To Gary Sanders
from V.Braginsky and F.Khalili.
Subject: remarks about "Strawman LIGO II Design"

General remark:

The document is too optimistic i.e. the predicted expected sensitivity is somewhat too high.

Specific remarks:

1. The nontermal noise in the suspension and in the mirror itself is completely ignored (e.g. the typical dimension instability of a bulk made of SiO_2 monocrystal is $\Delta l/l \simeq 10^{-10} \div 10^{-11}$ during one second; thus for $l = 10cm$ one may expect the random change $\Delta l \simeq 10^{-9} \div 10^{-10} cm$; the sensitivity of LIGO II corresponds to $\Delta l_{grav} \simeq 2 \cdot 10^{-17} cm$ during time interval $10^{-2} s$!).

2. [redacted] numbers of the conribution of the thermal noise from the suspension are substantionally different from the numbers in the figure: our calculations for the mirror's mass $30kg$, relaxation time of the pendulum mode 6 year (recently obtained value in MSU group) and for the model of viscous damping (!) the value of h_f is $4 \cdot 10^{-24}$ at $f = 100Hz$ and not $2.5 \cdot 10^{-25}$ as in the figure.

Note: we do not know anything about the data from experiments which gave better number and which shown that structural damping is the main source of dissipation.

3. The bonding of fused silica to sapphire inevitably may be a source of nonthermal noise due to the large difference between the thermal expansion factor of fused silica and sapphire. The possibility to substract the thermal and nonthermal noise (which is was reported by MSU group one year ago) is ignored.

Recomendations:

1. Before to declare the expected sensitivity of LIGO II together with the design it is necessary from our point of view to "invest" more efforts in the measurements of the nonthermal noise both in the suspension and in the mirror itself, to perform direct measurements of the relaxation time of the

pendulum mode with fused silica ribbons in the suspension and to find what is the dominant noise: the viscous or the structural one.

2. It is necessary also to elaborate in details the potential possibility to substract the thermal and nonthermal noises from the suspension.

3. We checked the curves for the shot noise and for the radiation pressure noise and did not find the discreapense with our calculations. It will be educative to add to the curves in the Fig.1 the SQL limit

$$\frac{2}{L}\sqrt{\frac{2\hbar}{(2\pi)^2 f^2 m}} \simeq \frac{2\cdot 10^{-22}}{f} Hz^{-1/2}$$

cc. B. Bareish
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