VSRT MEMO #036

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To: VSRT Group
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Subject: Microwave properties of water and ice

Using the single baseline interferometer set-up it is interesting to investigate the microwave properties of water and ice. Water has a dielectric constant of about 40 at 12 GHz and a loss tangent of about 45 degrees so that even a very thin layer will attenuate the signal from the CFL lamp. Carefully place some water in a zip lock bag and then compress the bag on either side to form a water thickness of a few mm. Notice that his will completely absorb the microwave signal from a CFL. Even a damp cloth will be almost completely opaque to 12 GHz. Next prepare a sheet of ice about 0.5" thick by placing a plastic plate filled with water in the freezer. The ice has entirely different properties and will hardly attenuate the CFL signal if the ice is pure. Adding slat or other impurity will increase the loss. You can also measure the dielectric constant using the method described in memo #35. You should find a value around 3 along with an attenuation up to about 3 dB/cm for impure ice. The Figure shows the sheet of ice being held in position to measure its refractive index.

See how these properties allow a microwave radar to study the sea ice and snow and aid to our knowledge of global climate change. Also read about controversial radar detection of ice on the moon and read how there could be ice at the poles of the planet mercury. But ice on Mercury is also controversial. Note that your measurements show that the microwave properties of ice are not very different from other dielectrics.

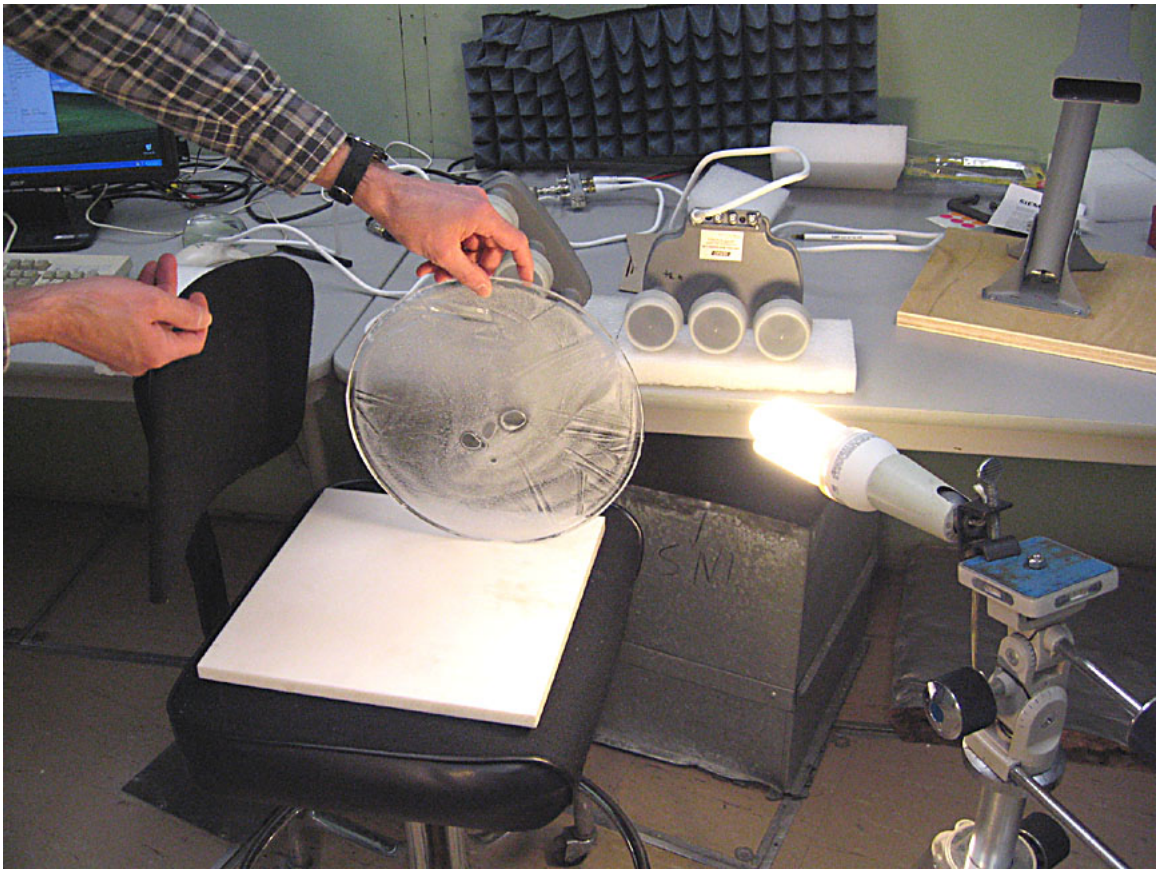

Figure 1. Sheet of ice being placed in the path to one of the CFLs to measure the refractive index as described in memo #036.