LISA and the Hubble Constant

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- Precise knowledge of H_0 over a range of z allows to probe Dark Energy

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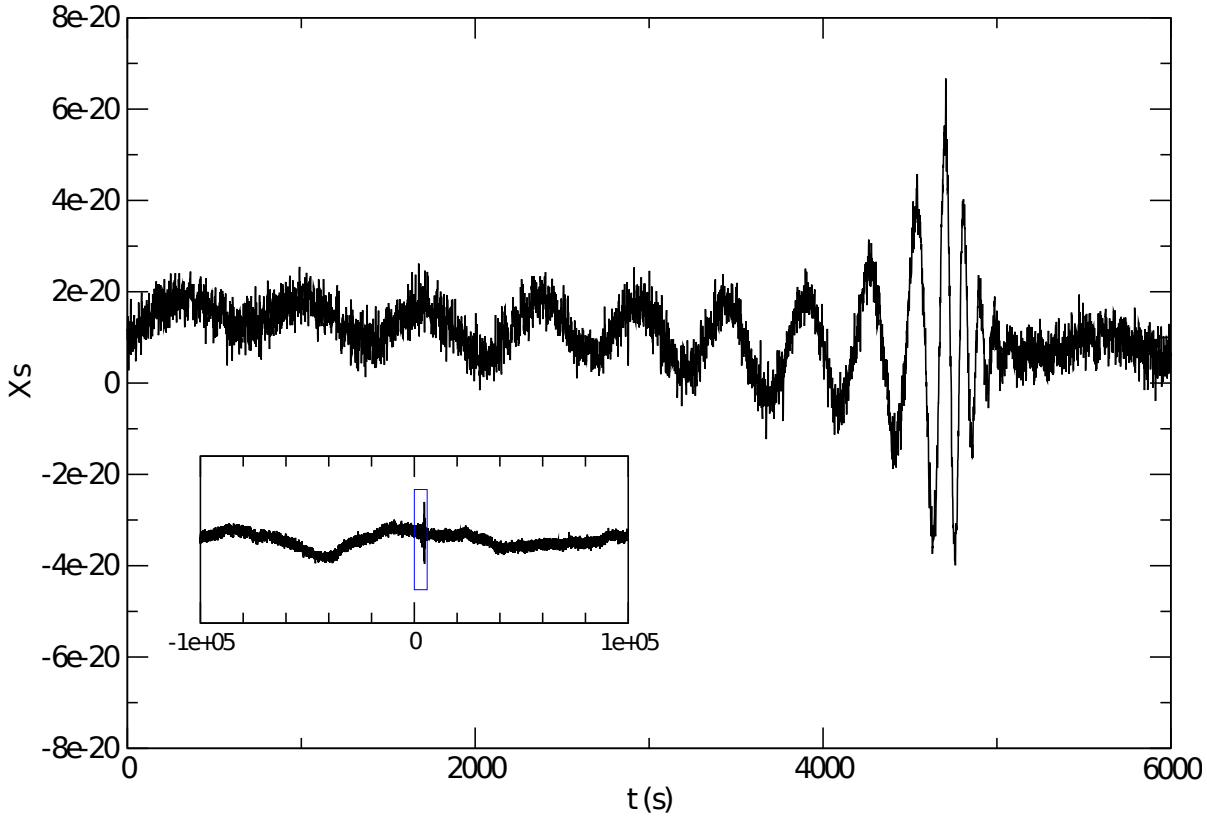
Because we can!

How to find the luminosity distance of a GW source



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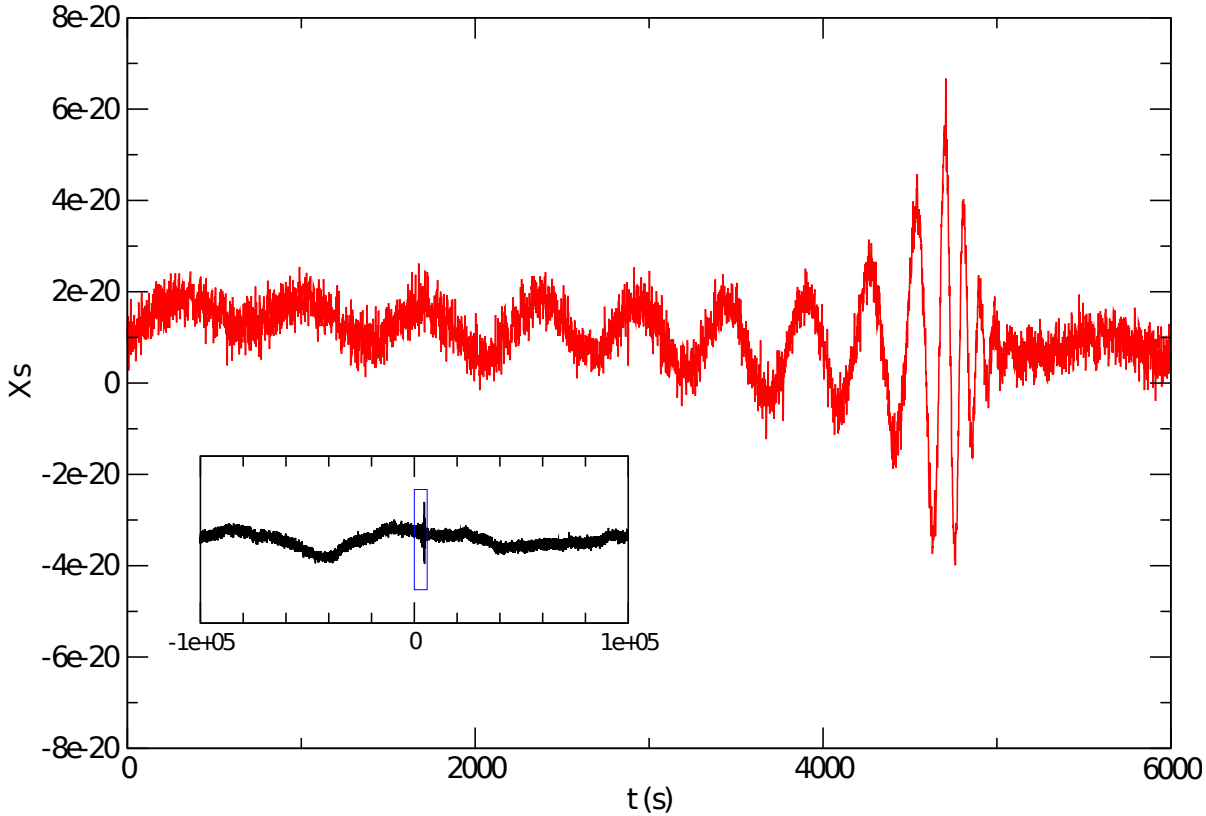

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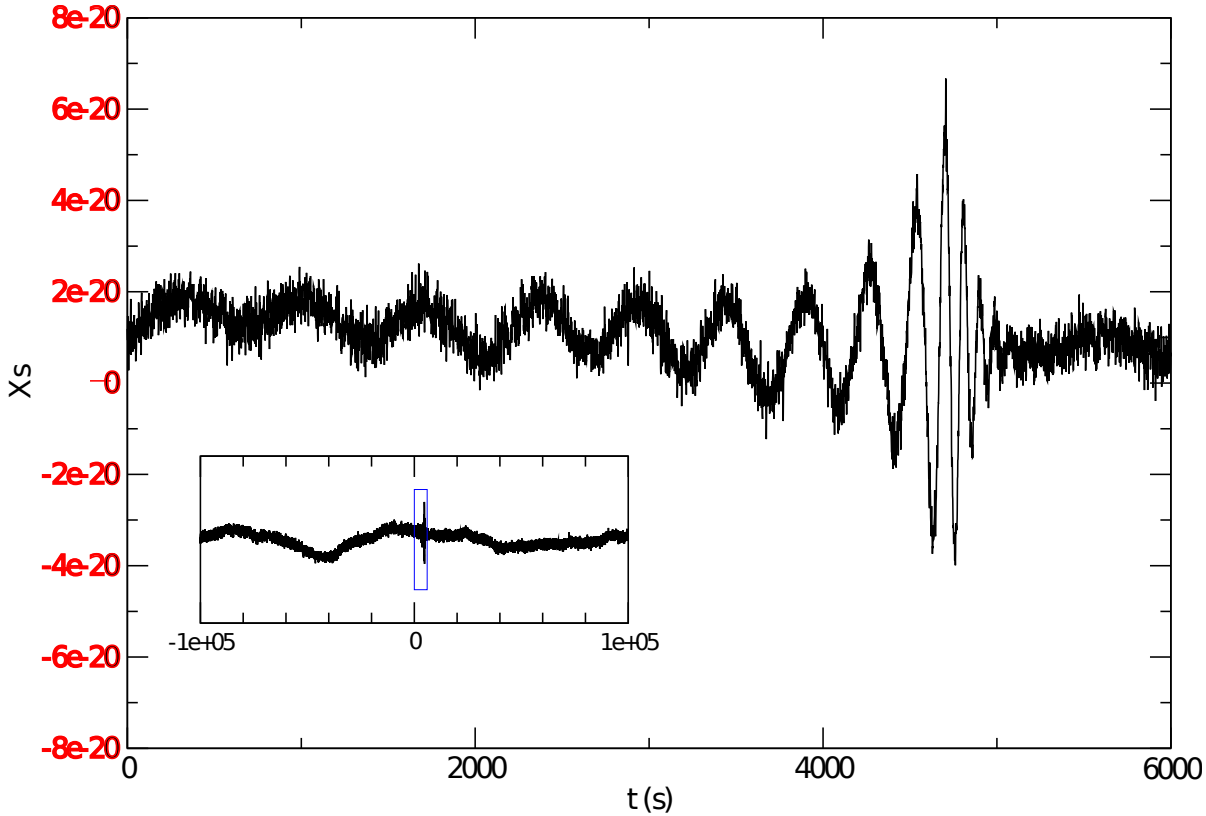

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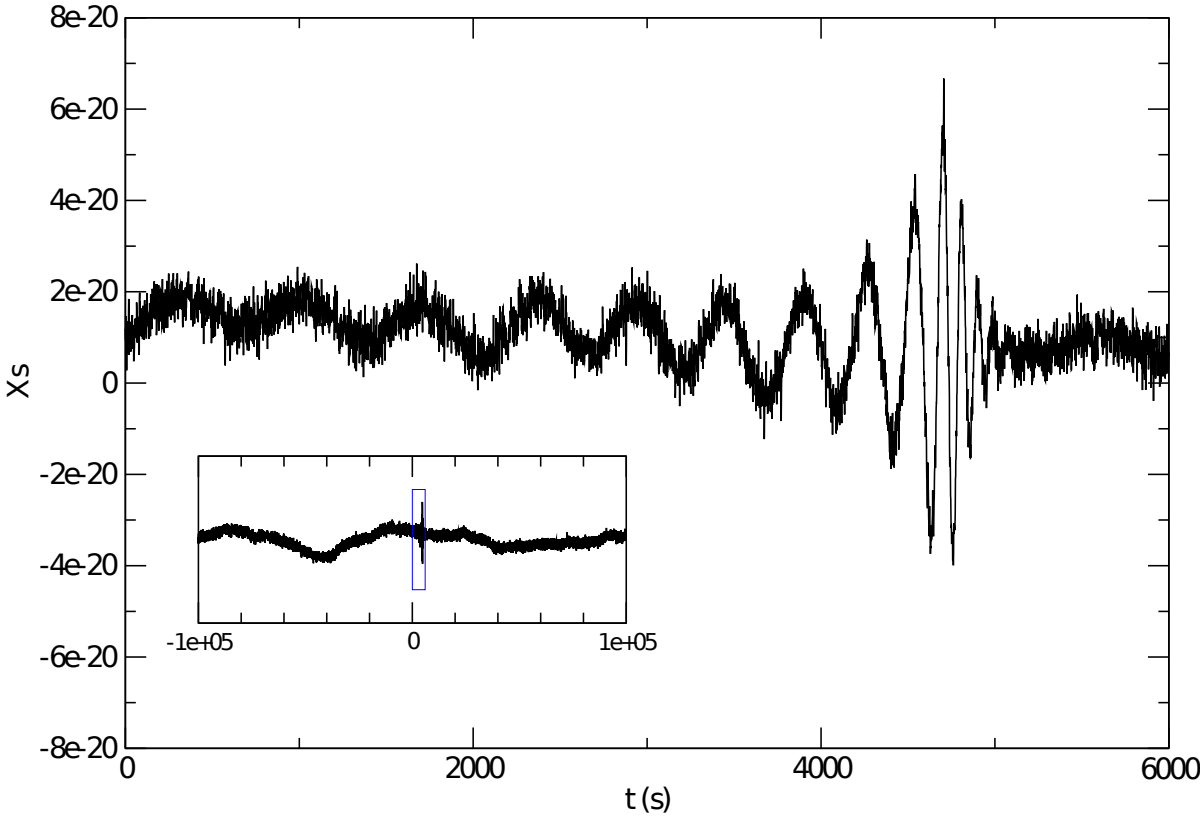

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- Some observation of EM counterpart is necessary to assess redshift
  - Direct observation relies on EM event associated with GW event
  - Statistical method uses distribution of host galaxies

Direct observation of EM event

- Best candidate for direct detection are MBH coalescences
  - Large signal-to-noise ratio, resulting in tight error-box for sky position (few arcmin) and D_L ($\sim 1\,\%$)
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- Need sources that are closer ($z < 1$)

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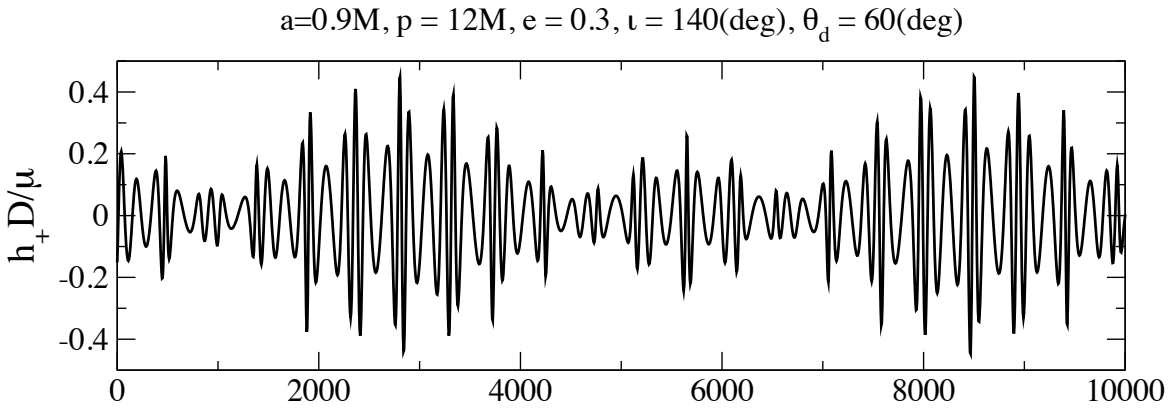

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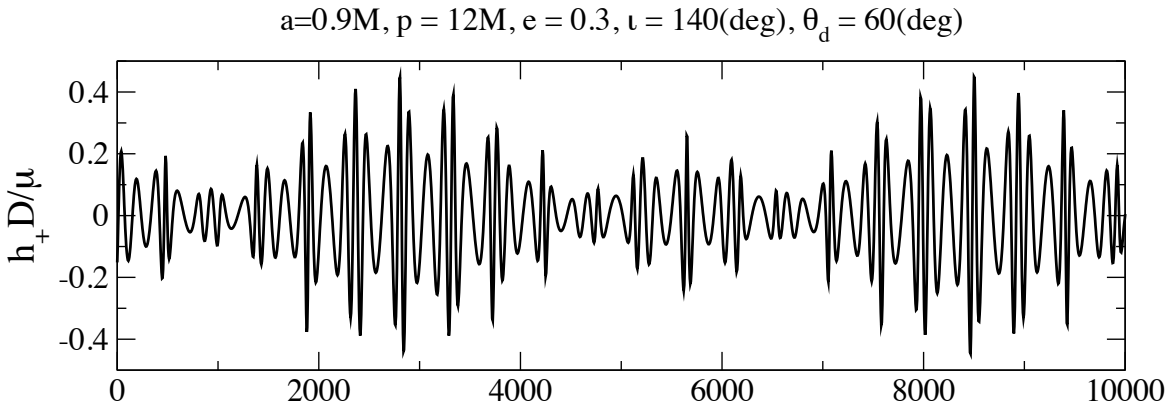

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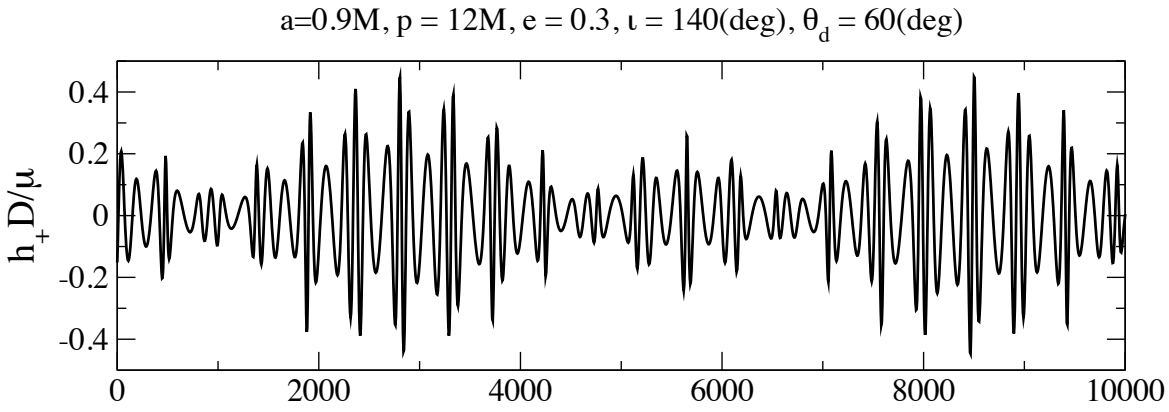

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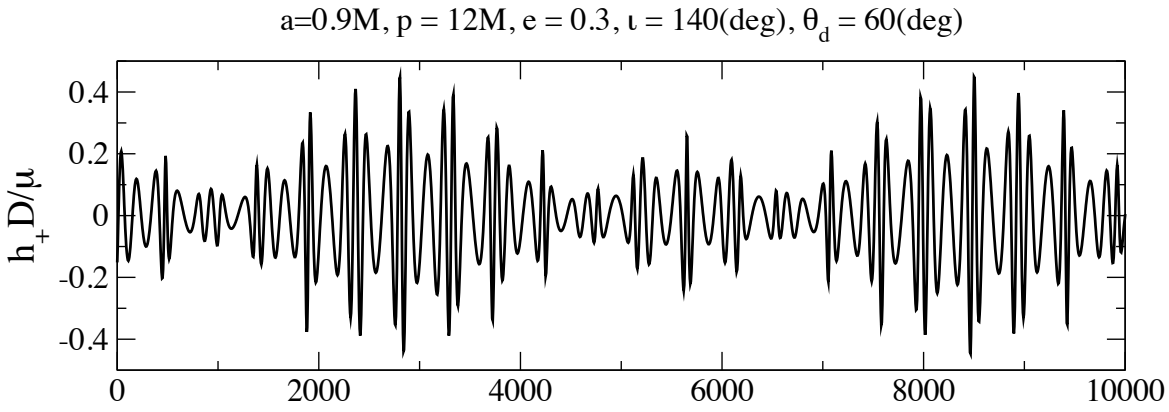

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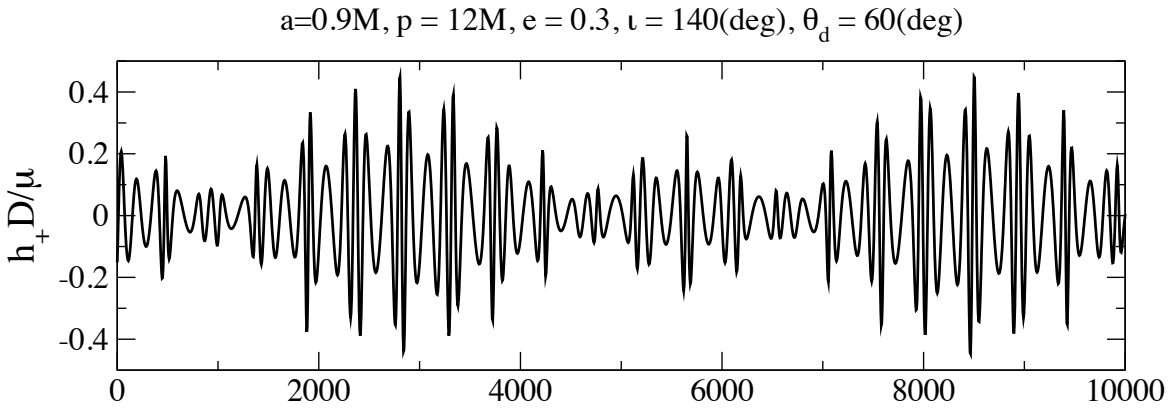

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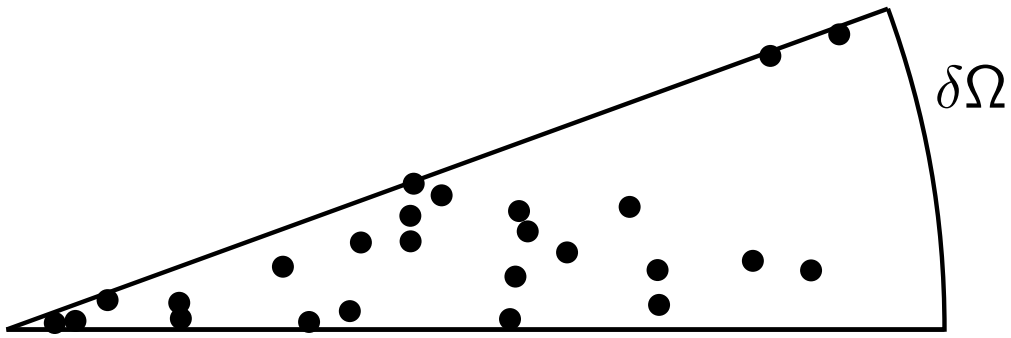
- Use a statistical method

Statistical method for obtaining the redshift



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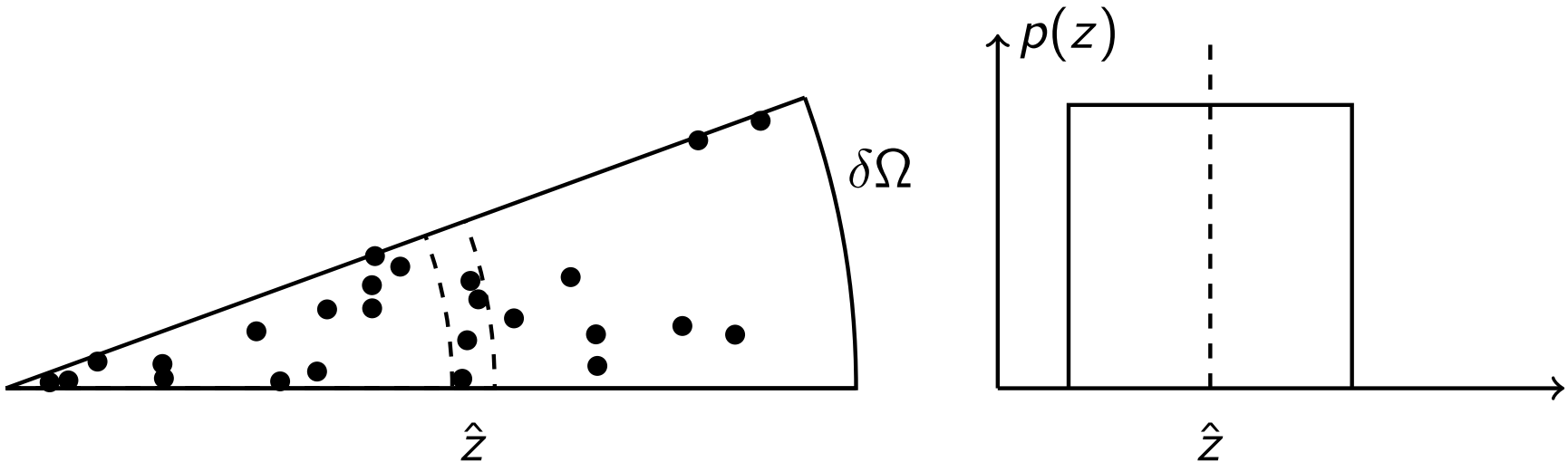

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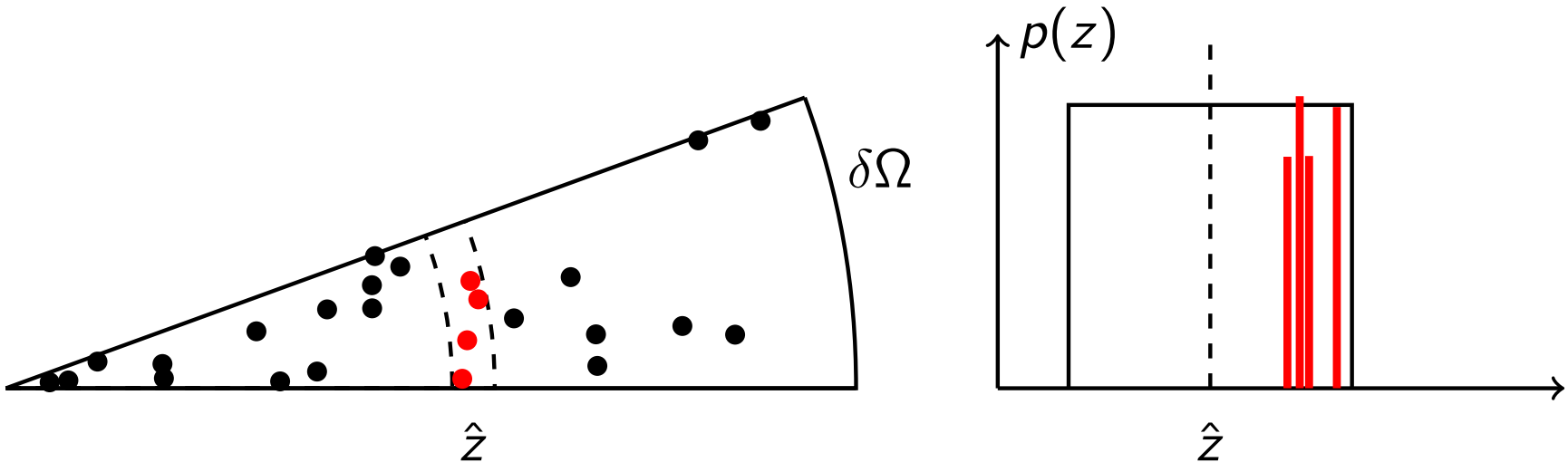

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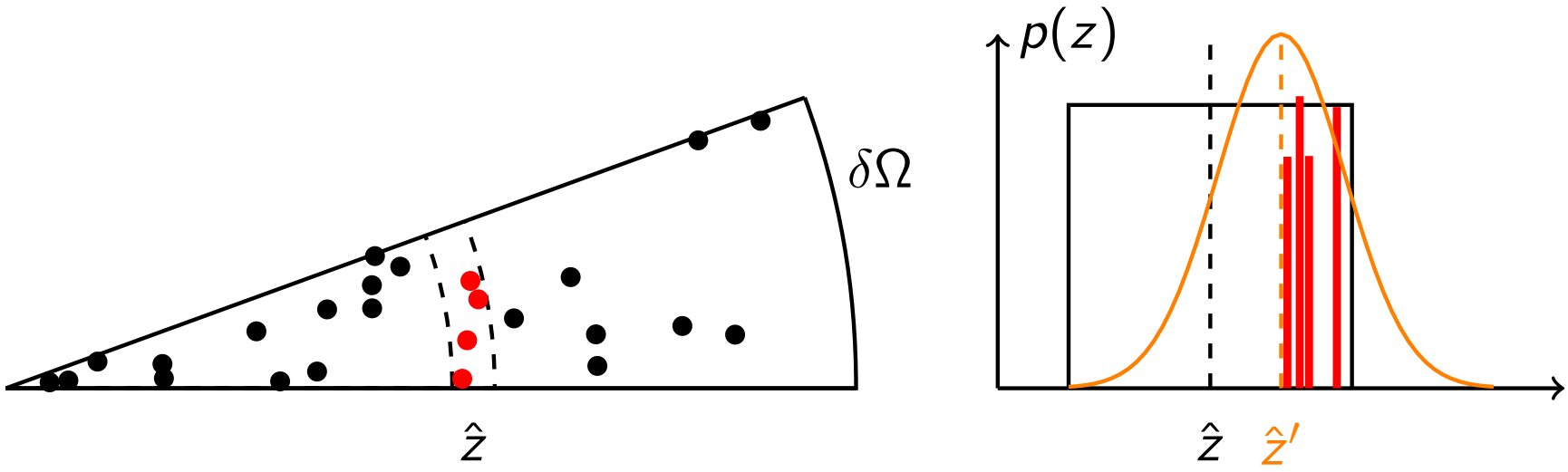

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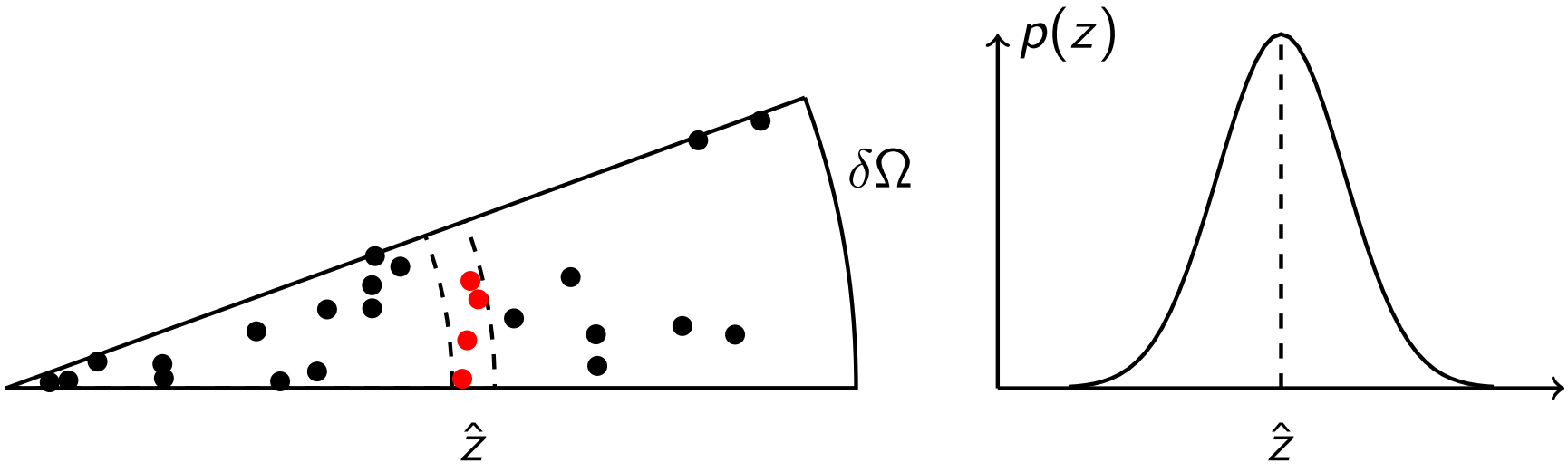

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- Repeat for as many signals as you can get

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Proof of concept using statistical redshift information

- Assume (simplified) LISA error boxes
- Take galaxy redshifts from the SDSS
- Possible estimate for precision of H_0

$$\frac{\Delta H_0}{H_0} < 1\,\%$$

- About 20 detected EMRI signals up to $z = 0.5$ needed

MacLeod & Hogan, PRD **77** *(4), February 2008*

Ideas for future work

- Using better estimates for LISA error boxes
- Using information from simulations on structure forming
- Re-visit gravitational lensing problem
- Use signals from MBH coalescence
- ...