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Addendum

WHY THERE ARE NO ELLIPTICAL GALAXIES MORE FLATTENED THAN E7. THIRTY YEARS LATER

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SUMMARY: The existence of some sort of instability with regard to prolate configurations has been advocated in an earlier paper (Caimmi 2006) in order to explain the observed lack of elliptical galaxies more elongated than $E7$. It is recognized that a viable physical process might be the occurrence of bending instabilities, which were fully investigated long time ago, both analytically (Polyachenko and Shukhman 1979) and numerically (Merritt and Hernquist 1991).

Key words. Cosmology: dark matter – galaxies: evolution – galaxies: formation – galaxies: haloes – galaxies: structure.

In an earlier paper (Caimmi 2006), dark (nonbaryonic) matter haloes and embedded elliptical galaxies, idealized as a single homeoidally striated Jacobi ellipsoid, were considered in connection with the cosmological transition from expansion to relaxation. By generalizing an earlier model (Thuan and Gott 1975) in many respects, the existence of a lower limit to the flattening of the relaxed (oblate-like) configurations was established. On the other hand, no lower limit was found to the elongation of the relaxed (prolate) configurations, and the existence of some sort of instability was predicted, owing to the observed lack of elliptical galaxies more elongated than $E7$.

In fact, the author had no knowledge that an alternative explanation for the absence of elliptical galaxies (and nonbaryonic dark matter haloes) more flattened or elongated than $E7$ as due to bending instabilities, was suggested long time ago from analytical methods involving homogeneous (oblate and prolate) spheroids (Polyachenko and Shukhman 1979, Fridman and Polyachenko 1984, Vol. 1, Chap. 4, Sect. 3.3, see also pp. 313-322; Vol. 2, p. 159) and numerical simulations involving inhomogeneous (oblate and prolate) spheroids (Merritt and Hernquist 1991, Merritt and Sellwood 1994).

In a cosmological scenario (Thuan and Gott 1975), the occurrence of a limiting ellipticity in oblate configurations depends on the amount of spin growth regardless of the onset of bending instabilities. The results found in an earlier attempt (Caimmi 2006) show that the same does not hold for prolate configurations, where the onset of bending instabilities is necessary for the occurrence of a limiting ellipticity in prolate configurations. The amount of figure rotation seems to be unimportant in this respect (Raha et al. 1991, Merritt and Sellwood 1994). A theoretical explanation of the absence of elliptical galaxies more flattened or elongated than $E7$, in terms of a dynamical bending instability (Merritt and Sellwood 1994), is generally recognized to explain also the maximum elongation of simulated nonbaryonic dark matter haloes (e.g. Bett et al. 2007).

The critical flattening and the critical elongation for the onset of bending instabilities in inhomogeneous models were found close to their counterparts related to homogeneous spheroids (Merritt and Sellwood 1994). If the orbital frequency ratio in

homeoidally striated Jacobi ellipsoids depends only on the axis ratio, as in potential-energy tensor component ratio (Roberts 1962), the above result may be interpreted in the following way: simulated inhomogeneous models (Merritt and Sellwood 1994) are well approximated by homeoidally striated Jacobi ellipsoids.

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