

We would like to thank both the referees for their detailed reports which led to several improvements in our manuscript. In the following we address all the points. To simplify their work of review, we have kept all the modifications in the manuscript in **red** color.

## 1 Report 2

This paper studies various bounds on transport proposed in the literature, with the hope of reaching something of universal status, all of which ultimately fall short depending on the context. Nevertheless I think such bounds may be interesting if the physical conditions under which they hold can be delineated.

The authors provide a fairly comprehensive review of such bounds. In addition they add new analyses in various cases: lower- and upper-bounds on diffusion, and bounds on the speed of sound. These computations apply to a particular class of holographic models with broken translations. I think the paper is of generally high quality and the results are an interesting and original contribution to the area. I recommend that it be published, subject to the following minor changes:

We would like to thank the second referee for his/her report and positive judgment.

1- "we have proved numerically that all the diffusive processes in the holographic models with broken translations considered obey the upper bound proposed in [15]". I think this presentation of their results is not appropriate - short of a proof they have simply not found any violation in their numerical studies.

We agree with this point of the referee, which was also mentioned in the first report. We have modified the sentences to convey the message that we did not prove anything but rather checked the validity in a quite general class of holographic models.

2- "This confirms the idea that  $\eta/s$  is not a meaningful quantity in non-relativistic systems" — The authors could clarify this and related statements in the manuscript. Do they relate only to translation-breaking as studied here, or to all non-relativistic contexts? e.g. what about Galilean-invariant systems?

The idea is that in relativistic setups the  $\eta/s$  ratio enters directly in the transport properties of the system since it defines the diffusion constant of momentum  $DT = \eta/s$ . Once the relativistic group is broken (and independently of how) the  $\eta/s$  ratio remains a well-defined dimensionless ratio but its not defining any specific transport property of the system. In this sense, it loses its privileged role. We agree with the referee that the word "meaningful" is not totally appropriate in this sense and we changed the sentence to be clearer.

3- There are several equations in the draft (8),(22),(33),(38) where for clarity the authors should indicate whether these are approximate or exact expressions in  $k$ . At the moment they are presented as exact.

We are sorry for the sloppiness. Of course, all the dispersion relations presented in those equations are valid only at small wave-vector and they get corrections at short length-scale. We have made them explicit in the equations.

4- The paper should include some technical details surrounding the holographic diffusion constant calculation. How is  $D$  computed numerically? Is it a direct computation or is there some fitting taking place with (22)?

Its twofold. The diffusion constant can be obtained numerically by fitting the dispersion relation of the diffusive modes found in the QNMs spectrum. Nevertheless, it can also be derived

independently using the hydrodynamic formulae which have been checked in our Refs.[84] and [111]. This second method is much easier and faster since most of the transport coefficients appearing in the formulae have an analytic expression and the rest of them can be computed using simple Kubo formulas at zero momentum. We decided to add a small appendix to explain this point better and show an example.