Vegar Guleng

Crossing the Event Horizon

Instruments:

Flute (Standard Flute, Alto Flute)
Clarinet (Clarinet in Bb, Bass Clarinet in Bb)
Percussion: Glockenspiel, Crotales, Vibraphone
- Extra: bow for crotales and vibraphone
Mezzo-soprano
Violin
Viola
Cello
Contrabass

Year of composition: 2019-2020

Duration: ca. 9 min

Composed for and in collaboration with:
***Hermes Ensemble*, Antwerpen**

About the piece

The concept of this piece is heavily inspired by my physicist wife, from the time she did her undergraduate in physics. The idea is based on a passage from *Astronomy – a physical perspective* (1) by Marc Kutner, an introduction book on astrophysics. In his chapter on general relativity, he provides a thought experiment on what would happen if an astronaut approaches a black hole. The thought experiment is constructed to show some of what we know about black holes today, based on mathematical calculations. In the following I will give a short resume on the mentioned thought experiment.

Imagine two astronauts. The first one, called Traveler, approaches the black hole, while the other, called Observer, observes at a safe distance. As Traveler moves closer to the black hole, the first peculiar event Observer will notice is a continuously increased redshift in the signals received from Traveler (light appearing to be redder, pitches sound lower, etc.). If the black hole is small (e.g. mass equal to the solar mass), the discrepancy in gravitational pull between legs and head will eventually tear the body apart. First the spinal chord breaks, then the body is torn into two pieces, which in its turn is torn into four, and so on. Eventually, the body is a long string of athoms. This process is called *spaghettification*, and applies to any object approaching a small black hole. (However, if the black hole is massive enough Traveler may rush into the black hole without noticing anything unusual.)

As Traveler moves even closer to the black hole, less and less signals (e.g. light reflected by Traveler) will escape as gradually more signals will be absorbed by the black hole. At one point the signals that Traveler sends out horizontally (relative to the black hole) will start orbiting around the black hole. So if Traveler looks straight out, she will look into the back of her own head!

Finally no signal whatsoever may escape. Traveler has now *crossed the event horizon*, she is inside the black hole. Any event taking place inside the event horizon will forever be inaccessible to the outside world. No signal, not even light, will ever escape, hence the name "black hole". To her, time passes at normal speed. For Observer, however, it seems like time slows down as Traveler approaches the event horizon. In fact, from Observer's point of view, Traveler will never reach the black hole, she will simply move towards it at ever slowing speed.

For this piece, my goal has been to treat this thought experiment artistically, especially the concept of relative time. My sincere gratitude goes to my wife for providing me with the idea for the piece, to Natalia Eiré Sommer, MSc in Astronomy for providing much needed expertise on black holes (including spaghettification, general relativity, etc.), and at last but not at least to Wim Henderickx and the Hermes Ensemble for first the giving me the opportunity to do this project in collaboration with them, and second for creating an extremely positive and professional learning environment. I am truly thankful.

Vegar Guleng, 15. sep. 2019, Trondheim, Norway

(1) Marc L. Kutner: *Astronomy – A Physical Perspective* (2003), Cambridge University Press, 2. Edition

Performance notes

Microtonality:
I call for microtonal alteration of pitches, (sometimes also in connection with glissandi). What I want is not necessarily exact quarter tones, the idea is simply to find a microtonal pitch between two half tones.

Mezzo-soprano:
In this piece, the mezzo-soprano more or less takes the role as the astronaut approaching the black hole. In other words, the mezzo soprano is the subject thrown into a world of physical objects and laws. Therefore, the very concept of this piece calls for non-traditional use of the vocal. The feeling I hope will be invoked in the listener, is that the vocal part is sung not by a professional, classically trained singer, as much as preformed by just a *human being*, in the most subjective and vulnerable sense. Inspiration from general human expressions (like sigh) permeates the vocal part.

During all of the piece, vibrato should be used very sparingly, if at all.

Sometimes I want singing with more or less airflow. In order to indicate this I have created five symbols, ranging from all air and no pitch, to all pitch and no air (corresponding the norm in classical singing). The symbols are indicated below:


Only air, no (clear) pitch. Notes are indicated as high or low.


Mostly air, but audible pitch


Halv air, halv pitch


Airflow somewhat audible, but mostly pitch


No air, all pitch (also standard when nothing else indicated).


This example would therefore indicate going from standard singing to singing with just some pitch, and lots of air. This will also probably entail diminuendo, since air breathing is by necessity very soft. Nevertheless, the intensity in louder dynamics should be extremely high, even though the volume as such will inevitably be reduced.

Special phonetic sounds: I call for three specific sounds, two of which are not found in English phonetics. The first one is the sound find for example in German words like "Mädchen" and "Kirche". I write this in the German way, as "ch".

The other sound is common in flamish, for example as the first sound in"Gent" (the City). I want this sound, when called for, to be greatly exaggereted, especially when the dynamic is loud. The result should be a very intense and almost unpleasent "scraping sound". In order to destingvish it effectively from other sounds, I use "GG" to refer to this sound.

The third one i Æ/æ, with which I refer to the first sound in English names or words as "America", "Andersson" and "ally".

Crossing the event horizon

The travelling astronaut (TA) is thrown into deep space, falling towards a black hole.

♩ = 76

Alto Flute

Clarinet in B♭

Vibraphone

Piano

Mezzo-soprano

Violin I

Viola

Violoncello

Contrabass

mp 7 p

gliss.

pp

hold pedal, release slowly, by ear after a few bars

--> s.p. ord. fpp

For the observing astronaut (OA), it is clear that TA is caught by a strong gravity field. A slight red shift is noticeable.

8

A. Fl.

Cl.

Vib.

Pno.

pp una corde

with ped.

M-S.

a sigh into the void

A - - - i

Sa - - - i

Vln.

Vla.

Vc.

Cb.

--> s.p.

ord.

gliss.

ppp

12

A TA continues falling at an ever faster speed.

A. Fl. *mf* *p*

Cl. *mf* *p*

Vib.

Pno. 7 7 3 6 5 *pp*

hold pedal, release sowly by ear after a few bars

M-S.

A

Vln. non vib. *pp* gliss. *mf* *pp* --> s.p. ord. *fpp* --> s.p. *fpp* (sim. ord. --> s.p.) *fpp*

Vla. *pp* gliss. *mf* *pp* --> s.p. ord. *fpp* --> s.p. ord. *fpp* --> s.p. *fpp* (sim. ord. --> s.p.) *fpp*

Vc. non vib. *pp* gliss. *mf* *pp* --> s.p. ord. *fpp* --> s.p. *fpp* (sim. ord. --> s.p.) *fpp*

Cb.

From OAs perspective, signals from TA appears to be redder and redder.

17

A. Fl.

Cl.

Vib.

Pno.

M-S.

Vln.

Vla.

Vc.

Cb.

pp

pp

p

pp una corde

(quick out-breathing)

pp *mf* *pp*

gliss.

Sta - i - he-he-he-he-he

fpp

arco ord. (not to s.p.)

arco ord. (not to s.p.)

arco ord. (not to s.p.)

ppp

21

B

A. Fl.

Cl.

Vib.

Pno.

M-S.

Vln.

Vla.

Vc.

Cb.

Shta - - i

(vib.)

p blend with pno.

p blend with vib.

Ped.

The pull is ever increasing, as does the redshift. Less and less signals reach OA.

25

A. Fl.

Cl.

Vib.

Pno.

M-S.

Vln.

Vla.

Vc.

Cb.

p

p *ppp*

mp *pp*

Ped.

flautando

ord.

fp

(*p*)

2+3

31

A. Fl.

Cl.

Bass Clarinet in B♭

Vib.

Pno.

M-S.

Vln.

Vla.

Vc.

Cb.

36

C

TA starts to realize she might be on a one-way ticked to a black hole

A. Fl.

B. Cl.

Vib.

Pno.

M-S.

Vln.

Vla.

Vc.

Cb.

(exact pitch is not important)
closed mouth
mm

like searching for the right starting pitch for the melody

In an attempt to stay calm, the TA hesitantly starts singing a simple tune

39

A. Fl.

B. Cl.

Vib.

Pno.

M-S.

Vln.

Vla.

Vc.

Cb.

Gradually slower

vib.

bend

(open mouth)

A - -

Gradually slower

vib.

43

Still slower…

… to ca. ♩ = 60

♩ = 92

D

A. Fl.

B. Cl.

Vib.

Pno.

M-S.

Vln.

Vla.

Vc.

Cb.

2+3

2+3

2+3

p dolce

mf

p

p dolce

p blend with vib. (arco)

pp < mf

p blend with vib. (arco)

(vib.)

arco

arco

To Glock.

p blend with b.cl.

p blend with b.cl.

mp

p

pp

mf

mp

Ped.

heavy breathing,
like being distressed

shta A - - - shta - - - var A - shta - ko

Still slower…

freely

… to ca. ♩ = 60

D

♩ = 92

s.t.

vib.

fz

pp

mp

s.t.

mp

s.t.

mp

pp

p

49

2+3

A. Fl.

B. Cl.

Vib.

Pno.

M-S.

Vln.

Vla.

Vc.

Cb.

mp

3

tr

3

bend down

pp

5

mp

p To Cl.

p pp

Glockenspiel

p

Ta - ki - de - be - ret

Ta - ki - de

s.t.
non vib.

p

fp

molto vib.

p pp

TA manages to momentarily let go of her circumstances while singing very calmly to herself.

55

Poco rit… **E** **A tempo** (♩ = 88)

A. Fl.

B. Cl.

Glock.

Pno.

M-S.

Vln.

Vla.

Vc.

Cb.

p *pp* *p* *pp* *mp threatening*

To Vib.

ppp

quasi glockenspiel

15ma

ppp very distant

p very calmly

- be-ret, ish - va - le - chen A - shta - ko Ta - ki - de - be - ret

arco ord.
vib.

p *pp*

Suddenly TA wakes up to her situation.

2+3

62

A few signals from TA reaches the observer. They appear as ever redder.

F

A. Fl.

tr

pp

p espressivo

pp

Clarinet in B♭

Cl.

mp

Vibraphone

Glock.

mp

fz

p (quasi ecco)

ppp

loco

(15)

Pno.

fz *p (quasi ecco)*

ppp

panicking

mp

f

Ped.

M-S.

Ta - ki - de - - - bret, ish - va - le - chen

F

Vln.

non vib.

Vla.

pp

s.t.

non vib.

p

ppp non vib.

arco ord. *pp*

pp

Vc.

pp

mp *pp*

Cb.

68

A. Fl.

Cl.

Vib.

Pno.

M-S.

Vln.

Vla.

Vc.

Cb.

exaggerate dynamics

exaggerate dynamics

To Crotales

exact pictes not important

quasi oscillation

very thin sound

Ish - va-len Æ

sempere s.t.

G

TA continues to rush towards the black hole at ever increasing speed.

74

A. Fl.

bend

p

Cl.

mf *pp*

mf *p*

mf

p *mf* *p* *f* *p*

Flt.

fp *ff*

Vib.

Pno.

M-S.

exaggerate dynamics

mp *f* *p*

GGre - di

mp

Ish - va - len si - mar - ze kor-shent

To Perc.

fp

Pshe

G

Vln.

Vla.

Vc.

very articulated, dark, threathening

pizz.

mp

very articulated, dark, threathening

Cb.

mp

79

A. Fl.

Flt.

f *fp* *pp* *ff* *p* *pp*

Cl.

mp *fp* *pp* *ffz* *p* *pp*

Vib.

Pno.

M-S.

fp *fp* *fp* *fp* *f*

GGe - - sha - var she - ra-na - ja - m - - -

(closed mouth)

Vln.

ord.

p *ffz* *p*

Vla.

ord.

p *ffz* *p*

Vc.

mf *p* *f* *p*

Cb.

mf *p* *f* *p*

2+3

H

To her astonishment, the TA notices that she can see the backside of her own head, as some of her signals orbit around the black hole.

83

A. Fl.

Cl.

Vib.

Crotales

Pno.

M-S.

Ach

Vln.

Vla.

arco

Vc.

Cb.

sul A

87

Poco accelerando...

A. Fl.

Cl.

Crot.

arco

arco sim.

Pno.

M-S.

(open mouth)

M - ach

Me - i

Mech

Vln.

Vla.

Vc.

Cb.

ord.

s.p.

molto s.t.

sul G

92

At the same time the pull is quickly increasing to levels of extreme pain.

A. Fl.

Cl.

Crot.

Pno.

M-S.

Shtech Shtö Blö Shte GGi Chi-

Vln.

Vla.

Vc.

Cb.

bend

airy

s.t.

ord.

s.p.

sul A

sul G

ord. sul D

gliss.

97

I

♩ = 105 - violently

A. Fl.

Cl.

Crot.

Pno.

M-S.

Vln.

Vla.

Vc.

Cb.

airy

flt.

To Fl.

ord.

To Vib.

(heavy inbreath)

scream

I

Sh

Æ

ShGGræ!

arco ord.

marcato

molto s.p.

s.p.

sul G

pizz.

legato

The TAs spinal chord is torn.
Spaghettification takes place.

Flute

101

A. Fl.

Cl.

f

Flt.

Crot.

Vibraphone

mp *distant, just audible*

Pno.

M-S.

Vln.

Vla.

Vc.

Cb.

arco ord.
marcato

pizz.

arco

fffz

f

104

Flt.

25

Fl.

Cl.

Flt.

Vib.

Pno.

ff

8va

M-S.

Vln.

pizz.

arco

Vla.

ffz

f

arco

Vc.

f

pizz.

arco

Cb.

ffz

f

106

Fl.

Cl.

Vib.

Pno.

M-S.

Vln.

Vla.

Vc.

Cb.

Flt.

fff

Flt.

ff

8va

109

J

Fl.

Cl.

Vib.

Pno.

M-S.

Vln.

Vla.

Vc.

Cb.

To OA however everything seems
to happen at ever slower speed.

112

Fl.

Cl.

Vib.

Pno.

M-S.

Vln.

Vla.

Vc.

Cb.

115

Fl.

Cl.

Vib.

Pno.

M-S.

Vln.

Vla.

Vc.

Cb.

119

To A. Fl.

Fl.

Cl.

Vib.

Pno.

M-S.

Vln.

Vla.

Vc.

Cb.

Flt.

s.p.

124 **K** ♩ = 50

Only a few signals can reach OA. From OAs point of view, TA moves towards the black hole at ever slowing speed, without ever reaching it.

Alto Flute

Fl.

Cl.

ppp

ppp

ppp

Vib.

(8)

Pno.

l.v.

distant signals

mp

una corde

pp

p

pedal sim.

M-S.

K ♩ = 50

non vib.

Vln.

ppp *pp*

distant signals

molto s.p. molto ad lib. (slow -> fast -> slow)

ppp

flickering *p* *ppp*

non vib.

Vla.

ppp *pp*

distant signals

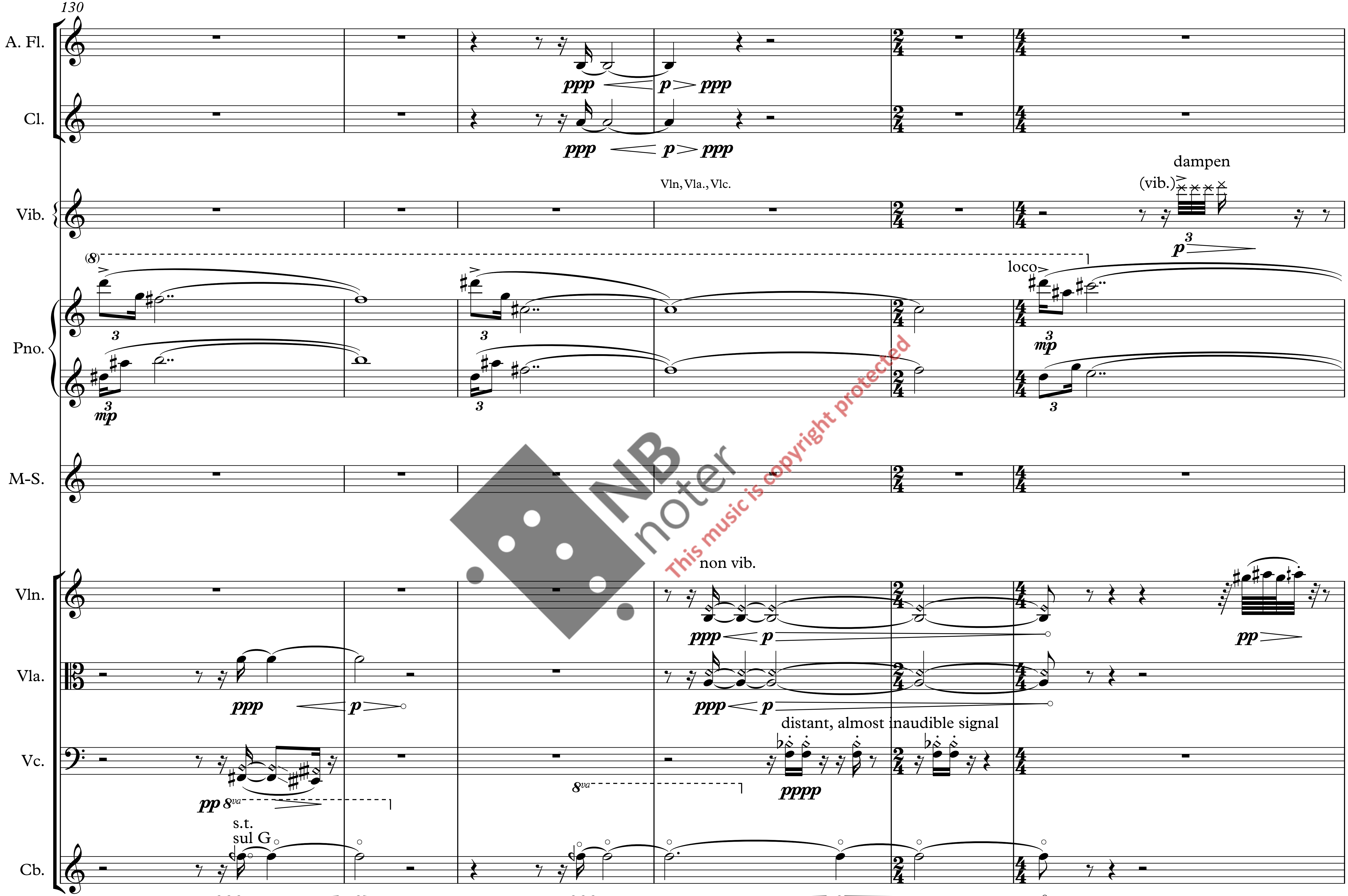
non vib.

Vc.

ppp *pp*

distant signals

Cb.


130
A. Fl.
Cl.
Vib.
Pno.
M-S.
Vln.
Vla.
Vc.
Cb.
Vln, Vla., Vlc.
dampen
(vib.)
loco
non vib.
distant, almost inaudible signal
s.t.
sul G
NB noter
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136

A. Fl.

Cl.

Vib.

Pno.

M-S.

Vln.

Vla.

Vc.

Cb.

ppp

ppp

p

3

8va

pp

3

5

mp

3

Ped.

molto s.p.

as before, but slower

ppp

p

ppp

flickering

pp

ppp

p

ppp

p

sul D

ppp

p

144

A. Fl.

Cl.

Vib.

Pno.

M-S.

Vln.

Vla.

Vc.

Cb.

pp mp pp

To B. Cl.

pp mp pp

Vibraphone
arco

p pp

(8)

p 3

mf p

8va

3

ord.

p ord.

p

ppp

s.p.

pp 3 mp pp

3 3 3 3 3 3

s.p.

pp 3 3 3 mp 3 3 3 pp

150

A. Fl.

Cl.

Vib.

Pno.

M-S.

Vln.

Vla.

Vc.

Cb.

airy

pp ppp

pp mp ppp

ppp mp ppp

dampen

To Crot.

p p

like a distant signal

(8)

pp

p

ord.

sul A

s.p.

ppp mp p

mp

2+2+3

158

A. Fl.

Cl.

Vib.

ppp

Crotales
arco

ppp

Pno.

(8)

pp

3

ppp

M-S.

Vln.

ord.

pp mp

ord.

ppp

gliss.
gliss.

Vla.

ord.

pp mp

ord.

ppp

Vc.

ord.

ppp

Cb.

sul D

pp mp

sul D

ppp