

Analyzing Boson Star as a Candidate for Dark Galaxy Using ADM Formulation of General Relativity

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Abstract : Boson stars can be viewed as zero temperature ground state, Bose-Einstein condensates, characterized by enormous occupation numbers. Time-dependent spherically symmetric spacetime can be a model of Boson Star. We use (3+1) split of Einstein equation (ADM formulation of general relativity) to solve Einstein field equation coupled to a complex scalar field (Einstein-Klein-Gordon Equation) on time-dependent spherically symmetric spacetime, We get the result that Boson stars are pulsating stars with the frequency of oscillation equal to its density. We search for interior solution of Boson stars and get the T.O.V. (Tollman-Oppenheimer-Volkoff) equation for Boson stars. Using T.O.V. equation, we get the equation of state and the relation between pressure and density, its total mass and along with its gravitational Mass. We found that the hypothetical particle Axion could form a Boson star with the size of a milky way galaxy and make it a candidate for a dark galaxy, (a galaxy that consists almost entirely of dark matter).

Keywords : axion, boson star, dark galaxy, time-dependent spherically symmetric spacetime

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