > 20$ for Hernquist-Hernquist models, suggesting that the inner slope of the halo component plays an important role in enhancing the presence of stationary points in the CV. This is confirmed by the Hernquist-Plummer model, where the cored halo profile produces maximums above a much smaller threshold $\mathcal{R} > 4$. We can draw the following conclusions:

- The CV maximums are always present with different restrictions on $\mathcal{R}$.
- Different paths along the 3D CV surface show both a monotonic and a non monotonic trend, but no real stationary points appear in the 3D CV surface.
- Cored halo profiles enhance the presence of the maximum in the CV for sufficiently low values of $\mathcal{R}$.

The question: **Is the CV maximum relevant in the dynamics of two-component spheroids?** In order to answer to this question we need to look for dynamical constraints to determine a further physically meaningful path on the CV 3D surface, and see if the occurrence of the maxima obey the same condition. In this way it will be finally possible to compare models' results with observations and simulations.

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References

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