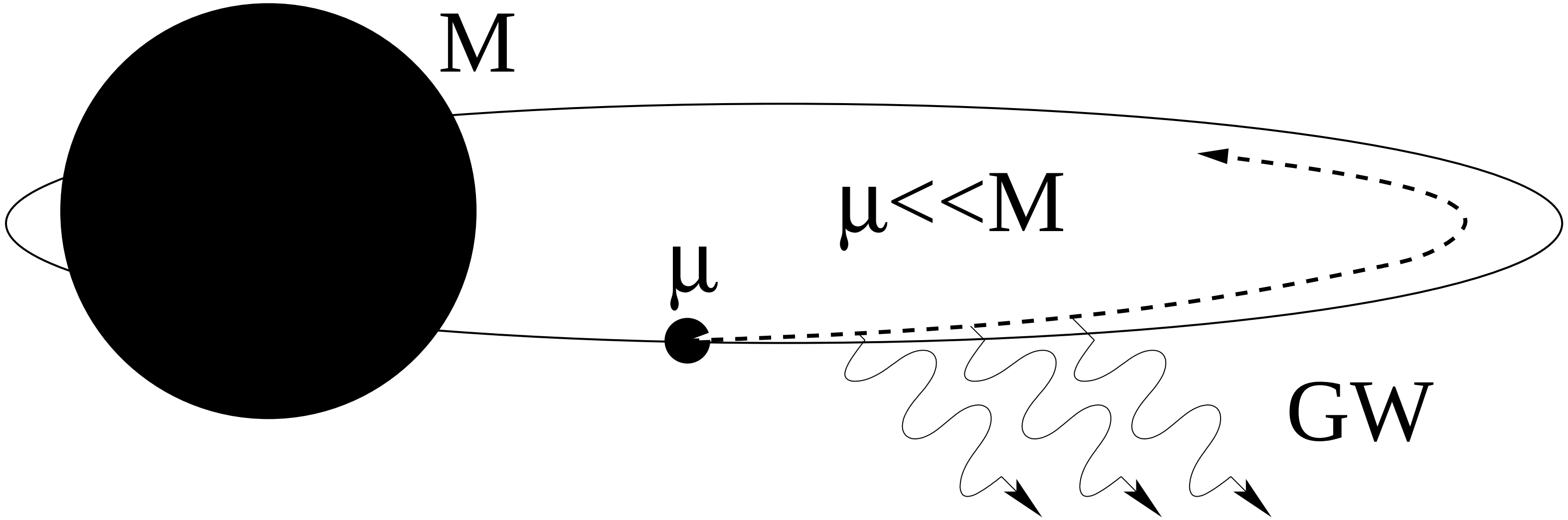
Gravitational waves from a particle orbiting a Kerr black hole in Brans-Dicke theory

Ryuichi Fujita (藤田 龍一)

Instituto Superior Técnico, Portugal

Compact stars and gravitational waves
October 31 - November 4 2016, Kyoto University

EMRIs in Brans-Dicke theory



- (Quadrupole radiation in GW) + (Dipole radiation in φ)
  - ∗ Deviation from GR: $dE/dt = dE^{\rm gw}/dt + dE^{s}/dt$
  - ∗ $N_\phi^{{\rm gw}+s} \gtrsim 10^5$ and $N_\phi^s < 1$ for $e = 0$ and $\omega_{\rm BD} > 4 \times 10^4$, where $N_\phi = \int \Omega_\phi(t) dt$ is Orbital cycle. [Yunes+(2012)]

⇒ We want to know how orbital eccentricity changes results

$N_\phi = \int \Omega_\phi[p(t), e(t)]dt$ w/o $\langle dE/dt \rangle_t^s$

$$N_\phi = N_\phi^{(0)} + N_\phi^{\rm gw} + N_\phi^{\rm s},$$

$$N_\phi^{\rm gw} = -\frac{(M\Omega_\phi)^{-5/3}}{32(\mu/M)}\left[1 + \frac{3715}{1008}(M\Omega_\phi)^{2/3} + \left(\frac{565}{24}q - 10\pi\right)(M\Omega_\phi) + \cdots + \delta N_\phi^{\rm gw,(e)}\right],$$

$$N_\phi^{\rm gw,(e)} = e_0^2 (M\Omega_\phi)^{-19/9}\left[-\frac{785}{272} - \frac{2045665}{225792}(M\Omega_\phi)^{2/3} + \left(\frac{65561}{2880}\pi - \frac{3059}{108}q\right)(M\Omega_\phi) + \cdots\right],$$

$$N_\phi^{\rm s} = -\frac{\alpha^2 (M\Omega_\phi)^{-1}}{4(\mu/M)}\left[1 + \frac{3}{2}(M\Omega_\phi)^{2/3} + (-9q + 2\pi)(M\Omega_\phi)\ln(M\Omega_\phi) + \cdots + \delta N_\phi^{\rm s,(e)}\right],$$

$$N_\phi^{\rm s,(e)} = e_0^2 (M\Omega_\phi)^{-2}\left[-\frac{3}{2} + \frac{9}{8}\frac{9\kappa - 4q^2 + 4}{\kappa}(M\Omega_\phi)^{2/3} + (6\pi - 15q)(M\Omega_\phi) + \cdots\right],$$

where e_0 is the initial eccentricity, $\kappa = \sqrt{1 - q^2}$ and $\alpha \sim \sqrt{\frac{16\pi G}{2\omega_{\rm BD} + 3}}$.

Poster number "I-8"