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Static EKG stars and matter-scalar field interactions

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Static (not stationary) solutions of the Einstein-Klein-Gordon (EKG) equations including matter are obtained for real scalar fields. The scalar field interaction with matter is considered. The introduced coupling allows the existence of static solutions in contraposition with the case of the simpler EKG equations for real scalar fields and gravity. Surprisingly, when the considered matter is a photon-like gas, it turns out that the gravitational field intensity at large radial distances becomes nearly a constant, exerting an approximately fixed force to small bodies at any distance. The effect is clearly related with the massless character of the photon-like field. It is also argued that the gravitational field can generate a bounding effect, that could avoid the unlimited increase in mass with the radius of the obtained here solution. This effect, if verified, furnishes a possible mechanism for explaining how the increasing gravitational potential associated to dark matter finally decays at large distances from the galaxies. A method for evaluating these photon bounding effects is just formulated in order to be further investigated.

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