

Top 20 Confirmed Predictions of Abraham (Avi) Loeb (2020)

1. Predicted the **existence and appearance of hot spots near the Innermost Stable Circular Orbit of SgrA*** (as a test of General Relativity and a method to measure the black hole spin) in the following papers:

<http://adsabs.harvard.edu/abs/2005MNRAS.363..353B>

<http://adsabs.harvard.edu/abs/2006ApJ...636L.109B>

<http://adsabs.harvard.edu/abs/2006MNRAS.367..905B>

<http://adsabs.harvard.edu/abs/2006JPhCS..54..448B>

*This prediction was verified in the following paper,

<http://adsabs.harvard.edu/abs/2018A%26A...618L..10G>

Also, predicted the **appearance of the base of the jet with the black hole silhouette in M87** in the paper:

<http://adsabs.harvard.edu/abs/2009ApJ...697.1164B>

*This prediction will be confirmed by the new data of the Event Horizon Telescope, to be released in February 2019.

2. Predicted a **high probability of gravitational lensing for high redshift bright quasars** in the following papers:

<http://adsabs.harvard.edu/abs/2002Natur.417..923W>

<http://adsabs.harvard.edu/abs/2002ApJ...577...57W>

*This prediction was verified in the papers,

<http://adsabs.harvard.edu/abs/2018arXiv181011924F>

<http://adsabs.harvard.edu/abs/2018arXiv181012302P>

3. Predicted **microlensing as a method for detecting planets** in the paper:

<http://adsabs.harvard.edu/abs/1992ApJ...396..104G>

*This prediction was confirmed in many observational searches since then; see the review in,

<http://adsabs.harvard.edu/abs/2018Geosc...8..365T>

4. Predicted the **global 21-cm signal** in the papers:

<http://adsabs.harvard.edu/abs/2008PhRvD..78j3511P>
<http://adsabs.harvard.edu/abs/2010PhRvD..82b3006P>
<http://adsabs.harvard.edu/abs/2012RPPh...75h6901P>

*An experimental detection of this signal was reported by the EDGES experiment in the paper:

<http://adsabs.harvard.edu/abs/2018Natur.555...67B>

5. Predicted the **thermal appearance of Tidal Disruption Events** of stars around supermassive black holes in galactic nuclei:

<https://iopscience.iop.org/article/10.1086/304814/pdf>

*Observations agree with a simple envelope model compared to far more complicated models that were developed subsequently.

<https://iopscience.iop.org/article/10.3847/1538-4357/aa7337/pdf>

6. Predicted the **end of reionization at redshift $z \sim 6.5$** in the paper:

<http://adsabs.harvard.edu/abs/2004Natur.427..815W>

*The latest observations confirm this prediction, as discussed in Figure 3 of the paper:

<http://adsabs.harvard.edu/abs/2015ApJ...802L..19R>

7. Predicted **Doppler beaming signal for exo-planets** in the paper:

<http://adsabs.harvard.edu/abs/2003ApJ...588L.117L>

*Confirmed by data from the Kepler and Corot satellites in papers such as:

<http://adsabs.harvard.edu/abs/2018MNRAS.480.3864E>

<http://adsabs.harvard.edu/abs/2015ApJ...815...26F>

<http://adsabs.harvard.edu/abs/2015A%26A...580A..21T>

8. Predicted prominence of **CII 158-micron line from galaxies at high redshifts:**

<http://adsabs.harvard.edu/abs/1993ApJ...404L..37L>

and then forecasted **Intensity Mapping** as a method to measure the large scale distribution of galaxies without resolving them:

<https://ui.adsabs.harvard.edu/abs/2011JCAP...08..010V/abstract>
<https://ui.adsabs.harvard.edu/abs/2010JCAP...11..016V/abstract>

*Confirmed by ALMA data as summarized in the papers:

<http://adsabs.harvard.edu/abs/2006ApJ...647...60N>
<http://adsabs.harvard.edu/abs/2013ARA%26A..51..105C>
<http://adsabs.harvard.edu/abs/2018A%26A...609A.130L>
<http://adsabs.harvard.edu/doi/10.1093/mnras/sty2969>

9. Predicted “**Direct Collapse Black Holes**” as the seeds of quasars in the paper:

<http://adsabs.harvard.edu/abs/2003ApJ...596...34B>

*Tentatively confirmed by recent observations as described in papers such as:

<http://adsabs.harvard.edu/abs/2016MNRAS.459.1432P>
<http://adsabs.harvard.edu/abs/2016MNRAS.460.3143S>
<http://adsabs.harvard.edu/abs/2019RPPh...82a6901M>

10. Predicted detectability of **afterglows from gamma-ray bursts at high redshifts**:

<http://adsabs.harvard.edu/abs/2000ApJ...540..687C>
<http://adsabs.harvard.edu/abs/2003astro.ph..7231L>
<http://adsabs.harvard.edu/abs/2006ApJ...642..382B>

*Confirmed by subsequent observations as summarized in papers such as:

<http://adsabs.harvard.edu/abs/2014ApJS..213...15W>
<http://adsabs.harvard.edu/abs/2015NewAR..67...1W>

11. Predicted the **correlation between mass of black holes and the velocity dispersion of stars in their host spheroids (so-called “M-sigma relation”)**, as summarized in section 6.2 of the review paper:

<https://arxiv.org/pdf/1304.7762.pdf>

12. Predicted the **use of pulsars to probe the spacetime around SgrA***:

<http://adsabs.harvard.edu/abs/2004ApJ...615..253P>

*Confirmed with the discovery of a magnetar near the Galactic center:

<http://adsabs.harvard.edu/abs/2013MNRAS.435L..29S>

13. Predicted **recoiled black holes** from gravitational wave emission during galaxy mergers:

<http://adsabs.harvard.edu/abs/2007PhRvL..99d1103L>

*Confirmed with the discovery of Doppler-shifted offset quasars:

<http://adsabs.harvard.edu/abs/2018ApJ...861...51K>

<http://adsabs.harvard.edu/abs/2017ApJ...840...71K>

<http://adsabs.harvard.edu/abs/2017A%26A...600A..57C>

<http://adsabs.harvard.edu/abs/2015MNRAS.447.1282N>

14. Predicted the use of differential ages of stars in distant galaxies as **cosmic chronometers** to measure cosmological parameters

<https://ui.adsabs.harvard.edu/abs/2002ApJ...573...37J/abstract>

*Confirmed in detailed studies to be accurate to 5%,

<https://ui.adsabs.harvard.edu/abs/2020arXiv200307362M/abstract>

15. Predicted that the black hole at the center of the Milky Way galaxy (**SgrA***) is **fed by winds from the surrounding stars**

<https://ui.adsabs.harvard.edu/abs/2004MNRAS.350..725L/abstract>

*Confirmed by detailed numerical simulations,

<https://arxiv.org/abs/2006.00005>

16. Predicted the existence of a **large scale structure hidden behind the Zone of Avoidance of the Milky Way**

<https://ui.adsabs.harvard.edu/abs/2008MNRAS.386.2221L/abstract>

*Confirmed by the discovery of the “South Pole Wall”,

<https://arxiv.org/abs/2007.04414>

17. Predicted the existence of **radio halos as a result of intergalactic shocks**

<https://ui.adsabs.harvard.edu/abs/2004ApJ...617..281K/abstract>

<https://ui.adsabs.harvard.edu/abs/2004NewAR..48.1119K/abstract>

*Confirmed by the discovery of “Circular Radio Objects”,

<https://arxiv.org/abs/2006.14805>

18. Predicted **acceleration of charged particles to high energies through the cyclotron autoresonance with electromagnetic waves**

<https://journals.aps.org/pr/abstract/10.1103/PhysRevA.33.1828>

*Confirmed as a mechanism for production as ultra-high energy cosmic rays

<https://arxiv.org/abs/2007.06409>

19. Predicted **feeding of SgrA* by an individual star**

<https://ui.adsabs.harvard.edu/abs/2004MNRAS.350..725L/abstract>

*Confirmed through 3D numerical simulations

<https://ui.adsabs.harvard.edu/abs/2020ApJ...896L...6R/abstract>

20. Predicted intensity mapping of 21cm **for baryonic oscillations of galaxies at modest redshifts:**

<https://ui.adsabs.harvard.edu/abs/2008PhRvL.100p1301L/abstract>

*Confirmed by the papers:

<https://ui.adsabs.harvard.edu/abs/2021MNRAS.505.3698W/abstract>

<https://ui.adsabs.harvard.edu/abs/2021arXiv210602107W/abstract>

21. ***To be tested soon***: Predicted ability to measure the **cosmic expansion in real time (so-called, the “Sandage-Loeb Test”)**:

<http://adsabs.harvard.edu/abs/1998ApJ...499L.111L>

*Planned for use with upcoming facilities as discussed in the papers:

<http://adsabs.harvard.edu/abs/2018EPJC...78...11L>

<http://adsabs.harvard.edu/abs/2016PhRvD..94d3001M>