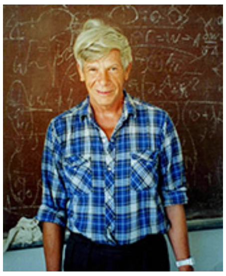

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Maximal Masses of White Dwarfs for Polytropes in Modified Gravity

We examine the Chandrasekhar limit for white dwarfs in $f(R)$ gravity, with a simple polytropic equation of state describing stellar matter. We use the most popular $f(R)$ gravity model, namely the $f(R) = R + \alpha R^2$ gravity, and calculate the parameters of the stellar configurations with polytropic equation of state of the form $p = K\rho^{1+1/n}$ for various values of the parameter n. In order to simplify our analysis we use the equivalent Einstein frame form of R^2-gravity which is basically a scalar-tensor theory with well-known potential for the scalar field. In this description one can use simple approximations for the scalar field ϕ leaving only the potential term for it.
Our analysis indicates that for the non-relativistic case with $n = 3/2$, discrepancies between the R^2-gravity and General Relativity can appear only when the parameter α of the R^2 term, takes values close to maximal limit derived from the binary pulsar data namely $\alpha_{max} = 5 \times 10^{15}$ cm^2.
Thus, the study of low-mass white dwarfs can hardly give restrictions on the parameter α. For relativistic polytropes with $n = 3$ we found that Chandrasekhar limit can in principle change for smaller α values. The main conclusion from our calculations is the existence of white dwarfs with large masses $\sim 1.33 M_\odot$, which can impose more strict limits on the parameter α for the R^2 gravity model.
Specifically, our estimations on the parameter α of the R^2 model is $\alpha \sim 10^{13}$ cm^2.

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