

Continuum Variability in Global GRMHD BH Accretion Simulations

A Montage of Preliminary Results

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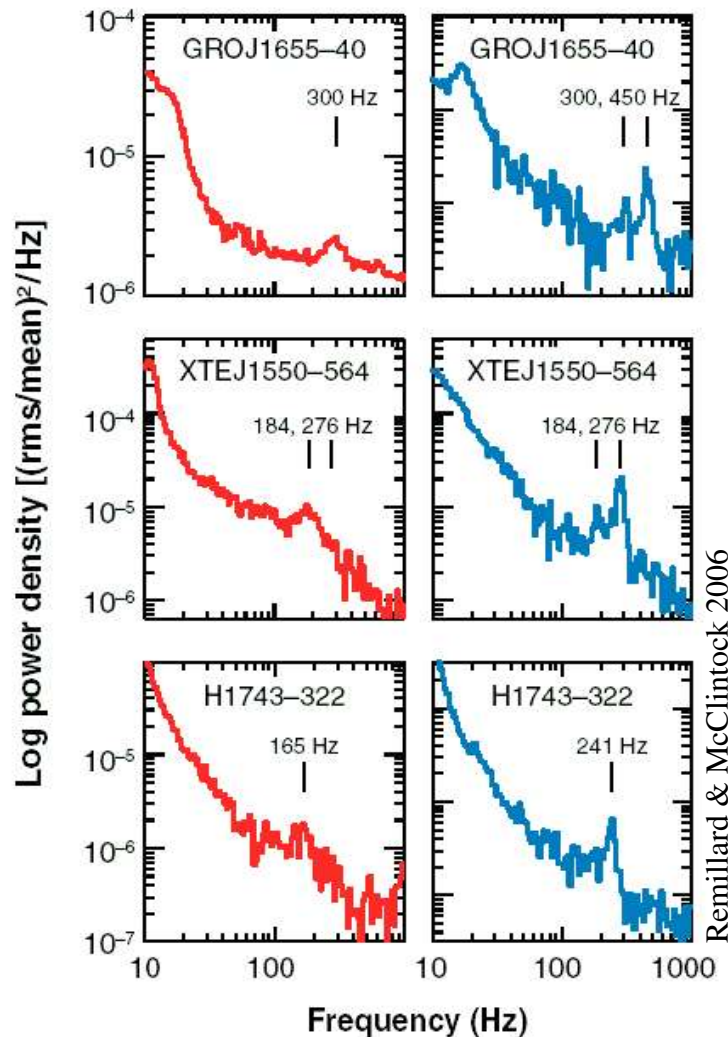
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The 8 Minute Game Plan

- Discussion of Relevant Observations
- Brief Overview of Our Simulations
- Summary of Preliminary Results
 - ✧ Analysis of Sharp Features
 - ✧ Qualitative Interpretation of Continuum
- Conclusions and Goals for the Future

Observations of BH Binaries

Power Spectra of X-Ray Light Curves



- High Frequency Quasi-Periodic Oscillations (QPOs)
- Commensurate QPO Frequencies (3:2)
- Broad Continuum Variability in X-Ray Light Curves

Our Simulations

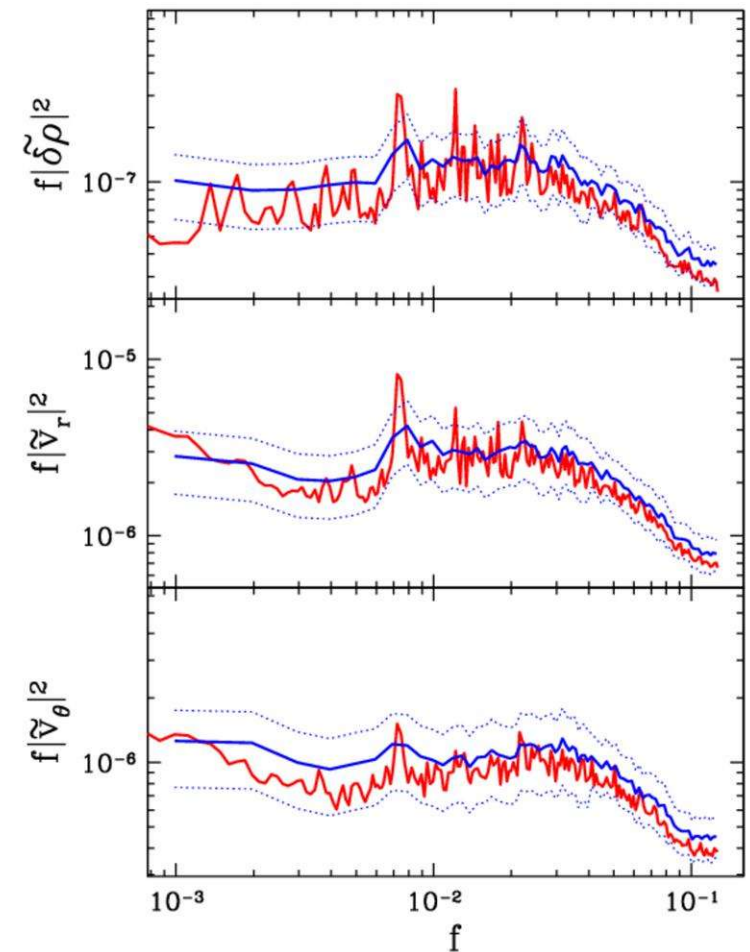
Cosmos++

- Global GRMHD Simulation
 - ⌘ *Global* ⇒ Fully 3-Dimensional Simulation Domain
 - ⌘ *GR* ⇒ Relativistic Code and Grid (Kerr Metric)
 - ⌘ *MHD* ⇒ Magnetohydrodynamic Evolution
- Three Resolutions
 - ⌘ Low (32x8x32 grid zones)
 - ⌘ Medium (64x15x64 grid zones)
 - ⌘ High (128x30x128 grid zones)
- Simulation Duration > 10 ISCO Orbital Periods

Preliminary Results

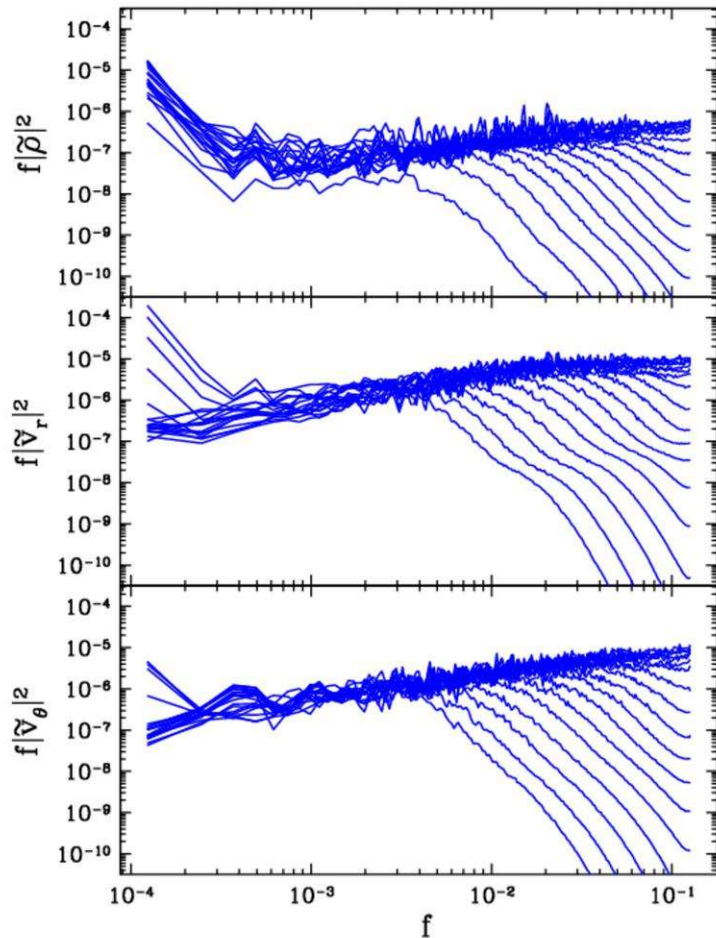
Sharp Spectral Features?

- Features may only be significant in med res simulation ($\simeq 1\sigma$)
- No obvious resonances exist (perhaps 1:4 and 2:3, but these are uncorrelated)
- More work is required to better estimate σ^2 and n_σ for each QPO candidate

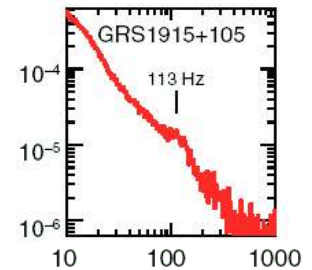
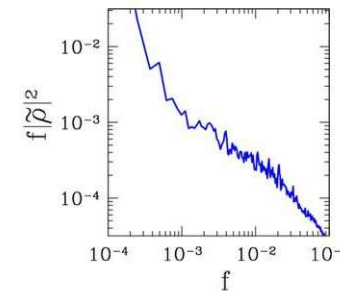


Preliminary Results

Characteristics of Continuum Variability



- Power spectra from individual radii are broken power laws (indices $\simeq -0.5$ and -5) with $f_{\text{break}} \propto r^{-1}$
- Central region of the composite PS has index $\simeq -1$; Matches light curves?



In Summary

- Conclusions
 - ✧ QPO activity seems insignificant in a thermal disc
 - ✧ Continuum variability can perhaps be explained by broken power law turbulence at varying radii
- Goals for the Future
 - ✧ Improve statistical analysis of QPO significance
 - ✧ Find physical meaning in radial PL break frequencies
 - ✧ Relate mechanical variability with emission variability