

**Annual Progress Report on the 1st Year of NSF Award ID 0907890, entitled:  
"Testing Accretion Physics and Strong-Field Gravity by  
Imaging Accreting Black Holes"**

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The papers listed below were published since August 2009 on black hole physics in relation to the above NSF award. These papers accomplish various goals listed in the original proposal. As part of our outreach effort, we have published an article on this topic in Scientific American (see first listing below), and the PI has included a related discussion in his new cosmology book, "How Did the First Stars and Galaxies Form? ", to be published by Princeton University Press (see [http://www.cfa.harvard.edu/~loeb/Loeb\\_book.pdf](http://www.cfa.harvard.edu/~loeb/Loeb_book.pdf)). As part of our educational effort, the PI has been mentoring PhD students at the Harvard Physics and Astronomy departments on various aspects of black hole physics; they include Laura Blecha, Jon Bittner, Ryan O'Leary, Doug Rubin, and Nick Stone.

**Papers**

1. Broderick, A., & Loeb, A. "Portrait of a Black Hole", Scientific American, Dec. issue, 42, 2010. [<http://cfa-www.harvard.edu/~loeb/sciam2.pdf>]
2. Broderick, A., Loeb, A., & Narayan, R. "The Event Horizon Around SgrA\*", ApJ, **701**, 2, 2009.
3. Broderick, A., & Loeb, A. "Signatures of Relativistic Helical Motion in the Rotation Measures of AGN Jets", ApJ, **703**, L104, 2009.
4. Fish, V., Doeleman, S., Broderick, A., Loeb, A., & Rogers, A. "Detecting Changing Polarization Structures in Sagittarius A\* with High Frequency VLBI", ApJ, **706**, 1353, 2009.
5. Stone, N., & Loeb, A. "Repeating Tidal Disruption of Stars as a Prompt Electromagnetic Signature of Supermassive Black Hole Coalescence", Phys. Rev. Lett., submitted (2010). [arXiv:1004.4833]
6. Loeb, A. "Electromagnetic Signature of Galactic Black Hole Binaries That Enter Their Gravitational-Wave Induced Inspiral", Phys. Rev. **D 81**, 047503, 2010.
7. Broderick, A. E., & Blandford, R. D. "Understanding the Geometry of Astrophysical Magnetic Fields", ApJ, submitted, 2009. [arXiv:0911.3909]
8. Yunes, N., Psaltis, D., Ozel, F., & Loeb, A. "Constraining Parity Violation in Gravity with Measurements of Neutron-Star Moments of Inertia", Phys. Rev. **D, 81**, 064020, 2010.

9. Patnaude, D., Loeb, A., & Jones, C. “Evidence for a Black Hole Remnant in the Type IIL Supernova 1979C”, *ApJL*, submitted, 2009. [arXiv:0912.1571]
10. Shen, Y., & Loeb, A. “Identifying Supermassive Black Hole Binaries With Broad Emission Line Diagnosis”, *MNRAS*, submitted, 2009. [arXiv:0912.0541]
11. Civano, F., et al. “A Runaway Black Hole in COSMOS: Gravitational Wave or Slingshot Recoil?”, *ApJ*, submitted, 2010. [arXiv:1003.0020]