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String Qua(antum)rtet

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Publication Date

2020

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Emiliano Imondi

String Qua(antum)rtet

per Quartetto d'Archi

for String Quartet

(Liberamente ispirato al mondo della Fisica Quantistica)

Freely inspired to the world of Quantum Physics

NOTA DI PROGRAMMA

La composizione è liberamente ispirata al mondo e ai concetti della fisica quantistica in generale e della meccanica quantistica in particolare. Questi principi oltre a ridisegnare la scienza del nostro tempo hanno modellato il pensiero filosofico della società moderna. Il brano è diviso in 9 momenti liberamente correlati alle leggi fondamentali (equazioni matematiche) e al loro contenuto filosofico:

I. Chi Lancia i Dadi?: riferito alla natura probabilistica del mondo quantistico in cui non sempre vale la legge di causa-effetto.

II. Sovrapposizione I: se un sistema può trovarsi in due stati distinti, può trovarsi anche in una qualsiasi loro combinazione lineare (sovrapposizione).

III. Il Paradosso del Gatto: ispirato al paradosso del "Gatto di Schrodinger", un esperimento mentale ideato da Erwin Schrodinger che mette in luce come la natura probabilistica della realtà quantistica e il principio di sovrapposizione portino a manifestazioni bizzarre nella realtà in cui il gatto può essere morto e vivo allo stesso tempo.

IV. L'entanglement e le sue Inquietanti Azioni a Distanza: riferito alla famosa frase di Einstein sullo strano fenomeno della correlazione quantistica in cui due sistemi possono essere "intrecciati" e interagire anche a grande distanza in modo istantaneo violando apparentemente il principio per cui la velocità della luce non può essere superata.

V. Sovrapposizione II: come Sovrapposizione I.

VI. Onde Probabilistiche: ispirato all'equazione di Schrodinger che governa la dinamica (l'evoluzione nel tempo) dei sistemi quantistici definendone le caratteristiche (funzione d'onda) mediante leggi probabilistiche.

VII. Una Strana Dualità: basato sullo strano comportamento ondulatorio-corpuscolare delle particelle elementari espresso dalla legge di De Broglie.

VIII. Figure di Interferenza: rappresentazione musicale del famoso "esperimento della doppia fenditura" che all'inizio del '900 diede il via alla meccanica quantistica facendo scoprire la doppia natura delle particelle subatomiche che al tempo stesso si comportano come onde e come corpuscoli.

IX. Relazioni di Indeterminazione: una mia personale trasposizione musicale del famoso "Principio di Indeterminazione di Heisenberg" che incrinò il sistema scientifico e le sue basi filosofiche mettendo in luce i limiti della fisica dimostrando che è impossibile conoscere contemporaneamente per una particella sia la sua posizione che la sua velocità oppure la sua energia e la sua durata.

PROGRAM NOTE

The piece is freely inspired by the world and concepts of quantum physics in general and quantum mechanic in particular. These concepts, besides redesigning the science of our time, have shaped the philosophical thought of modern society. The piece is divided into 9 moments freely inspired by the fundamental laws (mathematical equations) and their philosophical content:

I. Who Rolls the Dice?: referred to the probabilistic nature of the quantum world in which the law of cause and effect is not always valid.

II. Superimposition I: if a system can be in two distinct states, it can also be in any linear combination of the two states.

III. The Cat's Paradox: inspired by the conceptual experiment of "Schrodinger Cat" which highlights how the probabilistic nature of quantum reality and the principle of superimposition lead to bizarre manifestations in macroscopical world in which the cat can be dead and alive at the same time.

IV. Entanglement and its Spooky Actions at a Distance: referring to Einstein's famous phrase about the strange phenomenon of quantum correlation in which two systems can be "intertwined" and interact even at great distance in an instantaneous way apparently violating the principle that the speed of light can not be overcome.

V. Superimposition II: same as Superimposition I

VI. Probabilistic Waves: inspired by the Schrodinger equation that governs the dynamics (the time evolution) of quantum systems by defining their characteristics (wave function) through probabilistic laws.

VII. A strange Duality: based on the strange wave-corpuseular behavior of the elementary particles expressed by De Broglie's law.

VIII. Interference Figures: my musical representation of the famous "double-slit experiment" which, at the beginning of '900, has started the quantum mechanics making discover the double nature of subatomic particles that at the same time behave like waves and like corpuscles.

IX. Uncertainty Relations: my personal musical transposition of the famous "Heisenberg's Uncertainty Principle" which cracked the scientific system and its philosophical bases highlighting the limits of physics showing that it is impossible to know, at the same time for a particle, both its position and its speed or its energy and its duration.

Legenda



1/4 bemolle
1/4 flat



3/4 bemolle
3/4 flat



1/4 diesis
1/4 sharp



3/4 diesis
3/4 sharp

tasto → pont. → ord.

Muovere l'arco gradualmente dalla tastiera al ponticello e verso la posizione ordinaria

Gradually move the bow from the fingerboard to bridge and to the ordinary position



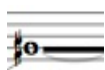
Bartók Pizzicato (Snap)



Accelerando/Ritardando gradualmente e liberamente
Freely and Gradually Accelerando/Ritardando



Tremolo libero non misurato
Not measured Tremolo



Prolungare il suono per tutta la durata del tratto di unione
Keep the sound for the entire duration of the line

String Qua(antum)rtet

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I. Chi Lancia i Dadi?

I. Who Rolls the Dice?

Emiliano Imondi 2018

Moderato e Deciso ♩=100 c.ca

Violino I

Violino II

Viola

Violoncello

fff pizz. arco *pp*

fff pizz.

fff *sf* *pp* *p* *ff*

fff *sf* *pp* *p* *ff*

Synchronicity between viola and cello is not required

5

5

Vln. I

Vln. II

Vla.

Vc.

2

arco *mf*

mf espress. *p* *mf* 3

p arco *gliss.*

p

4

Vln. I *pp* *f subito* *f*

Vln. II *fff* *mp*

Vla. *ff* *pp*

Vc. *ff* *ppp*

pont.

7

Vln. I *mf* *pp subito* *f* *pp* *ff* *fff*

Vln. II *f* *pp* *f* *pp* *ff* *fff*

Vla. *pp* *f subito* *ff* *pizz.* *sf* *fff*

Vc. *f* *ff* *sf* *fff*

pont.

pizz.

ord. arco

arco

9

Vln. I *ppp* *p* *mp*

Vln. II *pp* *mp*

Vla. *ppp* *p* *mp*

Vc. *ppp* *p* *mp*

sul pont.

glissando

(simile)

gliss.

14 *accel.*

Vln. I

Vln. II *mf*

Vla.

Vc.

fff

fff

fff

fff

II. Sovrapposizione I

II. Superimposition I

$$\psi = c_1\psi_1 + c_2\psi_2$$

Teso e Misterioso $\text{♩} = 95$

18

Vln. I

Vln. II *pizz.*

Vla. *pizz.* *p* *gliss.*

Vc. *pizz.* *p* *gliss.* *gliss.*

p

p

23

Vln. I

Vln. II *gliss.* *p*

Vla. *p*

Vc. *arco* *pp* *ord.* *mp* *pont.* *pizz.* *gliss.* *p*

27 *glissando*

Vln. I *IV* *III* *9* *mf* *pp subito* *arco glissando* *mf* *pizz.* *mf*

Vln. II *p* *mf* *pp* *arco pont.*

Vla. *arco* *ppp* *pizz. bartok* *arco* *mf* *pp*

Vc. *pizz. bartok* *arco* *pont.* *pp*

30 *pont. arco*

Vln. I *p*

Vln. II *pizz.* *mp*

Vla. *pont.* *port.* *pp* *sfp* *f* *p* *mp*

Vc. *mp* *sfp* *f* *pizz.* *sfp* *p* *3*

33 *pizz.*

Vln. I *ppp* *mp*

Vln. II *mf* *mp*

Vla. *mf* *mp* *gliss.*

Vc. *mp* *gliss.* *mp*

III. Il Paradosso del Gatto

III. The Cat's Paradox

$$|Gatto\rangle = \frac{1}{\sqrt{2}}(|Morto\rangle + |Vivo\rangle)$$

$$|Cat\rangle = \frac{1}{\sqrt{2}}(|Dead\rangle + |Live\rangle)$$

Moderato, Molto Ritmico e Ironico

$\text{♩} = 100 \text{ c.ca}$

37

Vln. I *mp*

Vln. II

Vla. *mp*

Vc. *mp*

41

Vln. I

Vln. II

Vla.

Vc.

45

Vln. I

Vln. II

Vla.

Vc.

48

Vln. I

Vln. II

Vla.

Vc.

51

Vln. I

Vln. II

Vla.

Vc.

sf sf mp

sf sf mp f

sf sf mp f

sf sf mp

56

Vln. I

Vln. II

Vla.

Vc.

f

ff ff mf

ff ff mf

f mf

59

59

Vln. I *f* *ff* *gliss.*

Vln. II *f* *ff* *gliss.*

Vla. *ff* *ff* *gliss.*

Vc. *ff* *f* *ff*

Measures 59-60. Vln. I: 6/4 to 5/4 to 4/4. Vln. II: 6/4 to 5/4 to 4/4. Vla.: 6/4 to 5/4 to 4/4. Vc.: 6/4 to 5/4 to 4/4. Dynamics: *f*, *ff*, *f*, *ff*. Includes glissando markings.



61

61

Vln. I *mp* *gliss.*

Vln. II *mp* *gliss.*

Vla. *mp* *gliss.*

Vc. *f* *mp*

Measures 61-64. Vln. I: 4/4. Vln. II: 4/4. Vla.: 4/4. Vc.: 4/4. Dynamics: *mp*, *f*, *mp*. Includes glissando markings.



65

65

Vln. I

Vln. II

Vla.

Vc.

Measures 65-68. Vln. I: 4/4. Vln. II: 4/4. Vla.: 4/4. Vc.: 4/4.

68

Vln. I

Vln. II

Vla. *arco*
mp espress.

Vc. *p*

72

Vln. I

Vln. II

Vla. *pizz.*

Vc. *p*

76

Vln. I

Vln. II

Vla.

Vc.

80

Vln. I *mf*

Vln. II *mf*

Vla. *mf*

Vc. *mf*

7/8

7/8

7/8

7/8

Detailed description: This system contains measures 80, 81, and 82. The first violin part (Vln. I) starts with a mezzo-forte (*mf*) dynamic and features a melodic line with accents and a crescendo to forte (*f*) in measure 82. The second violin part (Vln. II) mirrors the first violin's dynamics. The viola part (Vla.) and cello part (Vc.) play a rhythmic accompaniment of eighth notes, also starting at *mf*. The time signature is 7/8.



83

Vln. I

Vln. II *gliss.*

Vla.

Vc.

7/8

7/8

7/8

7/8

5/4

5/4

5/4

5/4

Detailed description: This system contains measures 83, 84, and 85. The first violin part (Vln. I) continues with eighth notes. The second violin part (Vln. II) has a glissando (*gliss.*) in measure 83. The viola part (Vla.) and cello part (Vc.) continue with eighth notes. The time signature changes from 7/8 to 5/4 between measures 83 and 84.



85

Vln. I *sf* *p* col legno battuto

Vln. II *sf* *p* col legno battuto

Vla. *sf* *p* col legno battuto

Vc. *sf* *p* arco

5/4

5/4

5/4

5/4

Detailed description: This system contains measures 85, 86, and 87. The first three measures (85-87) are in 5/4 time. The first violin part (Vln. I) has a sforzando (*sf*) in measure 85 and then plays *p* with col legno battuto. The second violin part (Vln. II) also has *sf* in measure 85 and plays *p* with col legno battuto. The viola part (Vla.) has *sf* in measure 85 and plays *p* with col legno battuto. The cello part (Vc.) has *sf* in measure 85 and plays *p* with arco. The time signature changes to 4/4 for measures 86 and 87.

88

Vln. I

Vln. II

Vla. arco *p*

Vc. *p*

90

Vln. I arco *mp*

Vln. II

Vla. *mp* *pp* *mp* col legno battuto

Vc. *mp*

92

Vln. I *mp*

Vln. II *f*

Vla. *f* gliss

Vc. *mp*

94

Vln. I
Vln. II
Vla.
Vc.

mp *f*

3 gliss. 3 3 3

Detailed description: This system covers measures 94 and 95. It features four staves: Violin I, Violin II, Viola, and Violoncello. Measure 94 starts with a dynamic of *mp* and contains several triplet markings (3). Measure 95 begins with a dynamic of *f* and includes a glissando marking (gliss.) in the Violin II and Viola parts.



96

Vln. I
Vln. II
Vla.
Vc.

arco

3 3 3 3 3

Detailed description: This system covers measures 96 and 97. It features four staves: Violin I, Violin II, Viola, and Violoncello. Measure 96 contains triplet markings (3). Measure 97 includes an *arco* marking in the Violin II and Viola parts, along with triplet markings (3).



98

ord. pont. *gliss.* *mf* *pp*

Vln. I

p *mf* *pp*

Vln. II

ord. pont. *gliss.* *pp*

Vla.

pizz. arco *mf* *pp* pizz. *p*

Vc.

ord. pont. *mf* *pp* *p*

p *mf* *pp* *p*

accel..

3 6 3 6 3

Detailed description: This system covers measures 98 and 99. It features four staves: Violin I, Violin II, Viola, and Violoncello. Measure 98 includes dynamic markings *p*, *mf*, and *pp*, and performance instructions like *ord.* (order) and *pont.* (ponticello). Measure 99 includes an *accel.* (accelerando) marking and further dynamic markings. Triplet markings (3) and sextuplet markings (6) are present throughout the system.

100 $\text{♩} = 90$

Vln. I
pizz. p mp f

Vln. II
pizz. p mp f

Vla.
 p mp f

Vc.
 p f

gliss. gliss. gliss. gliss.

IV. L'Entanglement e le sue Inquietanti azioni a distanza

IV. Entanglement and its Spooky Actions at a Distance



$$|\Phi^+\rangle = \frac{1}{\sqrt{2}}(|0\rangle_A \otimes |0\rangle_B + |1\rangle_A \otimes |1\rangle_B)$$

$$|\Phi^-\rangle = \frac{1}{\sqrt{2}}(|0\rangle_A \otimes |0\rangle_B - |1\rangle_A \otimes |1\rangle_B)$$

$$|\Psi^+\rangle = \frac{1}{\sqrt{2}}(|0\rangle_A \otimes |1\rangle_B + |1\rangle_A \otimes |0\rangle_B)$$

$$|\Psi^-\rangle = \frac{1}{\sqrt{2}}(|0\rangle_A \otimes |1\rangle_B - |1\rangle_A \otimes |0\rangle_B).$$

Vivace e Deciso $\text{♩} = 150$ c.ca

103 arco

Vln. I
 ff

Vln. II
 ff mp subito

Vla.
 ff mp subito

Vc.
 ff

108

Vln. I
Vla.

This system contains measures 108 through 112. The Violin I part features a melodic line with eighth-note patterns and some chromaticism. The Viola part provides a steady accompaniment with eighth-note chords. The key signature changes from one flat to two flats between measures 109 and 110.



113

Vln. I
Vln. II
Vla.
Vc.

mp
mf
arco 4
mp
mf

This system contains measures 113 through 117. It features a change in time signature from 6/8 to 11/16. The Violin I part has a melodic line with a *mp* dynamic. The Violin II and Viola parts have a rhythmic accompaniment. The Violoncello part has a melodic line with a *mf* dynamic. The *arco* marking is present above the Violoncello staff.



118

Vln. I
Vln. II
Vla.
Vc.

f
mp
mp
f
mp

This system contains measures 118 through 122. The Violin I part has a melodic line with a *f* dynamic. The Violin II part has a melodic line with a *f* dynamic. The Viola part has a rhythmic accompaniment with a *mp* dynamic. The Violoncello part has a melodic line with a *f* dynamic.

123

Vln. I *mf*

Vln. II *p* *mf*

Vla. *mf*

Vc. *mf* *f*

Detailed description: This system contains measures 123 through 127. It features four staves: Violin I, Violin II, Viola, and Violoncello. Measure 123 is marked with a dynamic of *mf*. Measure 124 is marked *p*. Measure 125 is marked *mf*. Measure 126 is marked *f*. Measure 127 is marked *f*. The music includes various rhythmic patterns and dynamic markings.

Vln. I *f* *mp* *mf*

Vln. II *mf*

Vla. *mp*

Vc. *mp*

Detailed description: This system contains measures 128 through 132. It features four staves: Violin I, Violin II, Viola, and Violoncello. Measure 128 is marked *f*. Measure 129 is marked *mp*. Measure 130 is marked *mf*. Measure 131 is marked *mf*. Measure 132 is marked *mf*. The music includes various rhythmic patterns and dynamic markings.

Vln. I

Vln. II *mp*

Vla.

Vc. *mf*

Detailed description: This system contains measures 133 through 137. It features four staves: Violin I, Violin II, Viola, and Violoncello. Measure 133 is marked *mp*. Measure 134 is marked *mf*. Measure 135 is marked *mf*. Measure 136 is marked *mf*. Measure 137 is marked *mf*. The music includes various rhythmic patterns and dynamic markings.

138

Vln. I
4 *mf* 2 *mp* 2 4 *mf*

Vln. II
mf

Vla.
2 *mp* 2 4 *mf*

Vc.
mp *mf*

Detailed description: This system contains measures 138 through 142. It features four staves: Violin I, Violin II, Viola, and Violoncello. Measure 138 has a 4-measure rest for Vln. I. Vln. II plays a rhythmic pattern of eighth notes. Viola and Vc. play eighth notes. Dynamics include *mf*, *mp*, and *mf*. Measure 139 continues the patterns. Measure 140 has a 2-measure rest for Vln. I and Vln. II. Measure 141 has a 4-measure rest for Vln. I. Measure 142 has a 4-measure rest for Vln. I and Vln. II.



143

Vln. I

Vln. II

Vla.
2 *f* 2

Vc.
4 *f* 2

Detailed description: This system contains measures 143 through 147. Vln. I has a 4-measure rest. Vln. II plays eighth notes. Viola has a 2-measure rest. Vc. has a 4-measure rest. Dynamics include *f* and *f* 2. Measure 144 has a 2-measure rest for Vln. I. Measure 145 has a 2-measure rest for Vln. I. Measure 146 has a 2-measure rest for Vln. I. Measure 147 has a 2-measure rest for Vln. I.



148

Vln. I
ff

Vln. II
mf

Vla.
f *mf*

Vc.
f *ff*

Detailed description: This system contains measures 148 through 152. Vln. I has a 4-measure rest. Vln. II plays eighth notes. Viola has a 4-measure rest. Vc. has a 4-measure rest. Dynamics include *ff*, *mf*, *f*, and *ff*. Measure 149 has a 4-measure rest for Vln. I. Measure 150 has a 4-measure rest for Vln. I. Measure 151 has a 4-measure rest for Vln. I. Measure 152 has a 4-measure rest for Vln. I.

153

Vln. I

Vln. II

Vla.

Vc.

8^{va} pont.

pp quasi un sibilo

pp quasi un sibilo

pp

pont. quasi glissato

f

pp

158 (8)

Vln. I

Vln. II

163 (8)

Vln. I

Vln. II

168 (8)

Vln. I

Vln. II

Vla.

Vc.

mp

pp

mf

pizz. mp

pp

mf

pizz. ff

ff

ff

173 ord.

Vln. I *pp* *mf*

Vln. II *pp* *mf*

Vla. *ff*

Vc. *ff*

178

Vln. I *mf* *fff*

Vln. II *mf* *fff*

Vla. *mf* *fff*

Vc. *mf* *fff*

pizz.

arco

183

Meno mosso ♩.=140

Vln. I *pp*

Vln. II *pp*

Vla. *pp*

Vc. *pp*

arco

187

Vln. I

Vln. II

Vla.

Vc.

ff

ff

191

Vln. I

Vln. II

Vla.

Vc.

ff sf sf

ff sf sf

sf sf pp ff sf sf

sf sf pp ff sf sf

195

Vln. I

Vln. II

Vla.

Vc.

pp

pp ff sf sf sf

pp ff sf sf sf

6/16

6/16

6/16

6/16

V. Sovrapposizione II

V. Superimposition II

$$\psi = c_1 \psi_1 + c_2 \psi_2$$

Meno mosso $\text{♩} = 70$

punta d'arco

199

Vln. I *pp liberamente tremolato*

Vln. II *pp*

Vla. ord. → pont.

Vc. *pp* quasi glissando gliss.



202

Vln. I ord.

Vln. II gliss. *p*

Vla. ord. → pont. quasi glissando gliss.

Vc. pizz. *mf*

206

Vln. I *mp* *p* *ord.* *p < f =*

Vln. II *f* *ppp* *p < f = p*

Vla. *mf* *pizz.* *f*

Vc. *mp* *arco*



210

Vln. I *p* *p < f = p* *p < f = p* *p < f = p* *fp* *f* *ord.* *pont.*

Vln. II *p < f = p* *p < f = p* *p < f = p* *f* *ord.* *pont.*

Vla. *ff* *ord.* *pont.*

Vc. *p* *f* *p* *fp* *f*

VI. Onde Probabilistiche

VI. Probabilistic Waves

$$i\hbar \frac{\partial}{\partial t} \psi(r, t) = \widehat{H} \psi(r, t)$$

Le linee verticali tratteggiate sono state inserite volutamente per agevolare la lettura e l'esecuzione dei musicisti fornendo un riferimento di durata approssimativo. Tuttavia l'intera sezione è da intendersi in notazione spaziale, quindi libera e senza tempo.

The vertical dotted lines have been inserted intentionally to facilitate the reading and performance of the musicians providing a reference of approximate duration. However, the whole section is to be interpreted as spatial notation, therefore free and timeless.

Calmo ma pian piano sempre più intenso come un'onda che cresce
Libero, Senza Tempo (Freely, Without Time)

Approx. duration 3" sec. c.ca

215

Vln. I *pp* sempre non vib. glissando a piacere prima del cambio nota

Vln. II *pp* sempre non vib. glissando a piacere prima del cambio nota

Vc. *pp* sempre non vib. glissando a piacere prima del cambio nota (continua simile tranne dove indicato)

225

Vln. I (continua simile tranne dove indicato)

Vln. II (continua simile tranne dove indicato) arco sempre non vib. non glissato

Vla. *pp* glissando a piacere prima del cambio nota (continua simile tranne dove indicato)

Vc. *pp* glissando a piacere prima del cambio nota (continua simile tranne dove indicato)

233

Vln. I

Vln. II ord. pont. *mp* *p*

Vla.

Vc.

240

Vln. I

Vln. II

Vla.

Vc.

molto libero e indefinito
ord. ————— ^{gr} pont.

p ————— *mp*

248

Vln. I

Vln. II

Vla.

Vc.

molto libero e indefinito
pont. ————— ord. ————— pont.

mp ————— *p* < *mf* ————— *p*

252

Vln. I

Vln. II

Vla.

Vc.

ord. ————— pont.

molto libero e indefinito

mp ————— *p*

ord. ————— pont.

mp

256 \flat \circ \flat \circ

Vln. I *pp*

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

Vla. *pp*

Vc.

molto libero e indefinito

pont. δ^{12} ord.

261 \flat \circ

Vln. I

Vln. II *mp* *pp*

Vla.

Vc.

pont.

5 6

267

Vln. I

Vln. II *gliss.*

Vla. *mp* *pp*

Vc.

ord. pont.

6 5 5 6

271

(senza glissando) *gliss.* *pp* *ripetere simile*

Vln. I

Vln. II

Vla.

Vc.

(senza glissando)

277

Vln. I

Vln. II

Vla.

Vc.

279

Vln. I

Vln. II

Vla.

Vc.

pp

281

Vln. I

Vln. II

Vla.

Vc.

p

3 3

5 5



283

Vln. I

Vln. II

Vla.

Vc.

p subito

5 5 6

Musical score for measures 285-290. The score includes staves for Violin I (Vln. I), Violin II (Vln. II), Viola (Vla.), and Violoncello (Vc.).

- Measures 285-286:** Vln. I and Vln. II play sustained notes. Vc. plays a low octave chord. Vla. plays a rhythmic pattern of eighth notes with five-fingerings.
- Measure 287:** Vln. I and Vln. II play sustained notes. Vc. continues with a triplet of eighth notes. Vla. continues with eighth notes.
- Measures 288-290:** Vln. I and Vln. II play sustained notes. Vc. continues with a triplet of eighth notes. Vla. continues with eighth notes.

Dynamic marking: *pp* simile



Musical score for measures 287-292. The score includes staves for Violin I (Vln. I), Violin II (Vln. II), Viola (Vla.), and Violoncello (Vc.).

- Measures 287-288:** Vln. I plays sixteenth-note patterns with six-fingerings and five-fingerings. Vc. continues with eighth notes.
- Measures 289-290:** Vln. I plays sixteenth-note patterns with three-fingerings, five-fingerings, and six-fingerings. Vc. continues with eighth notes.
- Measures 291-292:** Vln. I plays sixteenth-note patterns with six-fingerings. Vc. continues with eighth notes.

Dynamic marking: *pp*

289 *glissando lentamente* *gliss.* *v* *molto cresc.*

Vln. I

Vln. II

Vla.

Vc.

molto cresc.



rallentando - - - - *e* - - - - *accelerando* - - - - *liberamente* - - -

291 *ff* *ff* *ff* *ff*

Vln. I

Vln. II

Vla.

Vc.

ff

ff

ff

ff

VII. Una Strana Dualità

VII. A Strange Duality

$$\lambda = \frac{h}{mv}$$

Misterioso $\text{♩} = 70$

293

Vln. I pizz. *mp*

Vln. II pizz. *mp*

Vla. pizz. *mp*

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

sempre molto libero ed espress.

solo

297

Vln. I pizz.

Vln. II pizz.

Vla. pizz.

Vc. *p* *mp*

302

Vln. I pizz. *mp*

Vln. II pizz. *mp* *f*

Vla. arco *mp* *f*

Vc. *pp* *mp* *f* pizz.

305

arco

Vln. I *f* *f* *ff*

Vln. II *mf* *f* pizz.

Vla. *mf* *f* *ff* arco

Vc. *f* *ff* *mf sf* *p*

307

Vln. I *p* *pp*

Vln. II *p* *pp*

Vla. arco pont. *p* *mf* pizz.

Vc. pont. *p* *mf* pizz.

309

Vln. I *f* *p*

Vln. II *f* *p*

Vla. arco *f* *p* pizz. *mp*

Vc. *f* *p* *mp*

311

Vln. I *ff* *sf* pont.

Vln. II *ff* arco *sf* pont.

Vla. *ff* arco *sf* pont.

Vc. *ff* *sf* pont.

313

Vln. I *mp* *pp* *mf* 3 *tr.* *ord.* *pont.*

Vln. II *mp* *pp* *mp* *p* *ord.* *pont.*

Vla. *mp* *pp* *pizz.* 3 *ord.*

Vc. *mp* *pp* *mf subito* *fff* *ord.* 3 *pizz.* 3

rall. accel.

315

Vln. I *pp* *p* *ord.* *pont.* *sempre più indefinito* *fff*

Vln. II *mf* *f* *pizz.* *arco ord.* *pont.* *sempre più indefinito* *fff*

Vla. *f* *arco* *p* *ord.* *pont.* *sempre più indefinito* *fff*

Vc. *p* *ord.* *pont.* *sempre più indefinito* *fff*

VIII. Figure di Interferenza

VIII. Interference Figures

$$\sin \theta = m \frac{\lambda}{d} \qquad \sin \theta = \left(m + \frac{1}{2} \right) \frac{\lambda}{d}$$

Ancestrale e arcaico ♩=70

316 solo

Vc. *mp* molto espress. e cantabile *p*

319

Vln. I *mp* molto espress. e cantabile

Vln. II *p* *p* 7

Vla. *mp* molto espress. e cantabile

Vc. *pp* *p* *p* 7

322

Vln. I

Vln. II *mf* *p* *mf* *mf* *p* 6 7

Vla.

Vc. *mf* *p* 7 *f*

324

Vln. I

Vln. II

Vla.

Vc.

p *f* *p*

p *f* *f* *p*

325 A tempo ♩ = 70

Vln. I

Vln. II

Vla.

Vc.

mp molto espress. e cantabile *p*

mp espress.

sul tasto

pont.

p

328 ord.

Vln. I

Vln. II

Vla.

Vc.

p *f* *p*

p *f* *p*

mf *p*

p *f* *p*

ord.

sul tasto

pont. (quasi glissato)

pont. (quasi glissato)

mp espress.

mp espress.

331

Violin I: *mp* (6), *p* (pont.)
Violin II: *mp* (6), *p* (pont.)
Viola: *p*
Violoncello: *p*

Measures 331-333. Violin I and II play sixteenth-note patterns with sixteenth rests, marked *mp* and *p* respectively. Viola and Cello play eighth-note patterns. Measure 333 includes the instruction *pont.* (pizzicato).

334

Violin I: *pp*, *mp espress.*
Violin II: *pp*, *ord.*, *pont.*, *p*, *f*, *p*
Viola: *ord.*, *pont.*, *p*, *f*, *p*
Violoncello: *mp espress.*, *p*, *f*, *p*

Measures 334-336. Violin I plays a melodic line starting *pp* and becoming *mp espress.* Violin II and Viola play sixteenth-note patterns with sixteenth rests, marked *pp* and *ord.* (ordine). Measure 336 includes the instruction *pont.* (pizzicato). Dynamics range from *pp* to *f*.

337

Violin I: *pizz.*, *arco*, *rit.*, *Attaca Subito*
Violin II: *f*, *pizz.*, *arco*, *pont.*, *pp*, *ord.*, *mf*, *f*
Viola: *mf*, *pizz.*, *arco*, *pont.*, *ord.*, *6*, *pont.*, *sf*, *pp*
Violoncello: *p*

Measures 337-340. Violin I plays a melodic line, marked *pizz.* (pizzicato) and *arco* (arco). Measure 338 includes the instruction *rit.* (ritardando). Measure 340 includes the instruction *Attaca Subito* (Attaca Subito). Dynamics range from *f* to *pp*.

IX. Relazioni di Indeterminazione

IX. Uncertainty Relations

$$\Delta x \Delta p \geq \frac{\hbar}{2}$$

Lento e indeterminato (c.ca ♩=80)

340 *Molto Rubato e Libero* ord. pont.

Vc. *simile ma sempre più indeterminato e impreciso*

glissando

accel. - - - poco - - - a - - - poco

f *pp*



Molto Libero e Senza Tempo

342

Vln. I *punta d'arco* *Free Rythm. Repeat x2* *pont.*

pp molto liberamente

Vln. II *punta d'arco* *Free Rythm. Repeat x2* *pont.*

pp molto liberamente *Free Rythm. Repeat x2 col legno*

p molto liberamente

Vla. *Free Rythm. Repeat x2* *pizz.*

p molto liberamente *Free Rythm. Repeat x2 col legno*

p molto liberamente

Vc. *Free Rythm. Repeat x2* *pizz.*

p molto liberamente

348

Vln. I ord. → pont. *pp* < *f* > *pp* non vib. *pp* < *f* > *ppp*

Vln. II arco sul tasto ord. → pont. ord. → pont. *pp* < *f* > *pp* *pp* < *f* > *pp* *pp* < *f* > *pp* non vib. *pp* < *f* > *ppp*

Vla. arco ord. → pont. sul tasto *pp* < *f* > *pp* *pp* < *f* > *pp* non vib. *pp* < *f* > *ppp*

Vc. arco ord. → pont. sul tasto ord. → pont. *pp* < *f* > *pp* *pp* < *f* > *pp* non vib. *pp* < *f* > *ppp*



$$\Delta E \Delta t \geq \frac{\hbar}{2}$$

A tempo ♩=60 c.ca

353

Vln. I senza vibrato tasto → pont. → tasto → pont. ord. pizz. *pp* *p* *mp* < *mf* > *f* subito *ff*

Vln. II senza vibrato pont. → tasto → pont. → tasto ord. pizz. *pp* *p* *mp* < *mf* > *f* subito *ff*

Vla. senza vibrato tasto → pont. → tasto → pont. ord. pizz. *pp* *p* *mp* < *mf* > *f* subito *ff*

Vc. senza vibrato pont. → tasto → pont. → tasto ord. pizz. *pp* *p* *mp* < *mf* > *f* subito *ff*