Dark Energy Star Models

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Over the past decade, one of the most remarkable discoveries is that our universe is currently accelerating. In Einstein's general relativity, in order to have such an acceleration, one needs to introduce a component to the matter distribution of the universe with a large negative pressure. This component is usually referred as dark energy. Then, a natural question is how dark energy affects the process of the gravitational collapse of a star. It is known that dark energy exerts a repulsive force on its surrounding, and this repulsive force may prevent the star from collapse. Indeed, there are speculations that a massive star doesn't simply collapse to form a black hole, instead, to the formation of stars that contain dark energy. In order to give some answers to this question, we have constructed star models consisting of four parts: (i) a homogeneous inner core with anisotropic pressure (ii) an infinitesimal thin shell separating the core and the envelope; (iii) an envelope of inhomogeneous density and isotropic pressure; (iv) an infinitesimal thin shell matching the envelope boundary and the exterior Schwarzschild spacetime. We have analyzed all the energy conditions for the core, envelope and the two thin shells. We have found that, in order to have static solutions, at least one of the regions must be constituted by dark energy. The results show that there is no physical reason to have a superior limit for the mass of these objects but for the ratio of mass and radius.