Spheroidal stars: Magnetized BEC stars and SS

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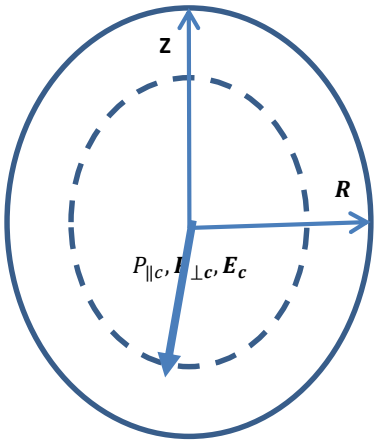
Axymetrical structure equations: Gamma structure equations

$$G_{\mu\nu} = 8\pi G T_{\mu\nu} \longrightarrow T_{\mu\nu} = diag(-E, P_\perp, P_\perp, P_\parallel)$$

Ansatz $\gamma = z/r = P_{\parallel c}/P_{\perp c}$

$$ds^2 = -\left(1-\frac{2Gm}{r}\right)^{\gamma} dt^2 + \left(1-\frac{2Gm}{r}\right)^{-\gamma} dr^2 + r^2 \sin\theta\, d\varphi^2 + r^2 d\theta^2, \quad \text{con } \gamma \cong 1, \gamma = z/r$$



$$\frac{dm(r)}{dr} = 4\pi\gamma r^2 \frac{E_\parallel(r) + E_\perp(r)}{2}$$

$$\frac{dP_\parallel}{dz} = -\frac{\left(E_\parallel(r) + P_\parallel(r)\right)\left(\frac{z}{2\gamma} + 4\pi G\left(\frac{z}{\gamma}\right)^3 P_\parallel(r) - \frac{r}{2}\left(1-\frac{2Gm(r)\gamma}{z}\right)^{\gamma}\right)}{\left(\frac{z}{\gamma}\right)^2\left(1-\frac{2Gm(r)\gamma}{z}\right)^{\gamma}}$$

$$\frac{dP_\perp}{dr} = -\frac{1}{\gamma}\frac{\left(E_\perp(r) + P_\perp(r)\right)\left(\frac{r}{2} + 4\pi G r^3 P_\perp(r) - \frac{r}{2}\left(1-\frac{2Gm(r)}{r}\right)^{\gamma}\right)}{r^2\left(1-\frac{2Gm(r)}{r}\right)^{\gamma}}$$

Reduce to TOV equations at $\gamma = 1$, i.e. $B = 0$ and $P_\parallel = P_\perp$.

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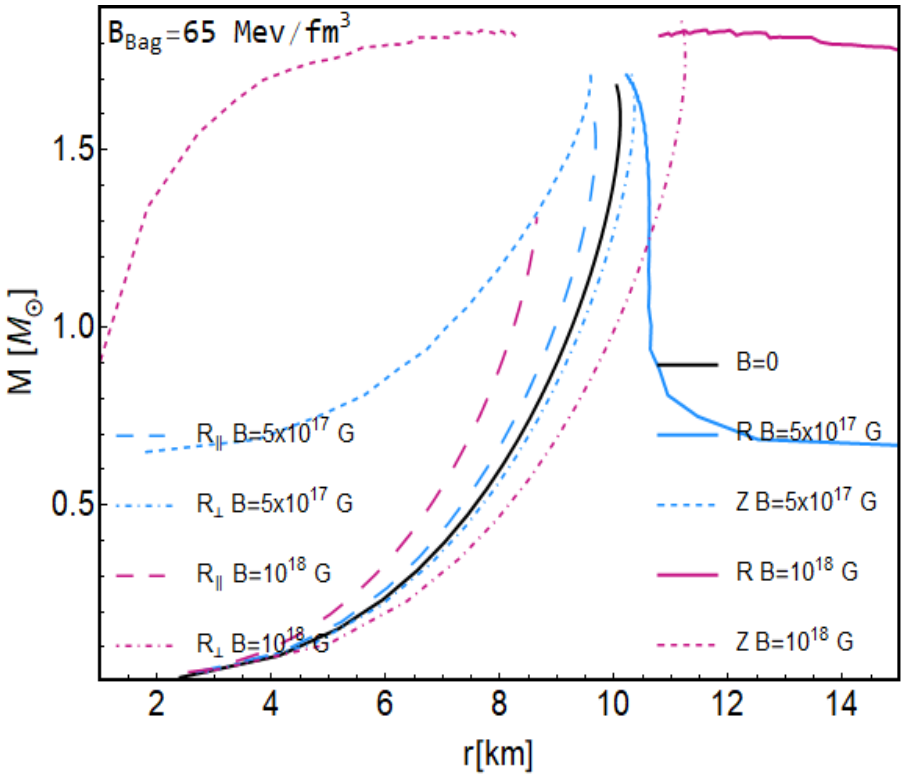
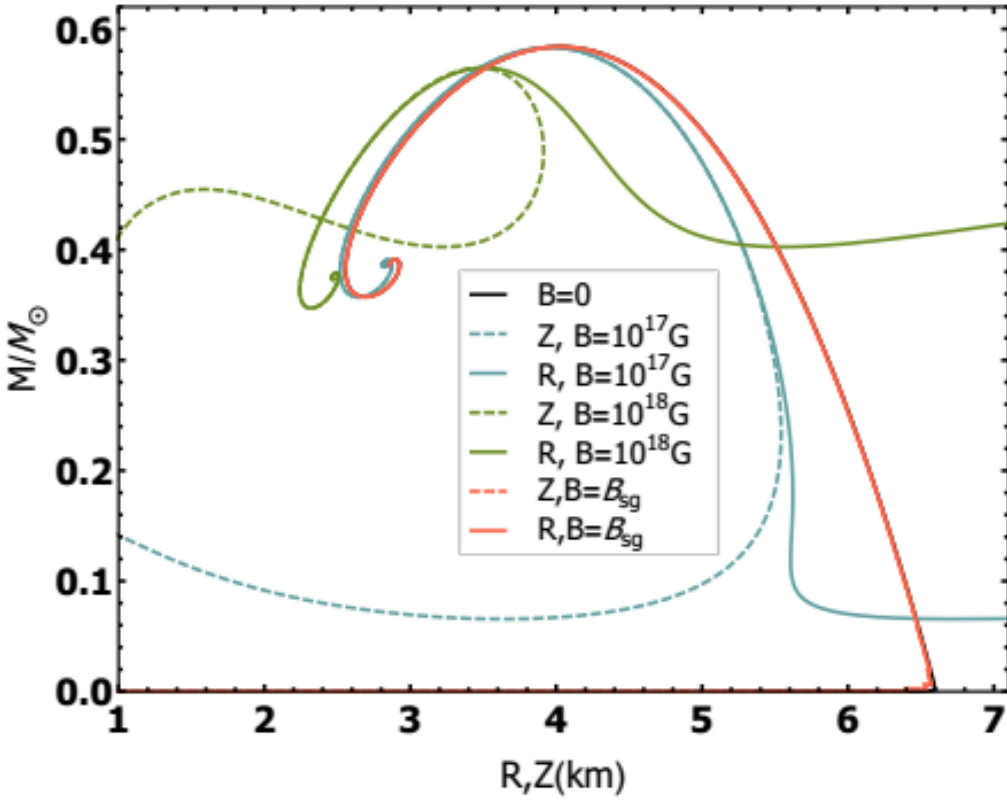
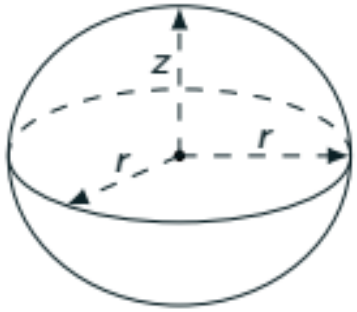
Gamma structure solutions





Magnetic field never produces an increment of the maximum mass of the stars but deform the star. The effect is more significant for low densities.



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