

Title: Discussion: PN/Gauge Invariants

Speakers: Aaron Zimmerman

Collection: The 24th Capra meeting on Radiation Reaction in General Relativity

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Discussion: PN and Gauge Invariants

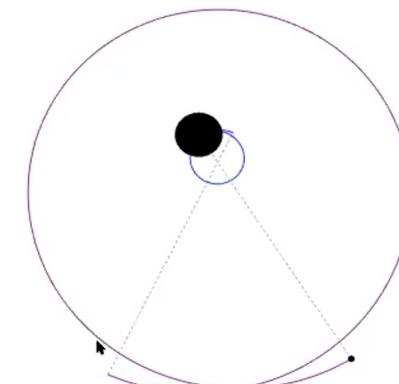
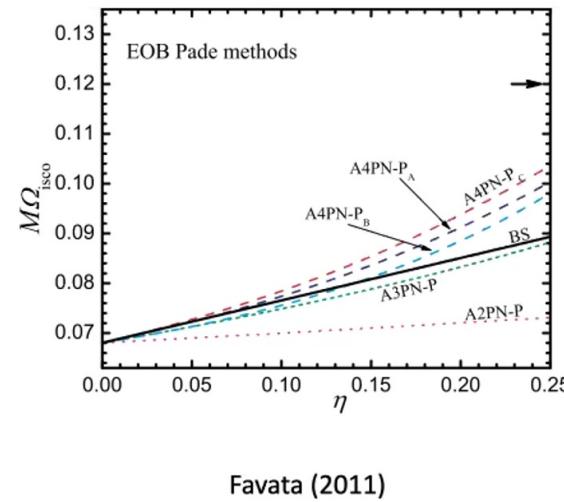
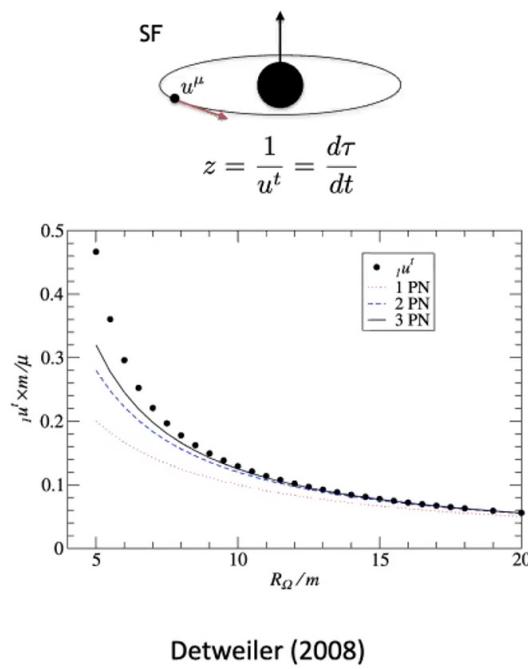
Aaron Zimmerman
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Capra 24

June 8, 2021



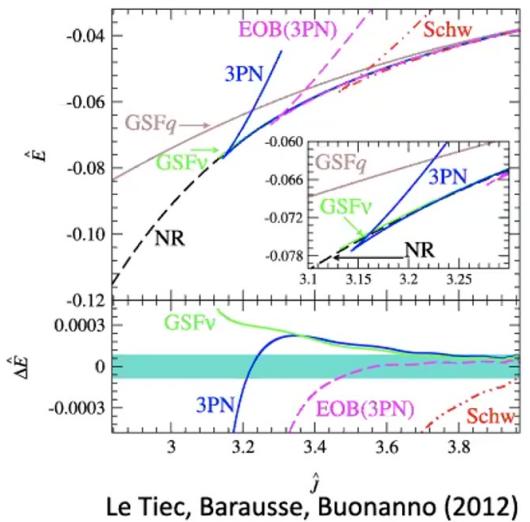
Using invariant quantities*



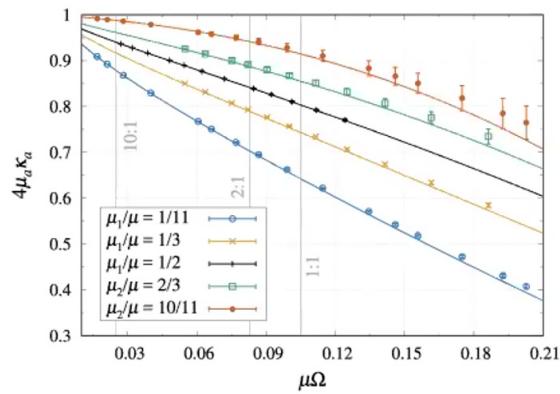
$$\Delta\Phi = 2\pi \left(\frac{\Omega_\phi}{\Omega_r} - 1 \right)$$

Le Tiec et al. (2011, 2013)

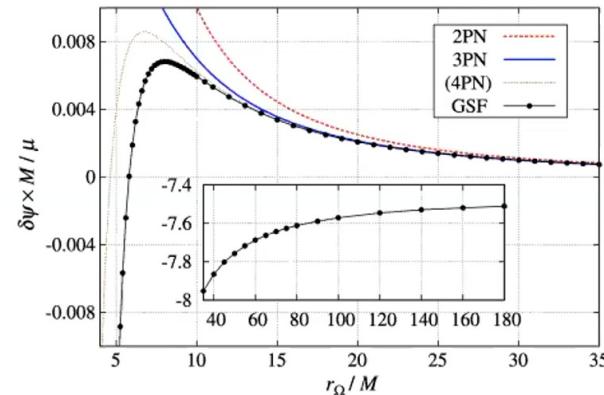
* No attempt to be exhaustive



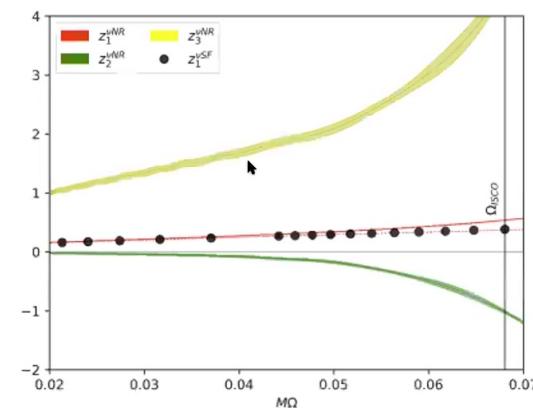
Le Tiec, Barausse, Buonanno (2012)



Le Tiec, Grandeclement (2017)

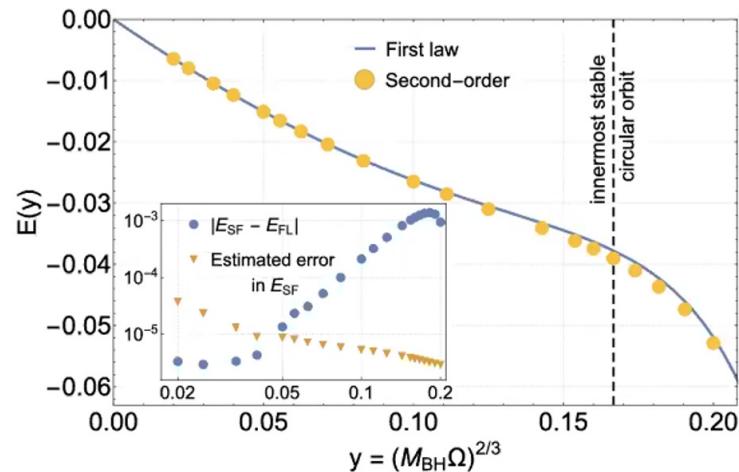


Dolan et al. (2014), Dolan et al. (2015)

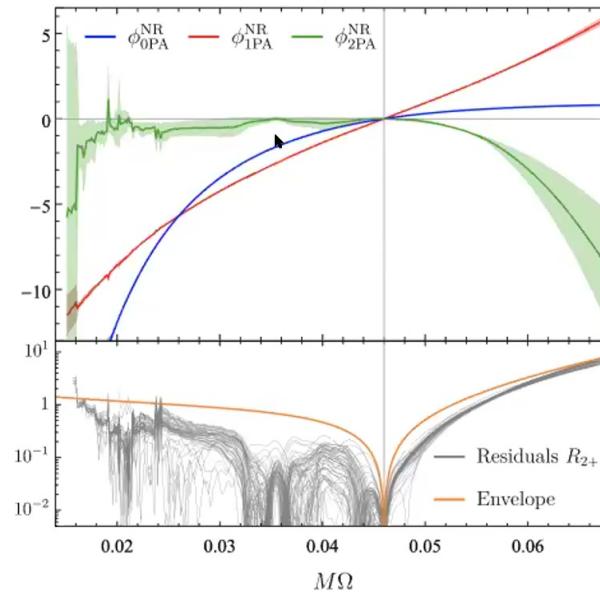


Navarro Albalat, Zimmerman

Using invariant quantities



Pound, Wardell, Warburton, Miller (2020)



van de Meent, Pfeiffer (2020)

Many successes

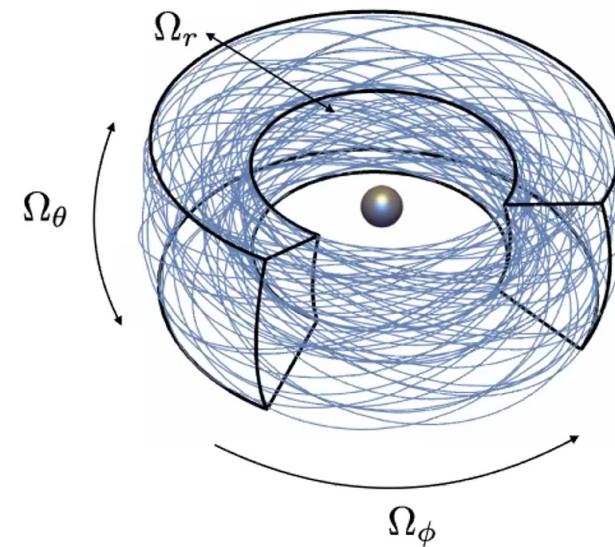
- High PN predictions
- Confidence in codes and results
- Connections to EOB, calibration of waveform models: GW data analysis
- Deeper understanding of theoretical issues

On the horizon?

- NRAR-style code comparisons: natural first checks
- New invariants: Scattering angles, spin precession effects (?)
- Continued comparisons to PN/EOB
- Checks and comparisons for 2nd order
- Use to clarify application of SF to comparable mass systems?

Some challenges

- Quasi-invariants: require gauge restrictions
 - Challenge for NR: little control of gauge
 - Do such challenges arise in PA expansion?
- Making comparisons for generic orbits
 - How to match frequencies?
 - Again, challenge for NR



Barack and Pound (2018)