Towards a full general relativistic approach to galaxies

Federico Re[a]

[a] Department of Physics Giuseppe Occhialini, Università di Milano-Bicocca,
Piazza della Scienza 3, 20126, Milano, Italy
federico.re@unimib.it

Abstract

We analyse the dynamics of a single disk galaxy from a general relativistic viewpoint. We investigate dark matter effects in terms of a known family of stationary axially-symmetric solutions of Einstein equations coupled to a rotating dust. These effects are generated by the non-Newtonian features of such solutions and are ascribed to the essential role of frame dragging. Indeed, in such models, the off-diagonal elements of the metric are, in general, of the same order of magnitude of the diagonal ones. We generalize the results of Balasin and Grumiller to the physical case of differentially rotating dust. In particular, we find that for differential rotation the amount of energy density required to account for the at rotation curves of disk galaxies is reduced with respect to the BG rigid rotation case. This stresses the discrepancy between Newtonian gravity and general relativity, even at low velocities and low energy densities.