Strong-field effects in the massive scalar-tensor gravity for slowly spinning neutron stars

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abstract

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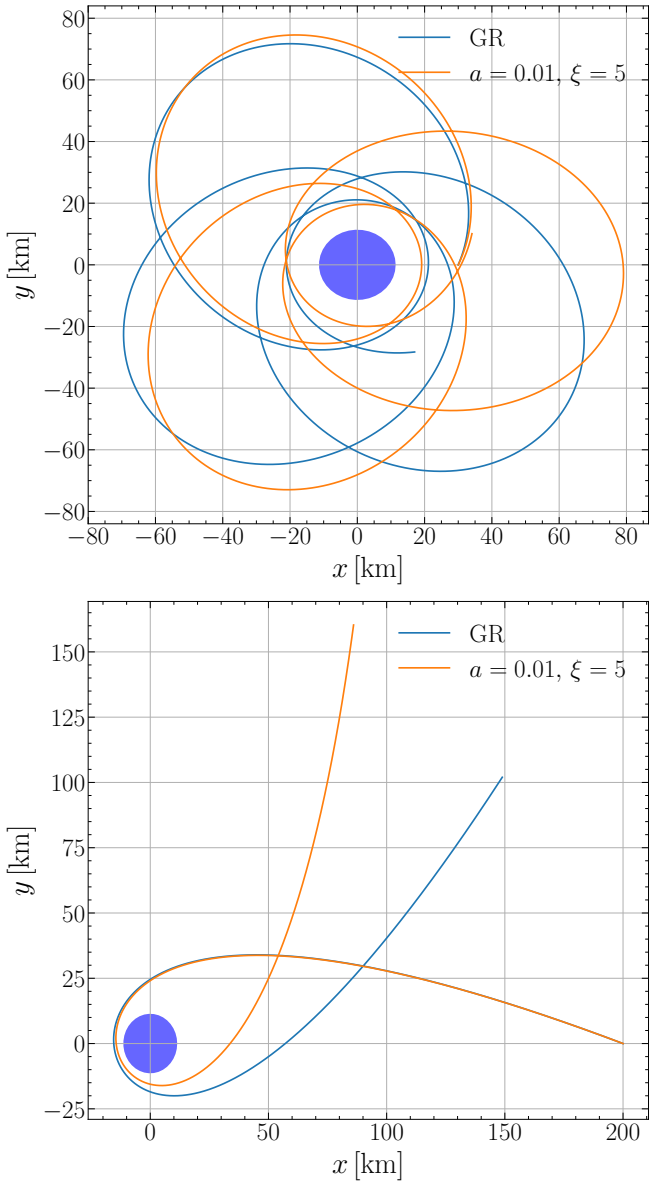

FIG. 1: Test-particle orbits around a NS with $M = 1.4M_\odot$ and interior structure solved using the EOS AP4. The GR orbits are presented for comparison. The solid circle is the NS. The Cartesian coordinates are defined as $x = r\cos\phi$, $y = r\sin\phi$. Upper panel: $\tilde{E} = 0.98$, $\tilde{L} = 4.5M$. Lower panel: $\tilde{E} = 1$, $\tilde{L} = 4.5M$. **[LS: use dashed lines for GR, as in Figs. 4 & 5. The NSs are not ROUND circles (oblate in upper panel and prolate in lower panel).]**

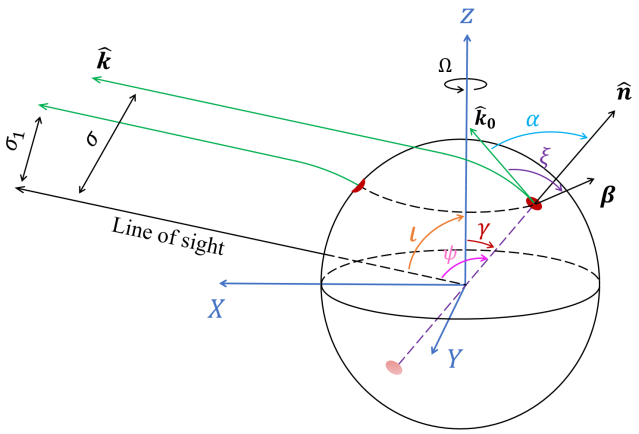

FIG. 2: The schematic illustration for the X-rays emitted from a hot spot on a rotating NS and reaching the observer at infinity. The Z-axis is along the rotation axis of the NS, while the X-axis is set in the plane formed by the Z-axis and the line of sight. **[LS: Y-axis is too short]** [skip this for the moment] The upper green curve represents a general trajectory with its initial direction along a unit vector $\hat{\boldsymbol{k}}_0$ and its asymptotic direction along the line of sight, whose unit vector is $\hat{\boldsymbol{k}}$. **[LS: do not use boldface for "0" for "hat"]** The lower green curve specifically stands for the trajectory of the ray when the hot spot is in the XZ-plane and closest to the observer. The unit vector $\hat{\boldsymbol{n}}$ is pointing along the local radial direction, and the vector $\boldsymbol{\beta}$ is the velocity of the hot spot in the local static frame. Five relevant angles show up: the angle ι between the line of sight and the Z-axis, the colatitude γ of the hot spot in the XYZ frame, the angle ψ between the line of sight and $\hat{\boldsymbol{n}}$, the angle α between $\hat{\boldsymbol{k}}_0$ and $\hat{\boldsymbol{n}}$, and the angle ξ **[LS: ξ was used for another purpose]** [let's use ζ to replace ξ] between $\hat{\boldsymbol{k}}_0$ and $\boldsymbol{\beta}$. **[LS: Ω should be boldface]**

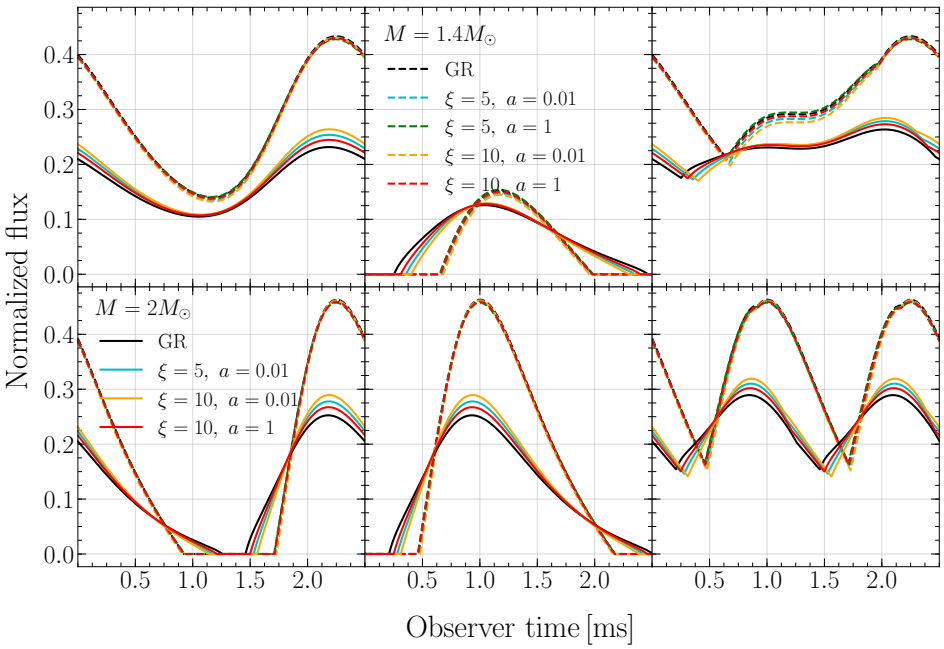

FIG. 3: The X-ray pulse profiles for NSs listed in Table **??** with $\iota = \frac{\pi}{4}$, $\gamma = \frac{\pi}{4}$ (upper panels) and $\iota = \frac{\pi}{2}$, $\gamma = \frac{\pi}{2}$ (lower panels). The angular frequency of the NSs is taken to be 400 Hz. Left panels: The pulse profiles of the spots at colatitude γ. Middle panels: The pulse profiles of the antipodal spots at colatitude $\pi - \gamma$. Right panels: The pulse profiles of the pair of spots. The solid curves are for $2M_\odot$ NSs, and the dashed curves are for $1.4M_\odot$ NSs. NSs with the same mass but different values of ξ and a are distinguished by colors. [let's put the legend to the right of the picture outside the panels.]