Dielectric constant of chemical water solutions

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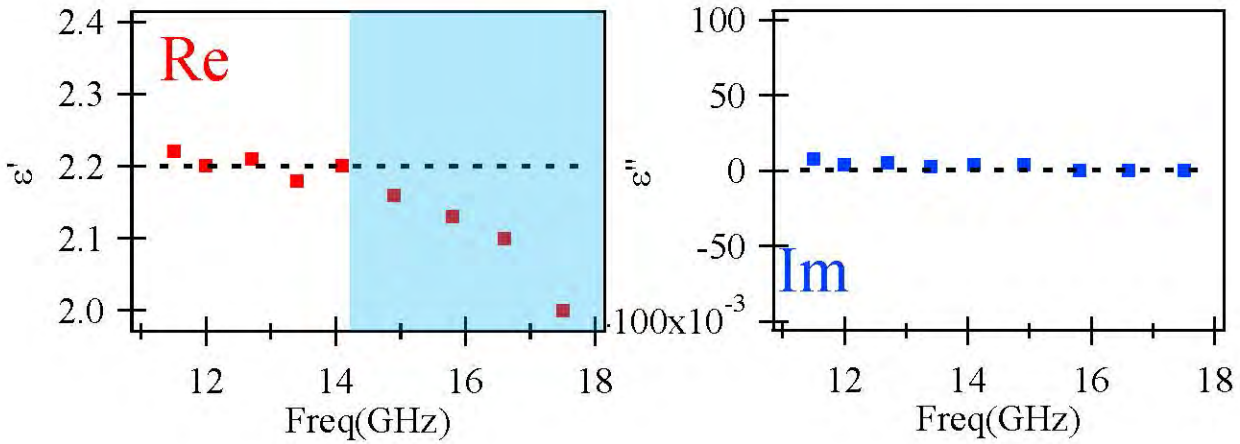
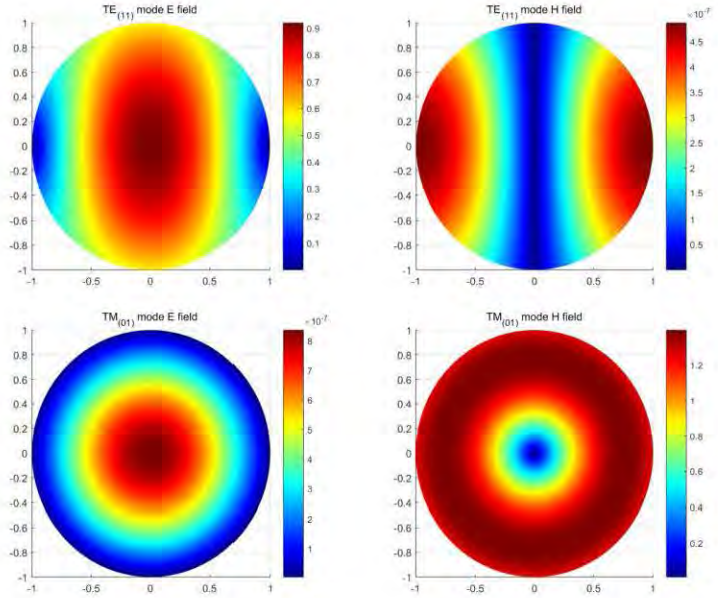
Resonant method: Yao's 1D cavity

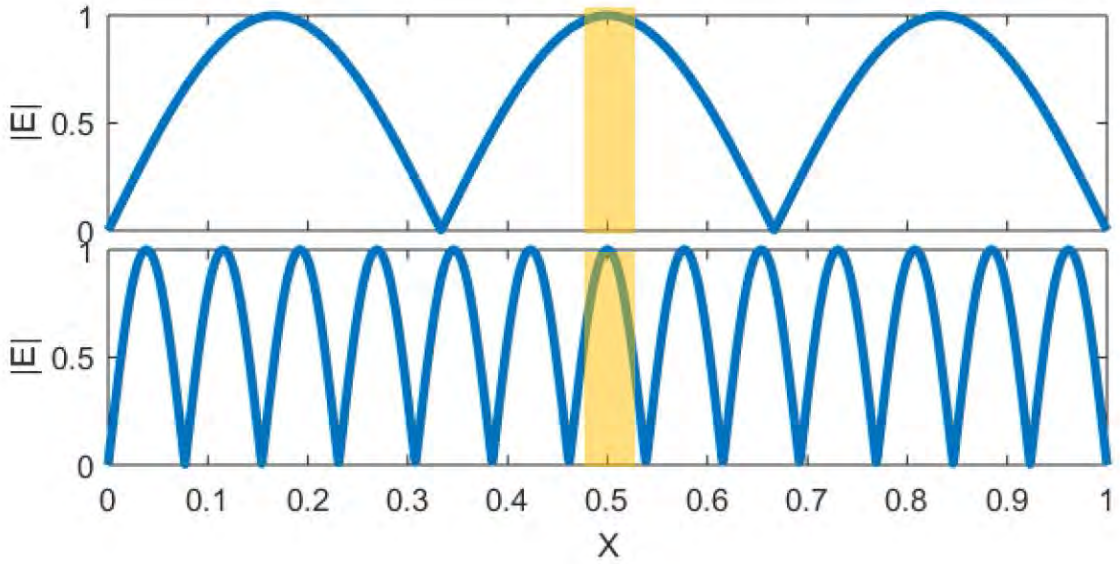




$$(f_c)_{TE_{11}} = 10.92\ GHz$$

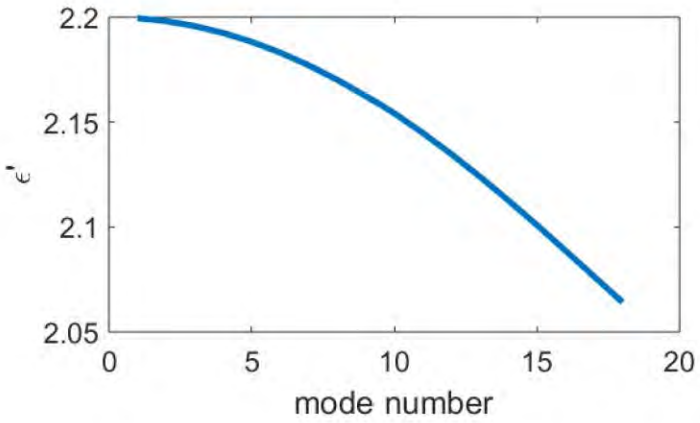
$$(f_c)_{TM_{01}} = 14.26 GHz$$

The shift may caused by the existence of TM_{01} mode



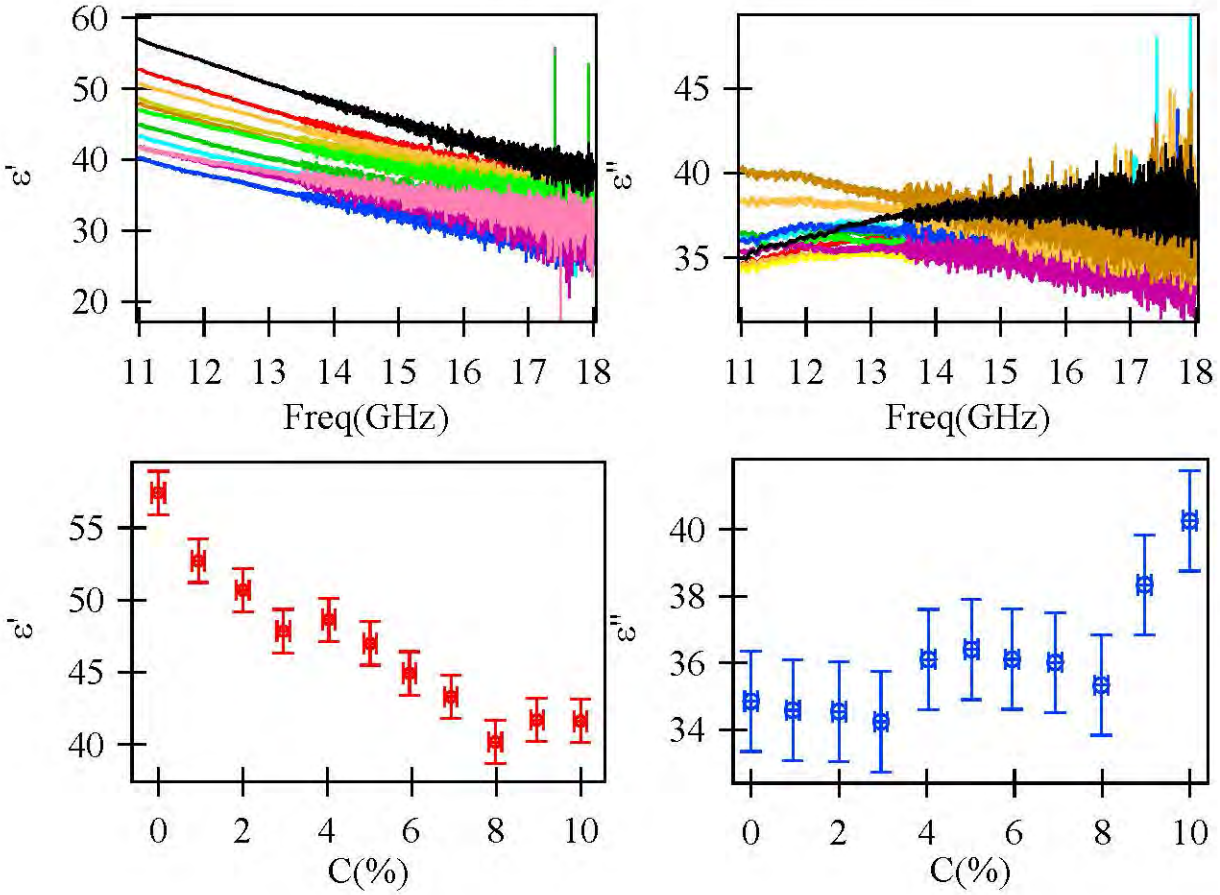
$$\frac{\delta f}{f_0} = \frac{\iiint \delta\epsilon |E|^2}{\iiint \epsilon_0 |E|^2}$$

$$|E| = \sin(\frac{\pi x}{L})$$

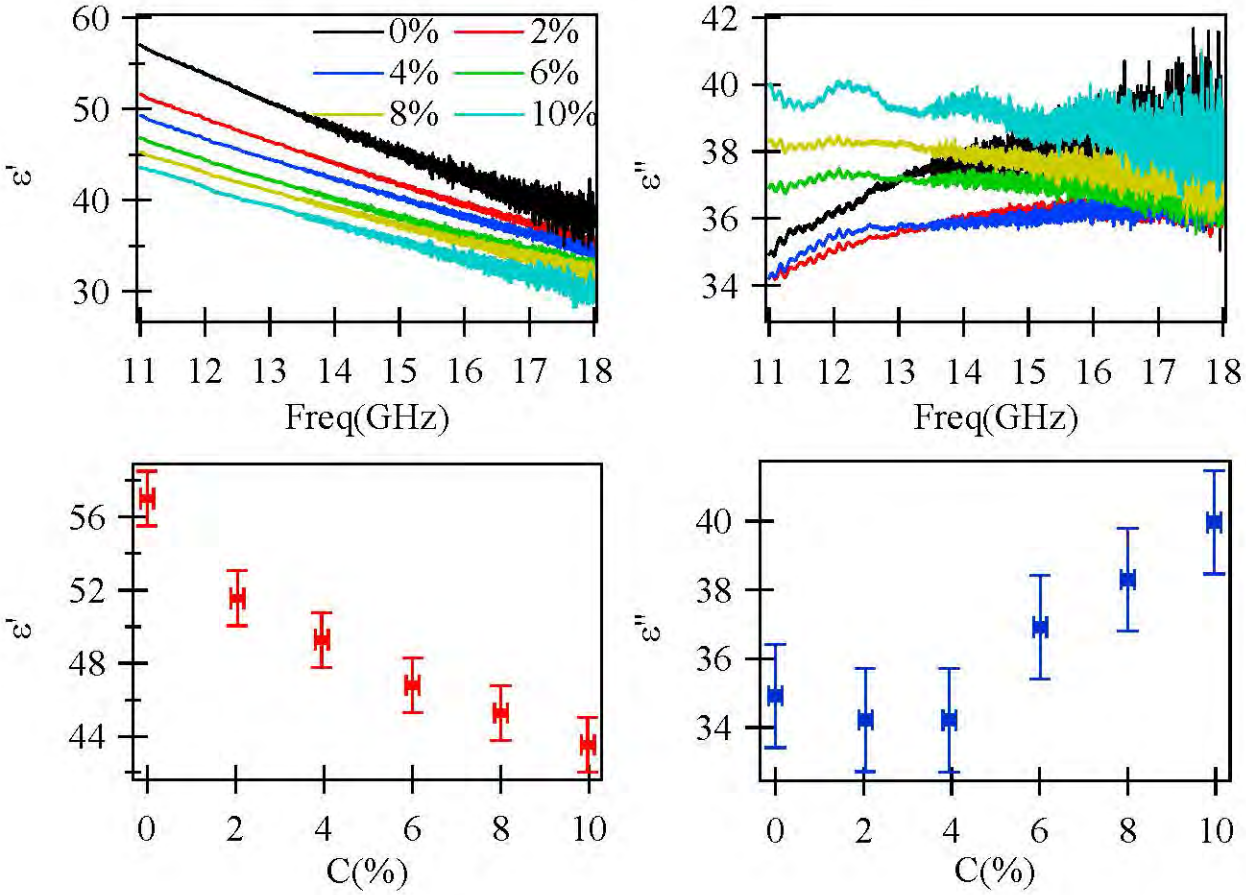


Dielectric constant of solutions

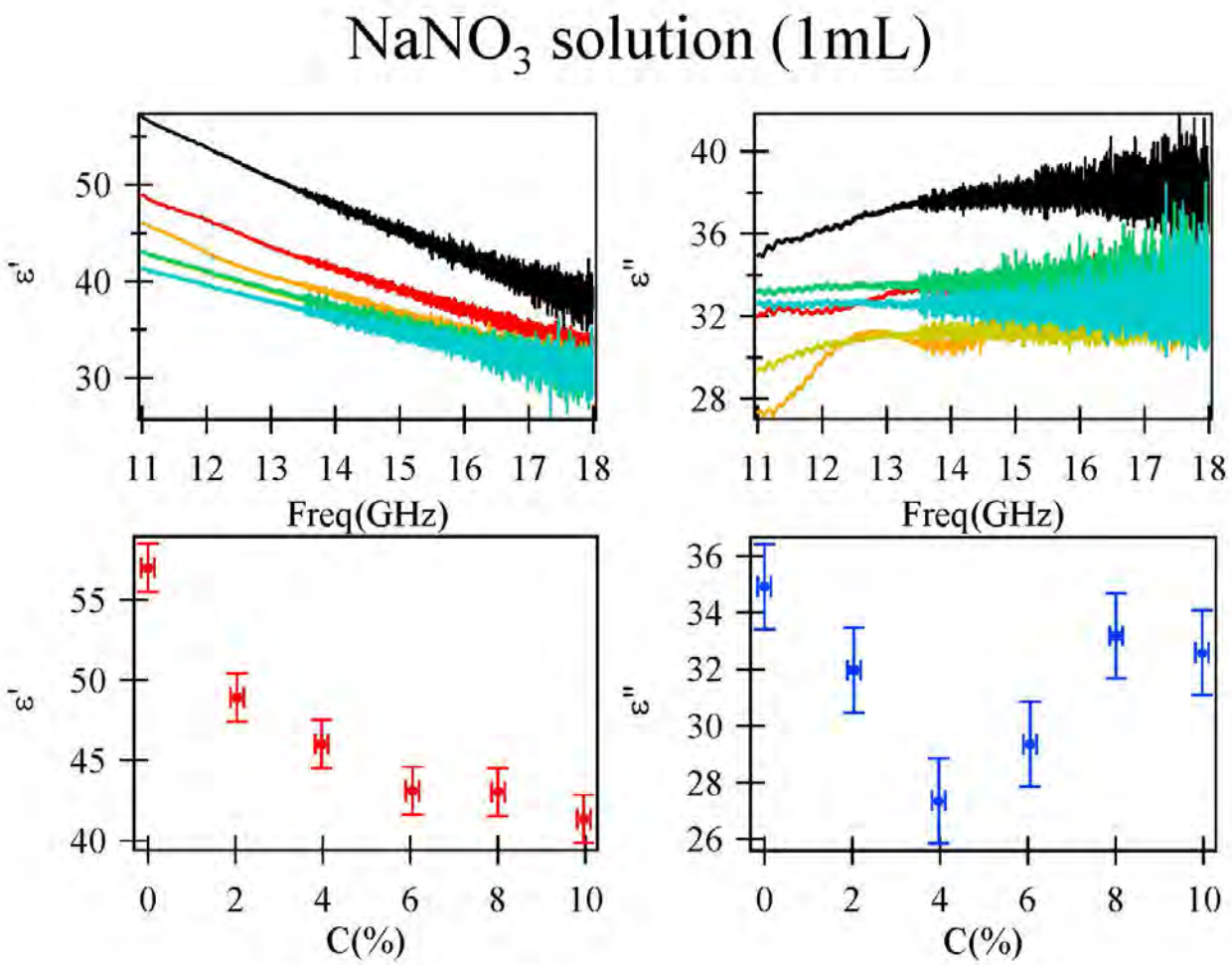
NaCl solution (1mL)

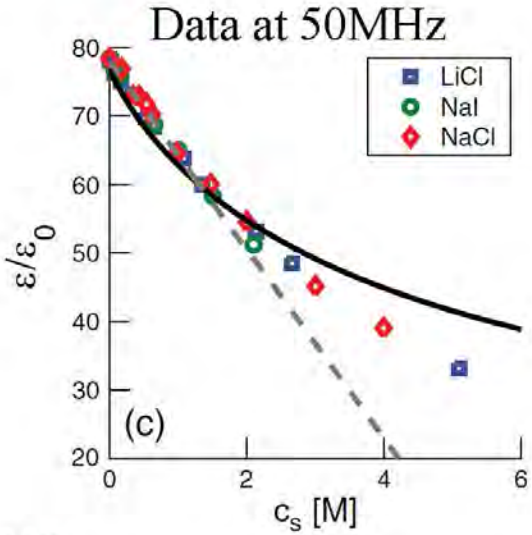


NH_4NO_3 solution (1mL)



Physical review letters 108.22 (2012): 227801.





Summary:

Real part: decrease with concentration.

Imaginary part: Complicated behavior

Next step:
Collect the data of
The rest three chemical solutions.
KNO_3, $KClO_3$, sugar

Possible application on industry

- Composites innovation center
  - Composites Material Testing (dielectric measurement)
  - Sensor design (near field imaging)
- Magnetic insight
  - Magnetic particle imaging. (microwave imaging on magnetic material)

- MITACS
  - Project/funding application