

1. Following the example for Schwarzschild orbits provided on the author's webpage (<http://web.physics.ucsb.edu/~gravitybook/mathematica.html>), write a Mathematica notebook to calculate equatorial particle orbits in the Kerr metric (using Boyer-Lindquist coordinates). You will need to use V_{eff} and $d\phi/dr$ for the Kerr metric, which are provided for you in equations (15.20) and (15.23) of your book. For concreteness, take $a = 0.99M$, $\ell = 3M$, and $e = 0.96$. Find the 2 extrema of V_{eff} . Then plot 3 orbits of this particle starting close to one of its outermost turning points. Find the perihelion precession $\delta\phi_{\text{prec}}$ for this orbit.