1 initial questions

why is a-sio2 fractal dimension 2.7? how do you measure fractal dimension of a structure? this will help figure out how to measure it for an atomistic structure.

what does a-sio2 accumulation look like?

2 paper comments

"We apply a simple-cubic sine-type dispersion to confined acoustic vibrations to approximate vibrational dispersion due to the tetrahedral orientation of bonds in certain dielectric materials."

First, I'm not sure you need to assume a simple-cubic crystal type to use a sine-type dispersion. For example, a sine-type dispersion describes a 1-D monatomic chain. I would just say simple sine-type, or something like that.

Why is a simple-cubic sine-type dispersion used "due to" the tetrahedrally-coordinated materials? I think that the psuedo dispersion of amorphous materials has been shown to follow a simple sine-type, at least at low-freq/low-wavenumber. Examples are a-Si and a-SiO2. The pseudo-dispersion can be more complicated at large wavenumber, as you can see from Fig. 3 of my amorphous draft.

3 ongoing discussion

4 buchneau soft potential model

[?]

5 orbach fracton model

Based on your reference to the fracton model, I am reading [?]:

"That the introduction of vibrational anharmonicity allows for thermal transport is an interesting feature of random structures. Whereas in ordered structures, anharmonicity serves to reduce heat flow, in disordered structures anharmonicity is the cause of heat flow."

This is an interesting comment about anharmponicity that deserves alot of attention.

Allen-Feldman claim that harmonic scattering is adequate to explain the features of T(K) for thin film a-Si which does NOT show the plateau in T(K) ¡ 10 K: [?]:

"The intrinsic broadening due to disorder is strong enough to suppress thermal conductivity to the level seen experimentally, with no need for special anharmonic effects or localization, except for the influence of two-level systems on the modes at very low frequencies."

Here is their conclusion after using a diffusivitiy scaling $D \propto \omega^{-2}$:

"The conclusion is that intrinsic harmonic glassy disorder contained in our finite calculation kills off the heat-carrying ability of propagons rapidly enough without invoking any exotic mechanism. Our (T) curve is reminiscent of the ex- periments of Zaitlin and Anderson after holes are introduced to enhance the elastic damping of long-wavelength modes. The plateau disappears from their data in much the same way that it disappears from our theory due to extra damping of small-Q propagons."

They explain T(K) for a-Si which DOES show the plateau by using a Rayleigh scaling $D \propto \omega^{-4}$:[**?**]

"The harmonic diffusivity becomes a Rayleigh m law and gives a divergent (T) as T O. To eliminate this we make the standard assumption of resonant-plus-relaxational absorption from two-level systems (this is an anharmonic effect which would lie outside our model even if it did contain two-level systems implicitly)."

The low-freq scaling of the diffusivities Depending on whether u see the plateau in T(K), at least according to AF.

The effect of anharmonicity is introduced by AF when using the Rayleigh type scaling, so it is hard to judge whether what the fracton model says is true. The AF theory seems to be able to describe both situations for a-Si (plateau and no plateua). This will be an important topic when you bring it up in the group meeting presentation.

orbach:

"Experimentally, Eq. (2)accounts for the increase in n(T) for temperatures above the plateau for many amorphous and glassy materials (see Fig. 1)."

This is explained by AF theory as a specific heat effect of the mid-range and high-freq modes. Again, these two theories are explaining the same feature in 2 different ways, so you should focus on these features.