

Vegar Guleng

# Crossing the Event Horizon



NB  
noter

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## About the piece

### 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**

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 atoms. 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.

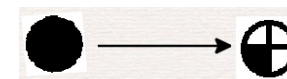
### **Mezzo-soprano:**

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 exaggerated, especially when the dynamic is loud. The result should be a very intense and almost unpleasant "scraping sound". In order to destingvish it effectively from other sounds, I use "GG" to refer to this sound.

The third one is  $\text{Æ}/\text{æ}$ , 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

The musical score is arranged in a multi-staff format. The top section includes:

- Alto Flute** and **Clarinet in Bb**: Both play a melodic line starting with a 7-measure phrase, marked *mp* and *p*.
- Vibraphone**: Plays a glissando effect, marked *pp*.
- Piano**: Plays a 7-measure phrase, marked *mp* and *p*.
- Mezzo-soprano**: The staff is mostly empty, with the instruction "hold pedal, release slowly, by ear after a few bars" written above it.

The bottom section features the string ensemble:

- Violin I**, **Viola**, **Violoncello**, and **Contrabass**: All play a similar melodic line with dynamic markings *pp*, *fpp*, and *ord.* (ordinando). The Violin I part includes the instruction "--> s.p." (sostenuto).

A large watermark "NB noter" and "This music is copyright protected" is overlaid diagonally across the score.

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.

M-S.

Vln.

Vla.

Vc.

Cb.

pp

mf

p

pp

pp

mf

p

pp

pp

mf

fpp

mf

pp

mf

ppp

una corda  
with ped.

a sigh into the void

ord.

s.p.

gliss.

**A** TA continues falling at an ever faster speed.

12

A. Fl. *mf p*

Cl. *mf p*

Vib.

Pno. *pp*  
 hold pedal, release slowly by ear after a few bars

M-S.

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

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

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

Cb.

gliss.

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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

*mf*

*pp*

(quick out-breathing)

gliss.

Sta - i - he-he-he - he

*fpp*

*fpp*

*fpp*

*fpp*

*fpp*

arco ord. (not to s.p.)

arco ord. (not to s.p.)

arco ord. (not to s.p.)

*ppp*

**B**

21

A. Fl. *mf p* *pp mf p*

Cl. *mf p* *pp mf p*

Vib. *p blend with pno.* (vib.) 3

Pno. *mp p blend with vib.* 7 3 7 3 5 7 3 3 5 5 5 *Ped.*

M-S. *fpp mf* Shta i

Vln. *pp mf p* *gliss.*

Vla. *pp mf p* *gliss.*

Vc. *pp mf p* *gliss.*

Cb. *pp mf p*

**B**







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

C

36

A. Fl.

B. Cl.

Vib.

Pno.

M-S.

Vln.

Vla.

Vc.

Cb.

*p*  $\rightarrow$  *ppp*

*fp*  $\rightarrow$  *fp*

*mf*

*mp*

*f*

*f*

*f*

*f*

7

7

7

7

3

3

3

3

tr<sup>#</sup>

8<sup>vb</sup>

mm

(exact pitch is not important)  
closed mouth

like searching for the right starting pitch for the melody

C

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

**Gradually slower**

A. Fl. *mp*

B. Cl. *mf* *p*

Vib.

Pno. *mp* *p*

M-S. *mf* (open mouth)  
A - - -

**Gradually slower**

Vln.

Vla. *p*

Vc. *mf* *p*

Cb. *pp*

Still slower...

... to ca. ♩ = 60

♩ = 92

43 **2+3**

**A. Fl.** *p dolce* *mf* *p* **2+3** *p dolce*

**B. Cl.** *p blend with vib. (arco)* *(vib.) arco* *pp < mf* *p blend with vib. (arco)*

**Vib.** *p blend with b.cl.* *arco* *To Glock.* *p blend with b.cl.*

**Pno.** *mp* *p* *pp* *mp* *3* *Ped.*

**M-S.** heavy breathing, like being distressed  
shta A - - - shta - - - var A - shta - ko

**Vln.** *fz* *pp* *freely* *... to ca. ♩ = 60* **D** *mp* *s.t.*

**Vla.** *vib.* *mp* *s.t.*

**Vc.** *pp* *mp*

**Cb.** *p*

49

2+3

A. Fl. *mp* *pp* *mp* *p* To Cl.

B. Cl. *p* *pp*

Vib. Glockenspiel *p*

Pno.

M-S. Ta - ki - de - be - ret. Ta - ki - de

Vln. *p* *fp*

Vla. *p* *pp* *p* *fp*

Vc. *p* *pp* *p* *fp*

Cb.

*tr* *bend down*

*s.t. non vib.*

*molto vib.*

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

*3* *tr* *3* *5*

*3* *3* *3* *5*

*bend down*

*To Cl.*

*Glockenspiel*

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

*s.t. non vib.*

*molto vib.*

*p* *pp* *p* *fp*

*3* *tr* *3* *5*

*3* *3* *3* *5*

*bend down*

*To Cl.*



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

Poco rit...

**E** A tempo (♩ = 88)

A. Fl. 55

B. Cl.

Glock.

To Vib.

ppp quasi glockenspiel  
15<sup>ma</sup>

Pno.

ppp very distant

M-S.

*p* very calmly

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

Poco rit...

**E** A tempo (♩ = 88)

Vln.

Vla.

Vc.

Cb.

arco ord. vib. pp

arco ord. vib. p pp

pp

Suddenly TA wakes up to her situation.

2+3

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

62

A. Fl. *tr* *pp* *p espressivo* *pp*

Cl. Clarinet in Bb *mp*

Glock. *mp* *fz* *p (quasi ecco)* *ppp*

Pno. (15) *fz* *p (quasi ecco)* *ppp*

M-S. *mp* *panicking* *f*  
 Ta - ki - de - - - bret, ish - va - le - chen

Vln. *pp* *p* *ppp non vib.* *pp* *non vib.*

Vla. *pp* *p* *ppp non vib.* *pp* *arco ord. pp*

Vc. *pp* *mp* *pp*

Cb. *pp* *mp* *pp*

**F**



68

A. Fl.

Cl.

Vib.

Pno.

*pp*

*mf*

*mp*

*pp*

*f*

*ppp*

*fz*

*ppp*

8va

Red.

To Crotales

exact picles not important

quasi oscillation

*pp* very thin sound

*p*

*pp*

*p*

*ppp*

3

7

Ish - va-len Æ

Vln.

Vla.

Vc.

Cb.

*mp*

*pp*

*p*

*ppp*

*pp*

*mp*

*pp*

*pp*

*pp*

*mp*

*pp*

sempere s.t.

G

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

74 bend

A. Fl. *p* *mf* *p* *mf* *fp*

Cl. *mf* *pp* *p* *mf* *p* *f* *p* *ff*

Vib.

Pno.

M-S. *mp* *f* *p* *mp* *f* *To Perc.* *fp*

GGre - di Ish - va - len\_ si - mar - ze\_ kor-shent Pshe

Vln.

Vla.

Vc. *mp* very articulated, dark, threatening

Cb. *mp*

Flt. 15

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79

Flt.

A. Fl.

Cl.

Vib.

Pno.

M-S.

Vln.

Vla.

Vc.

Cb.

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

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

*fp* *fp* *fp* *fp* *f* *3* (closed mouth)

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

ord. *p* *ffz* *p*

ord. *p* *ffz* *p*

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

*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. *f sub.*  $\langle$  *ff*  $\rangle$  *p* *mf* *pp*

Cl. *f sub.*  $\langle$  *ff*  $\rangle$  *p* *mf* *p* *pp*

Vib. Crotales

Pno.

M-S. *p* *ppp* *mf*  
Ach

Vln. *f*  $\langle$  *ffz*  $\rangle$  *fz* *p* *fz* *p* *ord.* *p* *s.p.* *pp*

Vla. *f*  $\langle$  *ffz*  $\rangle$  *fz* *p* *fz* *p* *p*

Vc. *f sub.* *p sub.* *ppp* *p* *arco* *arco s.p.* *pp* *sul A.*

Cb. *f sub.* *p sub.* *ppp* *p*

Poco accelerando...

87

A. Fl. *pp* *p* *pp* *p* *pp* *p* *pp*

Cl. *pp* *p* *pp* *p* *pp* *p* *pp*

Crot. arco *pp* arco sim.

Pno.

M-S. *mp* (open mouth) *mp* *mp* *mp*  
 M - ach Me Mech

Vln. *p* *pp* *p* *pp* *p* *pp* *p* *pp*  
 ord. → s.p. s.p. molto s.t. ord.

Vla. *p* *p* *p* *p* *p* *p* *p* *p*  
 ord. → s.p. ord. → s.p.

Vc. *p* *pp* *p* *p* *p* *p* *p* *p*  
 ord. s.p. → ord. s.p. → ord. ord.

Cb. *pp* *p* *p* *p* *p* *p* *p* *p*  
 sul G *8va*

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

92

A. Fl. *p* *pp* *p* *pp* *p* *mp* *p* *mp* *p*

Cl. *p* *pp* *p* *pp* *p* *mp* *p* *mp* *p* *mf*

Crot. *p* *pp* *p* *pp* *p* *mp* *p* *mp* *p* *mp*

Pno.

M-S. *mp* *mp* *p* *mf* *mf* *f*

Shtech Shtö Blö Shte GGi Chi.

Vln. *p* *p* *p* *mp* *mf* *p*

Vla. *p* *p* *p* *mp* *mf*

Vc. *p* *p* *p* *mp* *mf*

Cb. *p* *p* *p* *mp* *mf*

*s.t.* *ord.* *s.p.* *sul A* *sul G* *s.p.* *ord. sul D*

*gliss.*

*bend* *airy*

*5*

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I

To Fl.

97

A. Fl. *mf* *p < mf* *mp < f* *mp < f* *ff*

Cl. *p < mf* *mp < f* *mp < f* *ff* *f* *ord. 5* *5* *5*

Crot. *p < mf* *mp < f* *pp* *f* *To Vib.*

Pno. *fffz* *f legato*

M-S. *mf* *ff* *gliss.* (heavy inbreath) *scream fff*

Vln. *mf* *mp < f* *mp < f* *f* *mf < ff* *f* *arco ord. marcato* *5* *5* *5*

Vla. *p < mf* *mp < f* *mp < f* *f* *mf < ff* *f* *marcato*

Vc. *p < mf* *mp < f* *mp < f* *f* *fff* *pizz.*

Cb. *p < mf* *mp < f* *mp < f* *f* *fff* *pizz.*

*8va* *8vb* *s.p.* *sul G*

Sh *I* *Sh* *Æ* *ShGGræ!*

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The TAs spinal chord is torn.  
Spaghetification takes place.

Flute

Musical score for various instruments including A. Fl., Cl., Crot., Pno., M-S., Vln., Vla., Vc., and Cb. The score includes dynamic markings such as *f*, *mp*, *ffz*, and articulation instructions like *pizz.*, *arco*, and *arco ord. marcato*. The score is marked with the number 101 at the beginning and features a large watermark reading "NB noter This music is copyright protected".

**A. Fl.:** Starts at measure 101 with a treble clef. The staff contains a melodic line with many slurs and ties, including a *f* dynamic marking.

**Cl.:** Treble clef. Features a complex melodic line with many slurs and ties, similar to the flute part.

**Crot.:** Treble clef. Shows a rest for the first two measures, then a vibraphone part with a *mp* dynamic and triplet markings (*mp distant, just audible*).

**Pno.:** Grand staff. Features a rhythmic accompaniment with many slurs and ties.

**M-S.:** Treble clef. Shows a rest for the first two measures.

**Vln.:** Treble clef. Features a melodic line with many slurs and ties, including a *pizz.* marking.

**Vla.:** Bass clef. Features a melodic line with many slurs and ties, including a *pizz.* marking.

**Vc.:** Bass clef. Features a melodic line with many slurs and ties, including a *f* dynamic marking.

**Cb.:** Bass clef. Shows a rest for the first two measures, then a melodic line with triplet markings and a *f* dynamic marking.



104 25

Fl. Flt.

Cl. Flt.

Vib.

Pno. *ff* *8va*

M-S.

Vln. *f* *ffz* *f*

Vla. *pizz.* *arco*

Vc. *f* *pizz.* *arco*

Cb. *ffz* *f*

106

Fl. *5* *5* *5* *5* *5* *5* *5* *5* *5* *5* *5* *ff* *Flt.*

Cl. *7* *5* *3* *3* *3* *ff* *Flt.*

Vib. *3* *3* *3* *3*

Pno. *(8)* *3* *3* *3* *3* *3* *3* *3* *3* *3* *5* *8va*

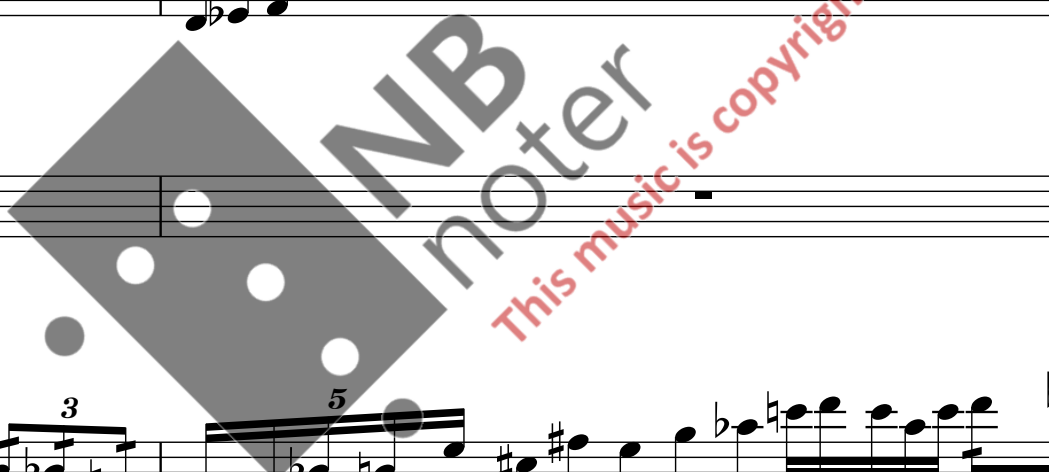
M-S.

Vln. *5* *5* *3* *3* *5* *5* *3* *3* *3* *3* *3* *5*

Vla.

Vc.

Cb. *3* *3* *3* *3* *3* *3* *3* *3* *3* *3* *3*



J

109

Fl. *f* 5 5 5 5 *mp* *fz* 5

Cl. *f* 3 3

Vib. 3 3

Pno. *mf*

M-S.

Vln. 5 5 5 5 *fff* *f* 3 5 *p*

Vla. *fff* *f* 5 *p*

Vc. 3 3 3 3 5

Cb. 3 3 3 3 3 3 3 3

This image shows a page of a musical score for page 27, starting at measure 109. The score is for a full orchestra and includes parts for Flute (Fl.), Clarinet (Cl.), Vibraphone (Vib.), Piano (Pno.), M-S. (Mellophone/Saxophone), Violin (Vln.), Viola (Vla.), Violoncello (Vc.), and Contrabass (Cb.). The Flute part features a melodic line with a dynamic range from *f* to *fz*. The Clarinet and Vibraphone parts play rhythmic patterns with triplets. The Violin and Viola parts have complex rhythmic figures with dynamics ranging from *fff* to *p*. The Violoncello and Contrabass parts play steady rhythmic patterns with triplets. A large watermark 'NB noter' is overlaid on the score, and a red diagonal watermark 'This music is copyright protected' is also present. A 'J' marking is placed above the first measure of the Flute part.

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

112

Fl. *mp* 5 5 5 *fz* 5 5 5 *mp* *p*

Cl. *mp* *fz* *mp* 5 5 *p*

Vib.

Pno. *p* *8va*

M-S.

Vln. *ppp* *p*

Vla. *ppp* *p*

Vc. *mp* 3 3 3 5

Cb. *mp* 3 3 *p* *f* 3 3





119 To A. Fl.

Fl. *> ppp*

Cl. *mp* *pp* Flt.

Vib.

Pno. (8) *3*

M-S.

Vln. *ppp* *p*

Vla. *ppp* *p*

Vc. *5* *pp* *3* *3* *3* *3* *ppp*

Cb. *3* *3* *3* *3* *p* *s.p.* *3* *ppp*

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.

124 **K** ♩ = 50

Alto Flute

Fl. *ppp*

Cl. *ppp* *ppp* *ppp*

Vib.

Pno. *mp* *pp* *p*

una corde

pedal sim.

*distant signals*

l.v.

6

M-S.

**K** ♩ = 50

Vln. *ppp* *pp* *ppp* *flickering* *p* *ppp*

*distant signals*

*non vib.*

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

Vla. *ppp* *pp*

*distant signals*

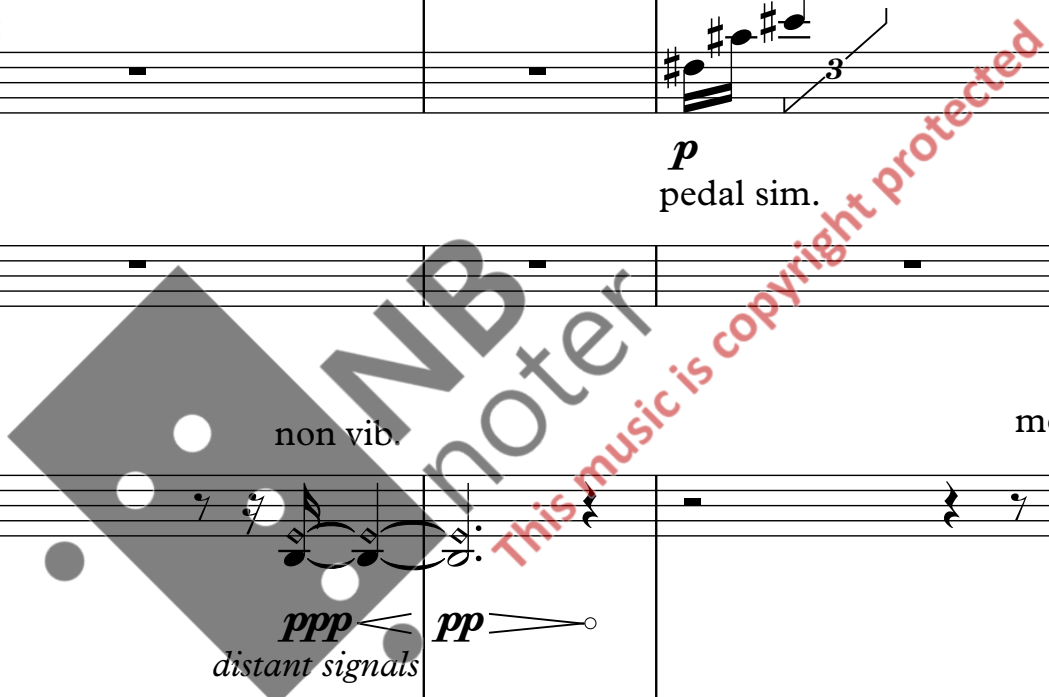
*non vib.*

Vc. *ppp* *pp*

*distant signals*

*non vib.*

Cb.



130

A. Fl.

Cl.

Vib.

Pno.

M-S.

Vln.

Vla.

Vc.

Cb.

*ppp*  $\leftarrow$  *p*  $\rightarrow$  *ppp*

*ppp*  $\leftarrow$  *p*  $\rightarrow$  *ppp*

Vln, Vla., Vlc.

dampen (vib.)

*p*<sup>3</sup>

loco

*mp*

*mp*

non vib.

*ppp*  $\leftarrow$  *p*

*ppp*  $\leftarrow$  *p*

distant, almost inaudible signal

*pp* <sup>8va</sup>

*pppp*

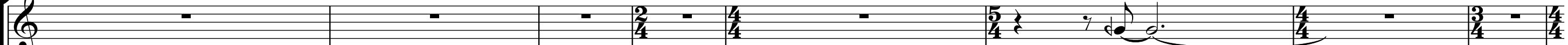
s.t. sul G.

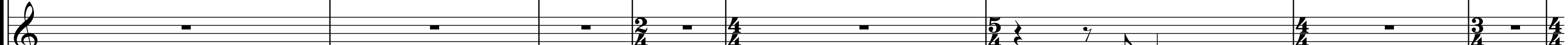
*ppp*  $\leftarrow$  *p*


*ppp*  $\leftarrow$  *p*





136


A. Fl.  *ppp*

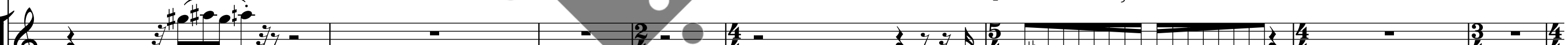
Cl.  *ppp*


Vib.  *p*<sup>3</sup>


Pno.  *pp* *mp* *Ped.*<sup>3</sup>

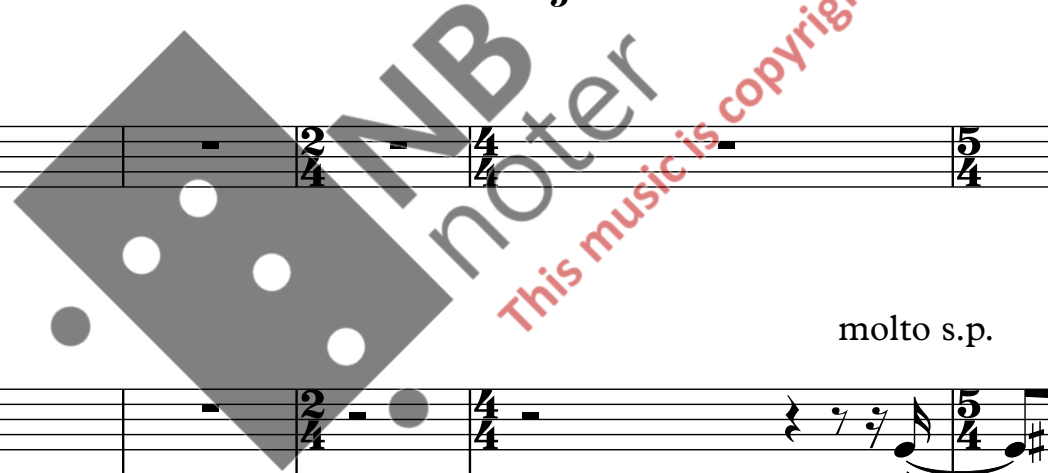
M-S. 

Vln.  *pp* *molto s.p. as before, but slower* *ppp* *flickering* *p* *ppp*

Vla.  *ppp* *p*

Vc.  *ppp* *p*

Cb.  *ppp* *p*



144

A. Fl. *pp* *mp* *pp*  
To B. Cl.

Cl. *pp* *mp* *pp*  
Vibraphone arco

Vib. *p* *pp*

Pno. *p*<sup>3</sup> *mf p*  
8va

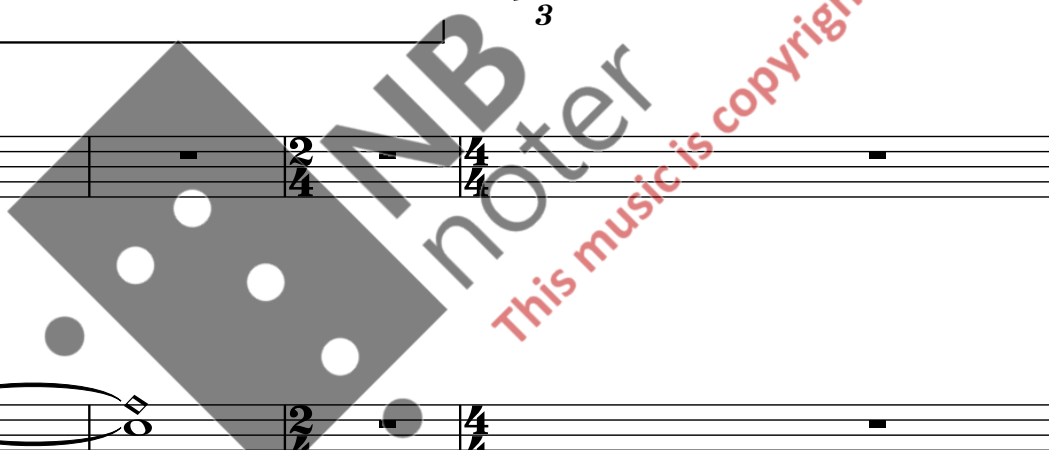
M-S.

Vln. ord. *p* ord. *ppp* s.p. 3 3 3 3 3  
*pp* *mp*

Vla. *p* *ppp* s.p. *pp*<sup>3</sup> *mp*<sup>3</sup> *pp*<sup>3</sup>

Vc. *p* *ppp* s.p. *pp*<sup>3</sup> *mp*<sup>3</sup> *pp*<sup>3</sup>

Cb.



150

airy

A. Fl.

Cl.

Vib.

Pno.

M-S.

Vln.

Vla.

Vc.

Cb.

*pp* *> ppp*

*pp* *mp* *ppp*

*ppp* *mp* *ppp*

dampen

To Crot.

*p*<sup>3</sup> *p*<sup>3</sup>

like a distant signal

*pp* *p*

*pp* *mp* *p*

*ppp* *mp*

ord.

sul A

*pp* *> ppp*

*pp* *> ppp*

s.p.

*ppp* *mp*

s.p.

*ppp* *mp* *p*

s.p.

*ppp* *mp*

