Intensity Mapping

Avi Loeb

Institute for Theory & Computation, Harvard University, 60 Garden St., Cambridge, MA 02138, USA

E-mail: aloeb@cfa.harvard.edu

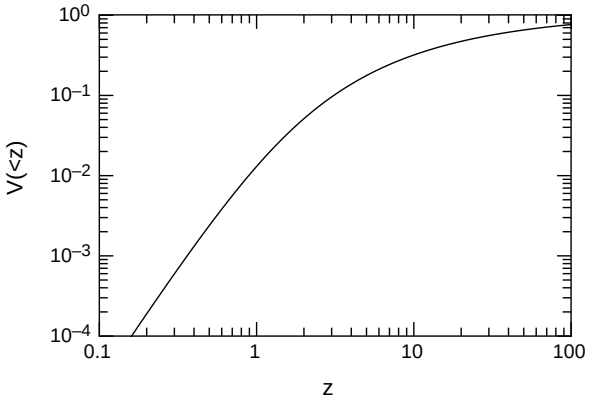

Figure 1. The fraction of the total comoving volume of the observable Universe that is available up to a redshift z. (from Loeb & Wyithe , PRL, 2008)

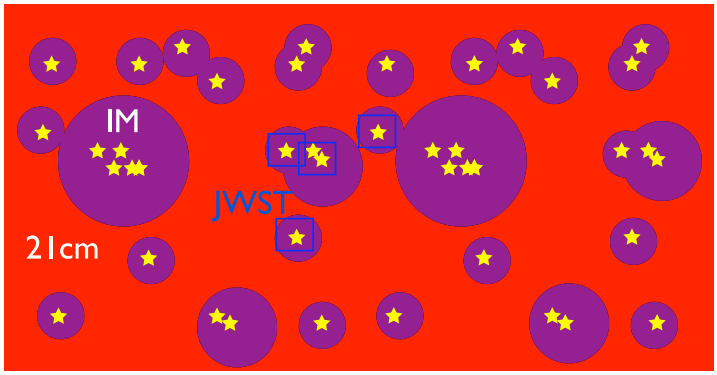

Figure 2. Cartoon of the role intensity mapping would play in understanding galaxy formation. Deep galaxy surveys with HST and JWST image the properties of individual galaxies in small fields (blue boxes). 21 cm tomography (red filled region) provides a "negative space" view of the Universe by determining the properties of the neutral gas surrounding groups of galaxies. Intensity mapping (purple filled regions) fills in the gaps providing information about the collective properties of groups of galaxies. Together the three would give a complete view of the early generation of galaxies in the infant universe. (from Pritchard & Loeb, RPP, 2011)

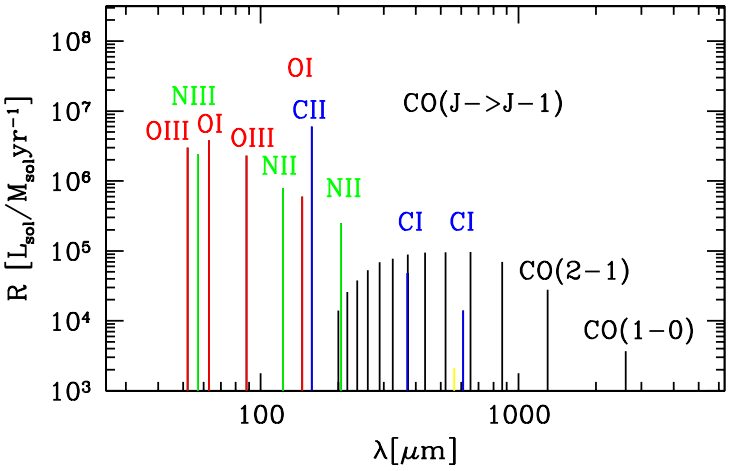

Figure 3. Ratio between line luminosity, L, and star formation rate, $\dot{M}_*$, for various lines observed in galaxies and taken from Table 1 of Visbal & Loeb (JCAP, 2010). For the first 7 lines this ratio is measured from a sample of low redshift galaxies. The other lines have been calibrated based on the galaxy M82. Some weaker lines, for example for HCN, have been omitted for clarity.

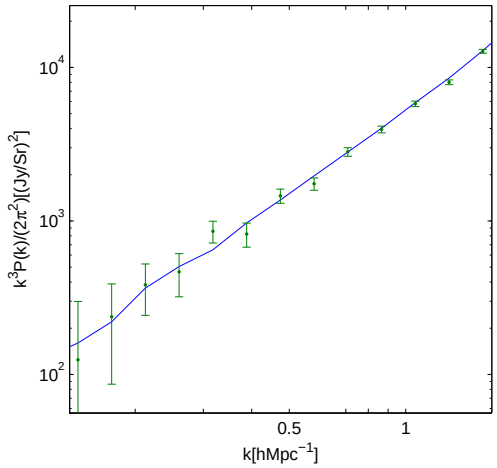

Figure 4. The cross power spectrum of OI(63 μm) and OIII(52 μm) at $z = 6$ measured from mock simulation data for a hypothetical infrared space telescope similar to SPICA (from numerical simulations by Visbal, Trac, & Loeb, JCAP 2011). The solid line is the cross power spectrum measured when only line emission from galaxies in the target lines is included. The points are the recovered power spectrum when detector noise, contaminating line emission, galaxy continuum emission, and dust in our galaxy and the CMB are included. The error bars follow an equation with $P_{1\mathrm{total}}$ and $P_{2\mathrm{total}}$ calculated from the simulated data, including detector noise, contaminating line emission and sample variance.