Erratum

Lecture Notes in Physics
T. Dauxois S. Ruffo E. Arimondo M. Wilkens (Eds.),
Dynamics and Thermodynamics of Systems with Long-Range Interactions, ISBN 3-540-44315-0

Figure 9 on page 230 of the contribution of Dr. Chavanis is incorrect. Please find here the correct version.

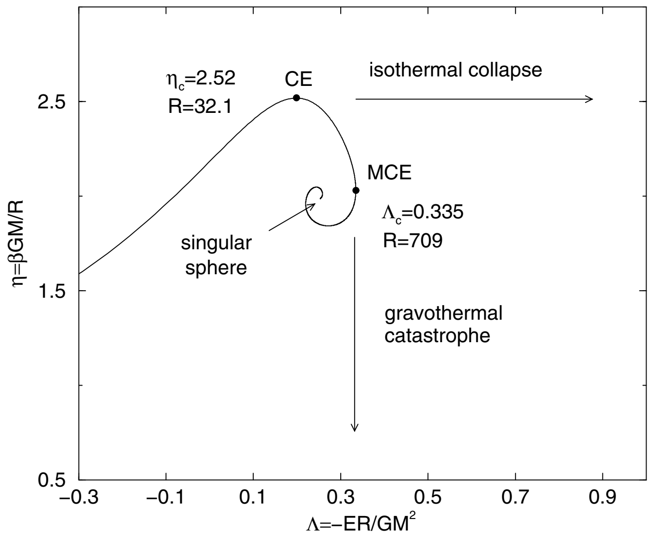

Fig. 9. Equilibrium phase diagram for self-gravitating systems confined within a box. For sufficiently low energy or temperature, there is no equilibrium state and the system undergoes gravitational collapse.

the benefit of a neighboring galaxy. In fact, the evaporation is so slow that we can consider in a first approximation that the system passes by a succession of quasiequilibrium states described by a truncated isothermal distribution function (Michie-King model) [9]. This justifies the statistical mechanics approach in that sense. Another way of solving the infinite mass problem is to confine the system within a box of radius R. However, even in that case, the notion of equilibrium poses problem regarding what now happens at the center of the configuration.

The equilibrium phase diagram (E, T) for bounded self-gravitating systems is represented in Fig. 9. The caloric curve has a striking spiral behavior parametrized by the density contrast $\mathcal{R} = \rho(0)/\rho(R)$ going from 1 (homogeneous system) to $+\infty$ (singular sphere) as we proceed along the spiral. There is no equilibrium state below $E_c = -0.335GM^2/R$ or $T_c = \frac{GMm}{2.52kR}$ [2,92]. In that case, the system is expected to collapse indefinitely. This is called *gravothermal catastrophe* in the microcanonical ensemble (fixed E) and *isothermal collapse* in the canonical ensemble (fixed T). Dynamical models show that the collapse is self-similar and develops a finite time singularity [105,85,56,91,84,46]. However, although the central density goes to $+\infty$, the shrinking of the core is so rapid that the core mass goes to zero. Therefore, the singularity contains no mass and this process alone cannot lead to a black hole.

Since the $T(E)$ curve has turning points, this implies that the microcanonical and canonical ensembles are not equivalent and that phase transitions will occur [103]. In the microcanonical ensemble, the series of equilibria becomes unstable after the first turning point of energy (MCE) corresponding to a density contrast of 709. At that point, the solutions pass from local entropy maxima to

Springer
http://www.springer.com/978-3-540-44315-5

Dynamics and Thermodynamics of Systems with Long Range Interactions
Dauxois, T.; Ruffo, S.; Arimondo, E.; Wilkens, M. (Eds.)
2002, XI, 492 p., Hardcover
ISBN: 978-3-540-44315-5