



INTISARI

ORBIT PLANET DALAM PENGARUH POTENSIAL YUKAWA GRAVITASI $F(R)$

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Teori relativitas umum telah menjadi dasar model kosmologi standar dalam menjelaskan ekspansi alam semesta dan dinamika gravitasi. Namun, keberadaan materi gelap dan energi gelap masih belum terverifikasi secara observasional. Modifikasi gravitasi melalui teori $f(R)$ menawarkan alternatif dengan menggeneralisasi skalar Ricci R menjadi fungsi $f(R)$, yang dalam limit gravitasi lemah memodifikasi potensial Newtonian dengan bentuk serupa potensial Yukawa. Penelitian ini menganalisis pengaruh parameter δ dan λ dalam modifikasi potensial Yukawa terhadap dinamika orbit planet. Hasil perhitungan menunjukkan bahwa koreksi δ melemah secara eksponensial terhadap sumbu semimayor orbit, dengan batas λ sekitar 33 AU. Selain itu, diperoleh batas atas massa graviton dalam teori gravitasi masif sebesar $m_g < 2.48 \times 10^{-19}$ eV.

Kata kunci: gravitasi $f(R)$, potensial Yukawa, orbit planet, presesi perihelion, modifikasi gravitasi.



ABSTRACT

PLANETARY ORBIT UNDER THE INFLUENCE OF $F(R)$ GRAVITY YUKAWA POTENTIAL

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General relativity has been the foundation of the standard cosmological model in explaining the expansion of the universe and gravitational dynamics. However, the existence of dark matter and dark energy remains unverified observationally. Modified gravity through the $f(R)$ theory offers an alternative by generalizing the Ricci scalar R into a function $f(R)$, which in the weak-gravity limit modifies the Newtonian potential in a form similar to the Yukawa potential. This study analyzes the influence of the parameters δ and λ in the Yukawa-modified gravitational potential on planetary orbital dynamics. The results show that the correction δ weakens exponentially with respect to the semi-major axis, with an upper limit on λ around 33 AU. Furthermore, an upper bound on the graviton mass in massive gravity theory is obtained as $m_g < 2.48 \times 10^{-19}$ eV.

Keywords: $f(R)$ gravity, Yukawa potential, planetary orbit, perihelion precession, modified gravity.