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On gravastars solutions of the Einstein-Klein-Gordon equations in the sense of Colombeau-Egorov's generalized functions

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Spherically symmetric solutions are presented of the equations of motion for a scalar field interacting with gravity (EKG equations) in the Colombeau-Egorov's sense. The scalar fields are confined within the interior region and the exterior fields are purely gravitational and coinciding with the Schwarzschild ones. The solution resembles the so called "gravastars"which had been discussed in the literature. These solutions of the EKG equations open a possibility for the existence of static boson stars. The argumentation is based in defining a one parameter ϵ dependent family of radial dependencies of the metric and the scalar field, being infinitely differentiable. Afterwards, it is argued that in the limit $\epsilon \to 0$, the EKG equations are satisfied in the sense of the generalized functions. The solutions exhibit properties which qualitatively support their physical meaning. For example close to the boundary at the interior, the scalar field energy density pile up towards to the limit surface. On the other hand, also close to the separation surface, but on the outside, the known " non-hair"theorem, clearly indicates that any scalar field perturbation also tends to be attracted to the boundary. The work also suggests the possibility for obtaining a regular gravastar, after using the found singular configuration as a first step in an iterative solution of the quantum EKG equations.

Authors: Dr CABO MONTES DE OCA, Alejandro (ICIMAF); Mr SUAREZ FONTANELLA, Duvier (Facultad de Fisica, Universidad de la Habana); Dr CABO-BIZET, Nana Geraldine (Instituto de Fisica, Universidad de Guanajuato)

Presenter: Mr SUAREZ FONTANELLA, Duvier (Facultad de Fisica, Universidad de la Habana)

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