

Existence and stability of circular orbits in exponential-type potentials

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The exponential law appears in lots of models of the real world, as Newton's law of cooling of heated objects (1701), Bouguer's law of absorption of the light through translucent materials (1729), Malthus theory of population increasing (1798), Verhulst model for the growth of a biological population (1838), or the damped oscillations in electrical circuits studied by Lord Kelvin - William Thompson (1853).

The idea of modifying the original $1/r$ Newtonian potential starts with Newton himself. In his *Principia* he has already proposed a potential of the form $A/r + B/r^2$ and studied the relative orbit in this case too.

The corrections to the Newtonian potential, containing exponential terms, have been proposed first by Seeliger (1895) and Neumann (1896). Such potentials are used in Astrophysics to explain recently observed phenomena that occur at various scales, from solar system to cosmological distances, which have not yet found an explanation in terms of conventional physics.

We study the shape of several exponential-type potentials, and then the existence and linear stability of circular orbits in these potentials.

References

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