The Pittsburgh News

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Collaboration Members

- Roberto Gomez [PSC, Pitt]
- Jeffrey Winicour [Pitt]
- Bela Szilagyi [Pitt]
- Yosef Zlochower [Pitt]
- Also in collaboration with: Nigel Bishop[SA], Sascha Husa [AEI], Luis Lehner [UBC]

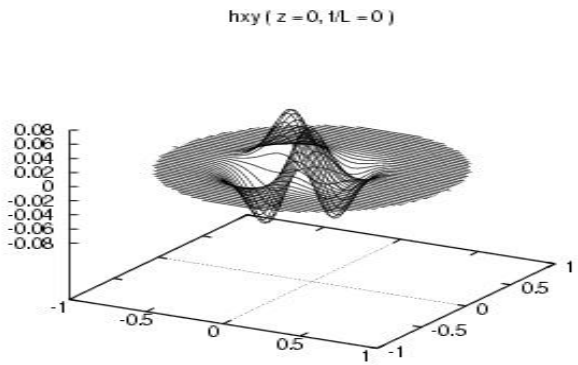
Main Lines of Research

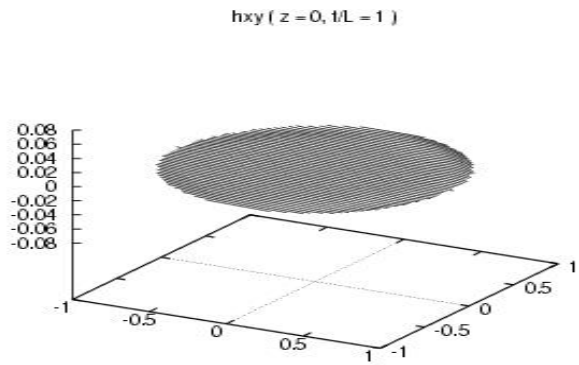
- Cauchy-characteristic matching (CCM)
- Characteristic evolution of BH spacetimes
- Close limit via characteristic approach

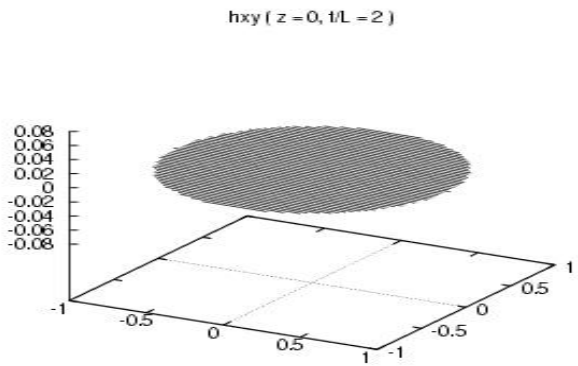
Cauchy-characteristic Matching

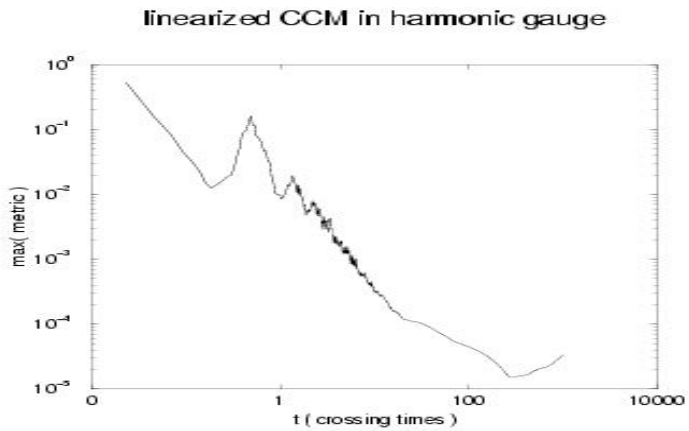
- Combine 3+1 approach (interior) with characteristic approach (exterior)
- Natural treatment of radiation
  - Gravitational waveforms at null infinity
  - Perfectly absorbing BCs for 3+1 evolution
  - Long-term stable – 1000's of crossing times
- Winicour, Szilagyi

CCM as BC for 3+1 Evolution







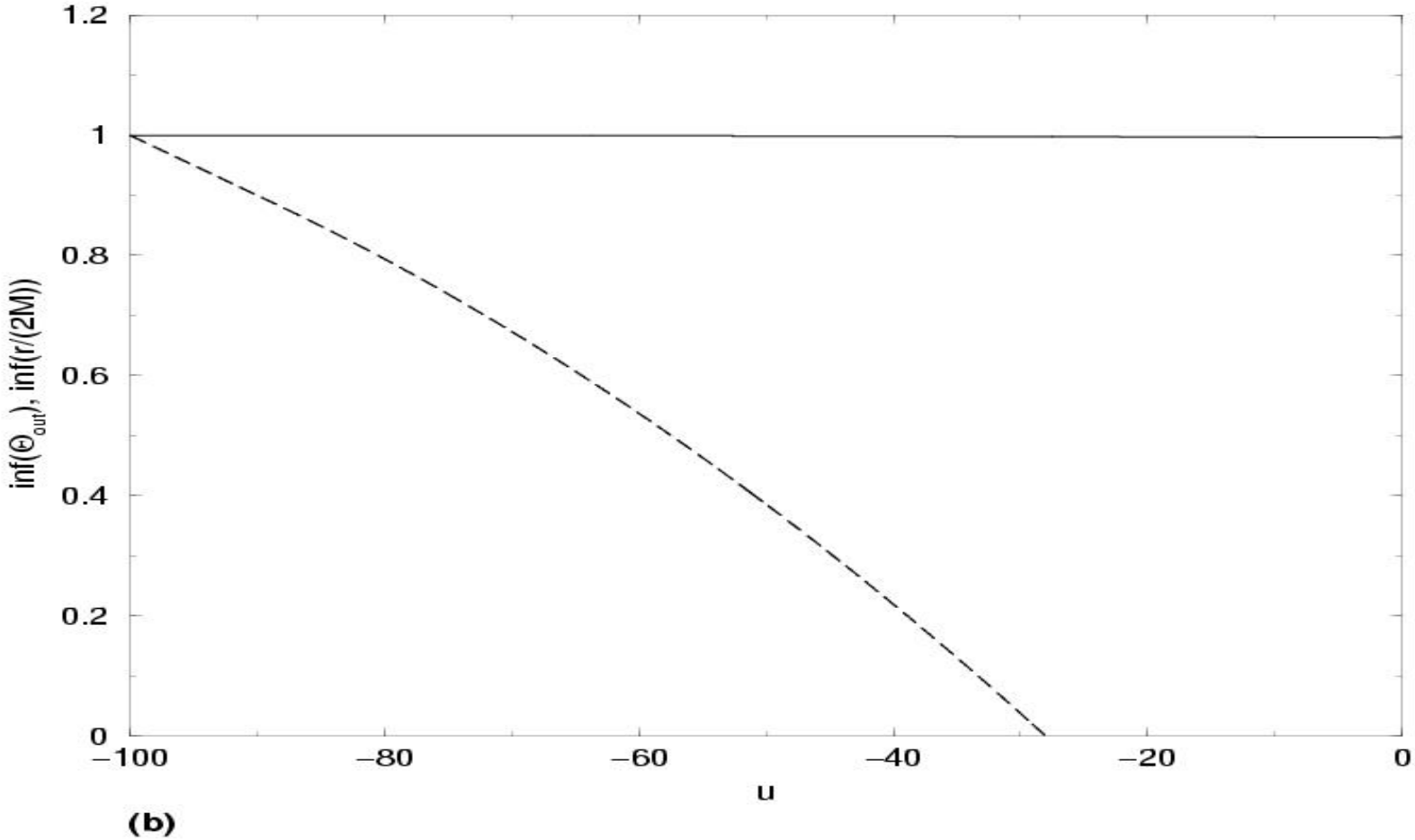


Post Black Hole Merger

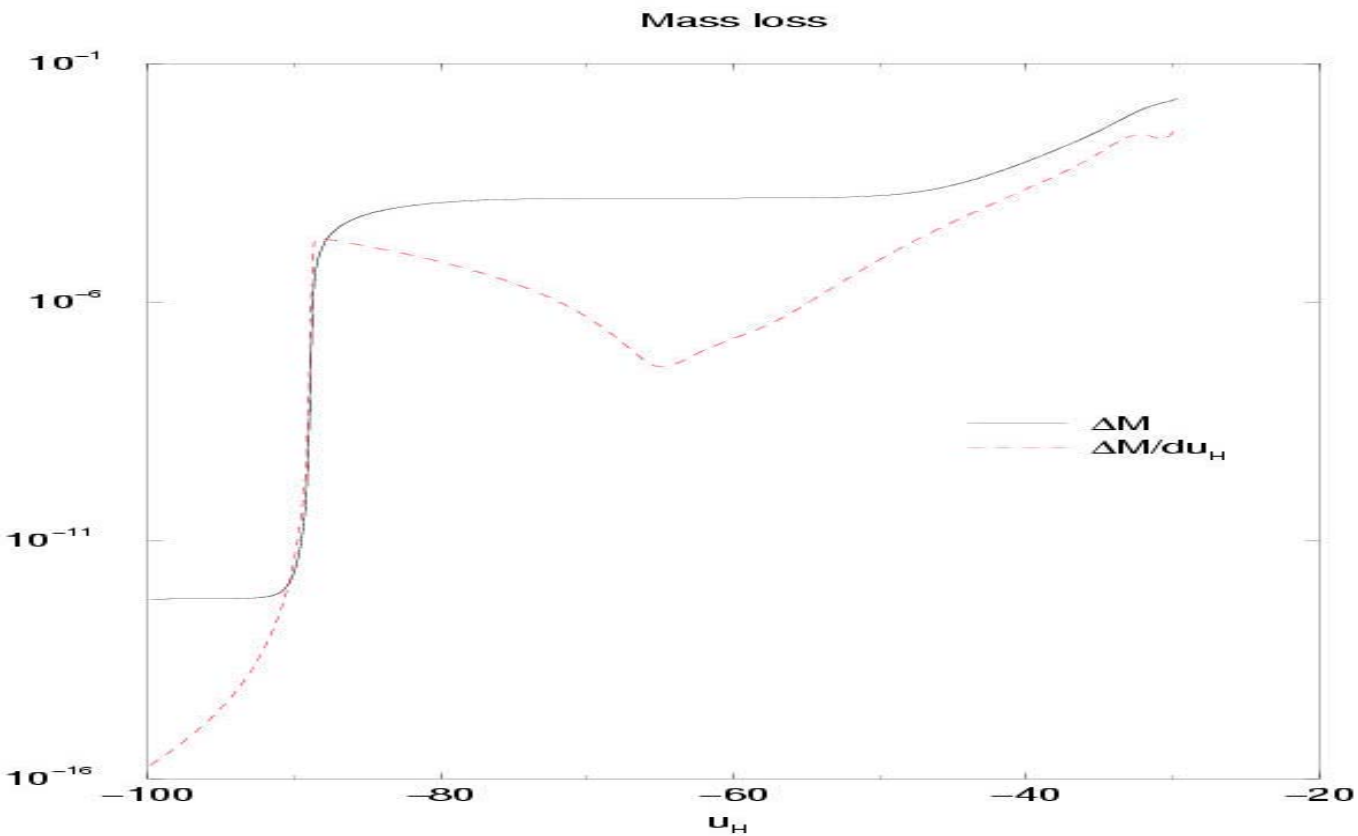
- Double-null initial boundary value problem
- Use boundary data for white hole fission
  - First stage in multi-step approach to BH merger
- Compute gravitational waveforms at null infinity

- Gómez, Husa, Winicour

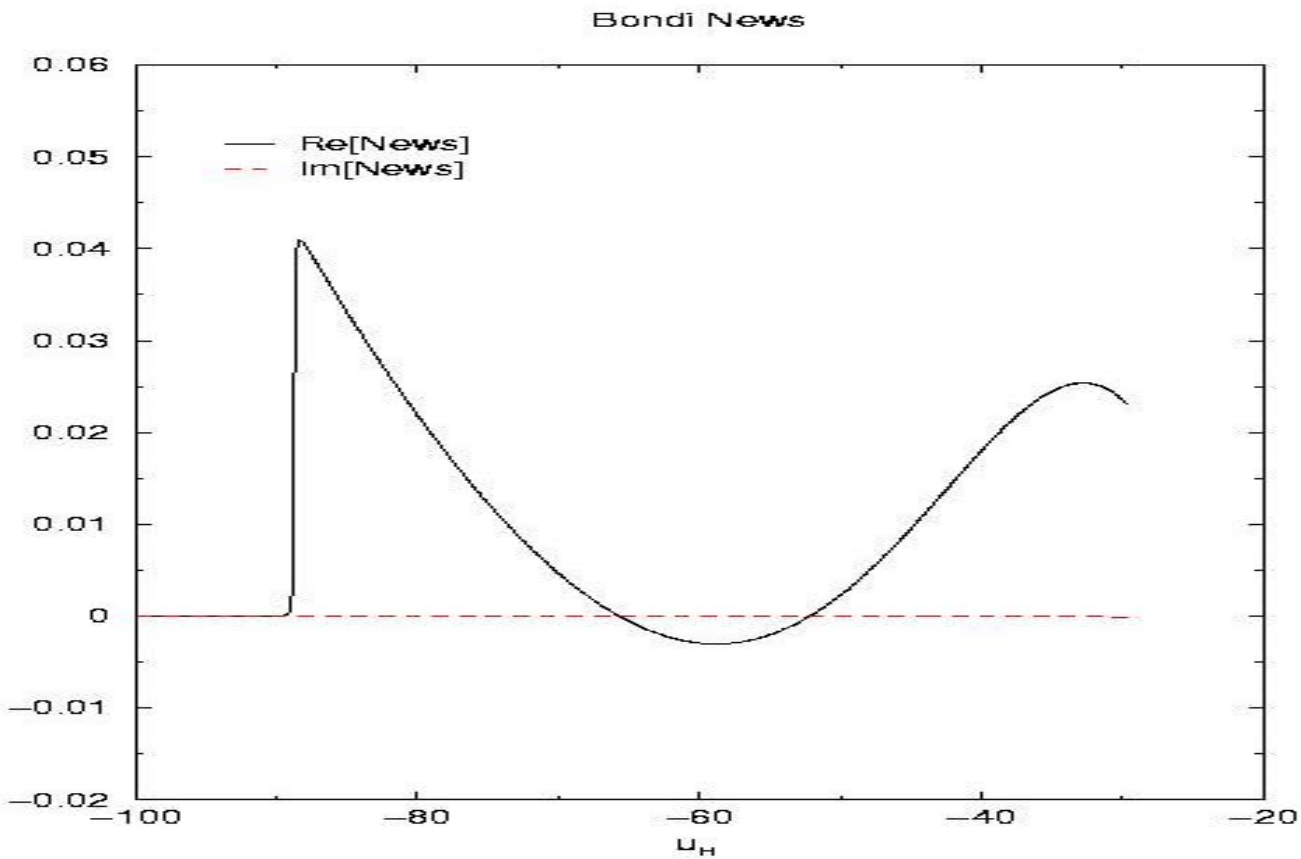
Formation of a Bondi Horizon



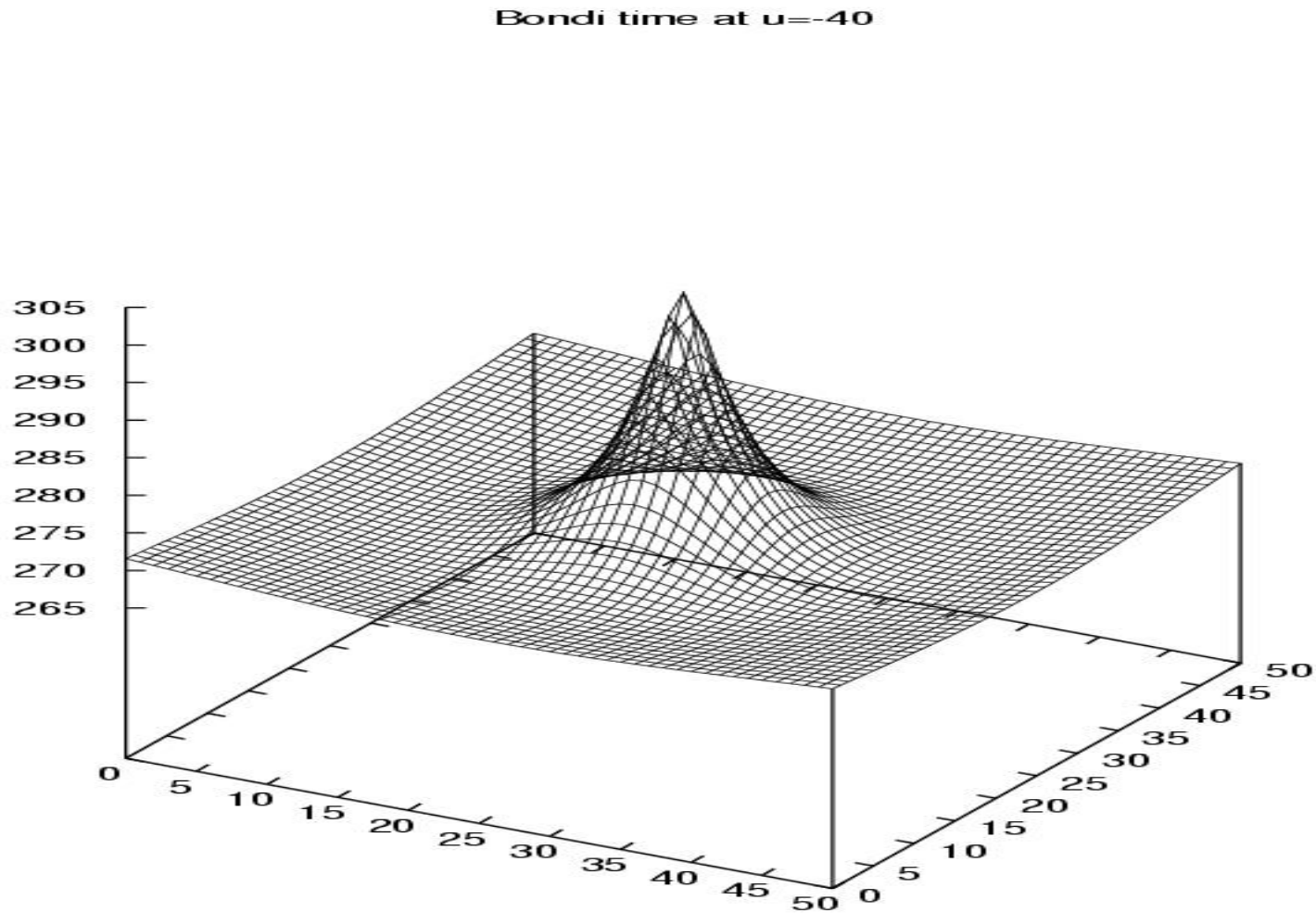
Mass Loss to Radiation



Gravitational Waveforms (News)



Bondi Time vs. Horizon Time



Close Limit Via Null Evolution

- Evolve Ψ_0, Ψ_4 – not metric variables
- Comparison with perturbative results
- Used to calibrate & validate characteristic (metric) approach
- Gomez, Husa, Winicour, Zlochower

Future Directions

- Develop CCM BC in nonlinear case !
- Waveform extraction
- Binary BH post-merger phase waveforms
- BH – NS type systems
- Feedback on what is needed