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6/24

I think you must also draw a limit to that action,  
i.e. the molecule must finally take up something  
of average energy and that average energy  
I might suggest to mean corresponding to the  
energy of radiation.

The conclusion I should draw is that the  
distribution of energy ~~perhaps~~ <sup>is</sup> established  
itself possibly quite independently of  
"impact". In fact each molecule must  
at every instant ~~be~~ be considered in  
collision with every other molecule; and  
this breaks down the fundamental assumption  
of the present gas theory.

It is assumed that Boyle's law proves that  
the molecules cannot only act at very  
small distances, & that they must be  
deflected by sharp little waves when ~~impinging~~  
<sup>deflected by</sup> impacting. But is this conclusion sound?

Dear Fitzgerald,

<sup>The suggestion contained in</sup>  
I did not mean my letter to Nature to be  
a solution of the difficulty - Far from it, I had  
originally added a paragraph which I struck out  
because I was afraid of the storm of discussion  
it might raise. -

1) The result of mathematical calculation breaks down  
hopelessly as far as I can see in the ineliminable  
fact that the vibratory energy as then <sup>by</sup> radiation  
phenomena, is not proportional to the translat. energy  
of Hooke's law is true - & it is not dispersed  
at any rate at vibratory energy <sup>would</sup> ~~would~~ very  
as the fourth power of the translat. <sup>an innumerate</sup> ~~on~~  
the energy given to the medium <sup>supposing</sup> & proportional to  
vibratory energy of the molecules

2) The idea that vibratory energy is a thing  
of a definite order for translation and  
independent of it, is very tempting. ~~It is this statement~~

6/26

Helmholtz - in a private conversation while shooting about in Switzerland - he expressed the opinion that this was the solution of the difficulty though he admitted that the two motions must be connected. The admission seems to me to do away with the explanation. It seems always very doubtful ~~to me~~ how far it is allowable to quote private conversations of the person in question, it might draw him or his son a punishment but when they are not liable to give their own version of the affair it is better not to allude to it at all, as memory is treacherous, and everybody finds out with other people, though not always with themselves and I seem to remember Helmholtz's words.

At any rate I do not see how to separate the two motions. If you compress a gas by moving a piston which heat it, it seems to me quite clear that the translation

vibration oil does  
motion must be converted into oscillation  
not at all matter what the intermediate  
steps are.

3. Imagine an enclosure large enough say to surround the planetary system, kept at a uniform temperature. Take away all matter from the inside & then place into this a single molecule somewhere near the middle. The molecule is supposed to at rest in the first instance but capable of absorbing some of the radiation which falls on it. Now ask yourself the following questions:
  - a. Will the molecule remain at rest. I fancy not. I cannot imagine any vibration which does not in some form produce unequal pressures front or back and unless the molecule is acted on perfectly symmetrically all round which you should we know of the nature of heat it cannot be at rest.
  - b. If you admit that translatory motion is initiated

interesting to know that the new gas is  
monatomic (from colors of absorption band)  
and that supposing it is not a mixture  
it does not fit into Mendel's off

Yours sincerely  
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Albert Schuster.

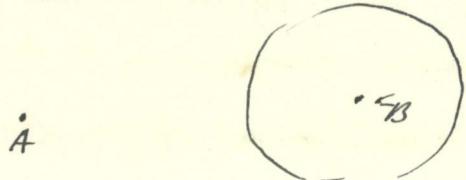
6/24

If you consider two molecules & bring them nearer  
nearer together, we know that until you  
come close there is no work done, but it does  
not follow that there are no forces. The latter  
may exist but h irregularly sometimes in one direction  
sometimes in the other.

I should like to have seen a theory of yours worked out  
on the assumption that there are no impacts  
at all but only forces due to vibrations.

5<sup>th</sup>. If you look back at the medium as a connected  
system the Boltzmann theorem cannot be true.  
Its crucial hypothesis is that any one variable  
can have any assigned velocity (say without)  
unless all the others being at rest, or have other assigned  
velocities. If there is anything in the above  
this cannot be; an infinite velocity of oscillations of  
one point would produce infinite force separated  
in the rest could not exist.

b. Sometime ago while I was trying to get  
clear ideas about this by working out some  
problems in the theory concerning forces due to  
radiation I was stopped by the following puzzle



If A & B are two arbitrary particles & if the vibrations  
have gone on for a sufficient time or <sup>otherwise</sup> may  
say in the case of ground bodies certain forces  
act between A & B satisfy the laws of action &  
reaction.

Now suppose A to have been vibrating originally  
long for the medium to have taken up its steady  
state but that B is only just starting so that its  
displacement does not yet reach as far as A.  
Then with a force on B but not on A, the reaction

6/24 at the various points  
throughout the medium? I could not quite see  
how to treat the problem without taking account  
of the reaction in the medium & this made it  
very complicated. —

I do not know how far any of these speculations  
are in the journal. I feel at them down from  
recollection of what I have thought  
various times but my ideas at present  
are not very clear. —

What a dell for dinner that  
Olejewski has solvated his new gas  
to white crystals & finds the critical  
point & boiling point lower than that of  
Argon.

If you have not seen the advanced prop  
of Rutherford & Ramsay you will be