



GRÁINNE MULVEY THE TYNDALL EFFECT

A commemoration of Carlow-born scientist John Tyndall



National Symphony Orchestra of Ireland | Gavin Maloney, conductor
Hard Rain Soloist Ensemble | Sinead Hayes, conductor
Nathalia Milstein, piano | Thérèse Fahy, piano
Isabelle O'Connell, piano | Martin Johnson, cello

GRÁINNE MULVEY

THE TYNDALL EFFECT

1.	Diffractions	9:31
2.	Interference Patterns	5:48
3.	LUCA	12:05
4.	Calorescence	11:20
5.	Sun of Orient Crimson with Excess of Light	10:24
6.	Cello Concerto - Excursions and Ascents	19:09

Total playing time 68:28

FOREWORD

Gráinne Mulvey's "Tyndall Effect" set in context of Tyndall, Leighlinbridge, Carlow, Leinster, Belfast, Ireland and Beyond: Composition towards an 'International Legacy' to connect 'Music to Science'

Dr Norman McMillan

The Millennium Project for Vocational Schools was a book, *Prometheus's Fire: A History of Irish Scientific and Technological Education in Ireland*, distributed to every vocational school in the country, coming from the work of the local Tyndall-Dargan Committee and launched at the IVEA Conference. This book was dedicated to Dr Thomas Walsh founder of Teagasc who worked on this project with the author. Walsh has two plaques erected in his memory, one in his birthplace in Wexford town for founding the Wexford Festival and one on his National School erected by the National Committee for Commemorative Plaques in Science & Technology (NCCPST) on his National School in *Piercetown*, or *Piercestown*, (Irish: Baile an Phiarsaigh). The NCCPST plaque being just a stone's throw from Johnstown Castle where "Dr Tom's" research legacy is today developed by Teagasc. He apologised the week before his death for not finishing his chapter on the history of agricultural education, which was posthumously delivered by his friend Dr Austin O'Sullivan. The book detailed the history of astronomical alignment and monumental construction in the Boyne Valley that predate the Egyptian Pyramids but connect to similar passage tomb and prehistoric structures in Carlow and Kilkenny. The book details early guilds history, the astronomical research legacy of the Jesuits in 16th century Dublin and the history of such research in Trinity College from which the modern Baconian science tradition derives from the Dublin Philosophical Society of William Molyneux. There are detailed histories of all relevant facets of Irish technical education, including a history of the Regional Technical Colleges. A recurrent theme in this book is the notable contributions to this history originating from Leighlin, Carlow and Leinster, a cauldron of educational innovation

that provided Tyndall with a birthright of controversy that most definitely shaped his career.

Tyndall's home village of Leighlinbridge bizarrely boasts the mediaeval St Lazerian's *Cathedral*, previously the *cathedral* of the Diocese of Leighlin and was the centre of a great ecclesiastical community. Carlow's Celtic religious history is one of great importance and indeed now a useful tourist attraction. The Battle of Carlow on 25th May 1798 was the first major battle of the United Irishmen's Revolutionary insurrection. Given its history, the Barrow Valley perhaps unsurprisingly has produced internationally acclaimed philosophers, religious leaders, revolutionary educationists, authors, playwrights, scientists, wonderful musicians and composers.

Gráinne Mulvey has obviously been inspired by the same legacy as John Tyndall but specifically her ingenious musical compositions connect to the scientific genius and founder of three Baconian sciences for climate science, molecular (Infrared) spectroscopy and bacteriology. These "Tyndall Effect" compositions relate to the work of Carlow's greatest scientist, founder of the modern sport of mountaineering, cultural icon of "self-improvement" and educational academic superstar inventor, whose lectures at the Royal Institution were visually unforgettable competing in their day with spectacles in the London theatre.

How did this human phenomenon arise?

John Tyndall (1820–93) was born 2nd August 1820 in Leighlinbridge, Co. Carlow, only son among two children of John Tyndall (1792–1847) and Sarah Tyndall (née McAssey; d. 1867). His father came from a family of small landowners in Co. Kilkenny, acted as land agent for the Steuart estate, later joining the Royal Institution but requiring to supplement his income by mending boots. His mother came from the Malone family, which owned considerable landed property near Fenagh, Co. Carlow;

however, his maternal grandmother, having married against her father's wishes, had been disinherited.

John attended a school in Leighlinbridge and at some stage the family moved to Castlebellingham, Co. Louth. He finished his education in two years spent in one very special National School in Ballinabranna as a mature student. The National School system was the first-ever state funded system and one closely linked with Carlow. James Doyle, Bishop James of Kildare and Leighlin, who signed himself JKL in contempt for the Penal Laws, was an educational reformer and recognised for being the prime mover in establishing these schools with his 1831 Westminster evidence that led directly to the National School System. The one-room Ballinabranna school, built in 1833, came from a JKL template design and is important as it was a design adopted throughout the British Dominions. Tyndall's father sent him to the "finishing school", meant to be a non-denominational school. This National School stood in the very grounds of the Catholic Church and was clearly not non-denomination. Tyndall's father famously commenting that his teenage son John would go to the famous teacher John Conwill even if he taught him on the altar in church. Emma Tyndall, John's younger sister was probably one of the 261 registered pupils in 1842 in a school built initially for 100 pupils. John spent time there from 1836 as a teaching assistant to this vocational educational pioneer.

Thomas Hirst, Tyndall's closest friend, evolutionist and X-Club member described the impressive Conwill, surprisingly given the absolute esteem Tyndall had for his teacher, rather disparagingly, as a small cadaverous man with a patch over one eye! John Conwill was a "Lancastrian-method teacher" who taught not only Tyndall, but also, later, another Leighlinbridge pupil, Patrick Francis Moran (1830-1911), later the first Archbishop of Australia. Many others passed through Conwill's hands for diverse careers in which they achieved some eminence. Ballinabranna was, then, among other things an impressive vocational finishing school. Aged 19 years, John Tyndall left with an impressive foundation including English, book-keeping, drawing, and, most

importantly for his later career, knowledge of practical surveying and the associated mathematics of logic and geometry. The author, with Martin Nevin, located Conwill's grave at the side of the Ballinabranna church. On 17th April 1980 a plaque to both Tyndall and Conwill was unveiled by ETS Walton, then Ireland's only science Nobel Laureate, on this one room school. The school was under threat of demolition because of the Tyndall association; he was persona non-grata in the 1970s in Ireland being a founder of agnosticism, an evolutionary spokesman and, most damningly, a Unionist advocate for the British Empire. A campaign led by Joe Feeley, the Chair of the Tyndall-Dargan Committee, working with Walton, John Coolahan (Professor of Education in Maynooth), members of the Irish Countrywomen's Association and the Ballinabranna School Principal Myles Kavanagh, attempted unsuccessfully to save the JKL school.

How did such entrenched attitudes arise with regard to Tyndall? He was certainly an heroic icon for his age of self-improvement but was shaped by his life's experience in what was the Age of Empire. He was formed by working in Berlin and then London at the very centres of two Empires. He came from Leighlinbridge, that had seen fighting in 1798, two of William Dargan's United Irishmen uncles dying on 25th May 1798. The Wexford United Irishmen's Army of Father Murphy was camped above Old Leighlin in June 1798 before their decisive defeat and the execution of the 'rebel-priest' in Tullow.

Ireland's greatest entrepreneur and engineering contractor, Dargan built the reservoirs and water system to supply Belfast's burgeoning population in the 19th century and dredged the Lagan to make it navigable, creating what for years was known as Dargan's Island but renamed by Unionism "Queen's Island". Dargan was a Young Irelander's hero and his railway, canal, water and business enterprises were so internationally significant that he had become Ireland's richest-ever man. It was said he employed 100,000 men during the Famine and personally ran the Great Dublin Exhibition of 1853 at his own expense. The Dublin International Exhibition

was on a scale comparable to the much lauded Crystal Palace International Exhibition in London. Dargan was mentioned by “favourably” by Marx in *Capital*.

The Catholic Primate of Ireland, Paul Cullen, had roots in Leighlinbridge; indeed, his nephew, Patrick Francis Moran was one of Conwill’s pupils. Cullen hated liberals after being left by the Pope to negotiate with the revolutionary Garibaldi, agreeing in these fraught discussions to accept for the Church the minuscule Papal State. Conwill was no radical and described in educational histories in 1970s as a “former hedge-school teacher”, which is doubtful. Mid -19th century Leighlin was a hotbed of religious and political controversy, preparing Tyndall to become “*arguably the most disputatious scientist of Victorian times*”.

Tyndall joined the Ordnance Survey office in Carlow from school, moving from there to Youghal, Co. Cork. Tyndall felt fortunate to be chosen (1842) to transfer to the English survey, where he was posted to Preston, Lancashire. Despite working long hours, Tyndall began attending classes in the local Mechanics’ Institute. As leader of the Irish in the English Survey protesting over their unjustifiable inferior conditions, he was summarily dismissed (November 1843) after being identified as the leader in what had become a public dispute with Robert Peel in the *Liverpool Mercury*. He was unemployed for a period, but eventually found work as a surveyor with Manchester partners Nevin & Lawton, and then on the West Yorkshire line as a railway surveyor. During this time he developed his prodigious walking capacity and the stamina that was to serve him so well later as a mountaineer.

Tyndall’s interest in physics and engineering education began seriously from 1847 when he met George Edmondson, who at the time was endeavouring to introduce the elements of experimental science into his Quaker school, Tulketh Hall, Preston. Edmondson shortly thereafter entered into negotiations with representatives of the communalist Robert Owen to take over ‘Harmony Hall’ near Stockbridge, Hampshire, the unsuccessful

school which was Owen’s last great social experiment to reform the character of communalists. The lavish educational facility stood on its own 500-acre self-sufficient farm, boasting palatial buildings with the latest educational facilities, including an agricultural school with a purpose-built science laboratory, printing office, and carpenter’s and blacksmith’s shops. The name was changed to Queenwood College. Edward Frankland, another passionate self-improver, became superintendent of the chemistry laboratory, and the younger Tyndall superintendent of the engineering laboratory. The two established the first programme of practical science and engineering ever established in Great Britain and Ireland. The experiment in developing “*heuristic science*”, in what were almost certainly the earliest science and engineering school laboratory facilities, became very important. Their pioneering work was, a decade later, amplified into the national arena with the appointment (1853) of both men as examiners in the Department of Arts and Science. Frankland was the first government examiner in chemistry and Tyndall in physics. Indeed, physics – which as a subject Tyndall did so much to define in Britain – was a new school subject that came from revolutionary France via Germany. Tyndall was also appointed (1857) as the first chief examiner for military examinations for the Royal Engineers and Royal Artillery. Frankland’s student and educationalist Armstrong developed heuristic teaching programmes later in the century at Imperial College, building from this educational experiment.

In October 1848 Frankland and Tyndall left Queenwood to attend – at their own expense – Marburg University, the centre of the radical scientific materialist movement. Tyndall wrote his Ph.D. thesis in 1849, after intense study, on ‘Die Schraubenfläche mit geneigter Erzeugungs-Linie und Bedingungen des Gleichgewichts für solche Schrauben’ (‘screw surfaces with inclined generatrix, and the conditions of equilibrium for such screws’). He studied chemistry under the Robert Bunsen, whose own research interests in spectroscopy were to fire and shape much of Tyndall’s own later research ambition.

Bunsen's burners were developed as spectroscopic sources delivering coloured flames (atomic emissions) from chemicals thrown into the flame, but are today found in nearly every chemistry laboratory in the world. Tyndall was Bunsen's assistant in his lectures. On completing these mathematical studies, he moved decisively towards physics, collaborating with Heinrich Knoblauch, who had arrived in Marburg from Berlin, to produce his first published paper on the topic of diamagnetism. He extended his stay in Germany long enough to produce a second memoir with Knoblauch, and then to spend several months in Gustav Magnus's laboratory in Berlin. His research fame by this time was such that in his first memoir he felt able to dispute with Michael Faraday and Julius Plücker, both senior eminent Victorian scientists. In Berlin Tyndall had cemented what were lifelong ties to the elite of Germany's scientific community, working alongside Bunsen, Kirchhoff, Magnus, Poggendorff, Heinrich Dove, Emil du Bois-Reymond, and Rudolf Clausius.

In June 1851 Tyndall returned to Queenwood and continued his work on diamagnetism with small equipment grants from the Royal Society of London (hereafter (Royal Society)). His considerable work on this topic was only much later consolidated and published as *Researches on diamagnetism and magne-crystallic action* (1870). During a second spell at Queenwood he also undertook a considerable amount of translation work for William Francis. These translations in the Royal Society's *Philosophical Magazine* cemented his German research links and brought to the British audience the latest and most important papers emanating from Germany and famously opposed the 'Gentlemen of Science', who were led by members of the established church, teaching in universities. There was a chauvinistic "Newtonian" complacency that facilitated a national scandal with the Royal Society transformed into the Duke of York's drinking club for aristocratic friends. Being based in the Royal Institution of Great Britain and with a significant role in the Royal Society, doing translations of internationally significant German paper

for the Royal Society's *Philosophical Magazine*, Tyndall successfully led a campaign for recognition of Mayer's priority in discovery of First Law of Thermodynamics. He also promoted and obtained recognition for the work of Clausius on the Second Law. Tyndall's campaigns provoked hostile chauvinistic and class reactions from the "Gentlemen" in concert with Joule's supporters Manchester and Kelvin's in Scotland.

Tyndall from the mid-1850s acquired the reputation as the uber-controversialist in science and was well prepared for the events that unfolded on the publication of Darwin's *On the origin of species* (1859), and enmity with the Scottish establishment deepened. Initially, eight London-based evolutionists were organised from 1864 by Tyndall and Frankland from their base on Albemarle St. for the defence of the 'great hypothesis'. The ninth member, William Spottiswoode, was admitted at the second meeting, and the club eventually became known as the 'X-Club' – so named because of the nine members plus their acknowledged, but always absent, 'Xth' member and leader Charles Darwin, who was too retiring to attend X-Club meetings, or indeed even to defend publicly his own theory. The members all adopted epithets – Xcentric (Tyndall), Xalted (T. H. Huxley), Xpert (Frankland), Xperienced (J. D. Hooker), Xquisite (John Lubbock), Xemplary (George Busk), Xhaustive (Herbert Spencer), Xtravagant (T. A. Hirst), and Xcellent (Spottiswoode). Each member took on the role of defending and deepening aspects of the theory. Xcentric was to provide the physics that underpinned life on earth, namely atmospheric physics.

Tyndall's legacy in science is impressive by any standards. His devotion to Faraday's method means his work will never lose its fundamental importance and it was seeking experimental truth. His long series of meteorological studies formed the basis of three Royal Society Bakerian lectures on the subject (1861, 1864, 1881), in which Tyndall formulated a quantitative understanding of atmospheric physics and dealt with related issues such as nephelometry and floating matter in the air. Tyndall opened up the serious debate on the

'greenhouse effect' although he did not discover this. He used his experimental knowledge on the large absorptive capacity of water vapour to explain, for instance, meteorological conditions in deserts and other climates to great effect. In the latter part of these studies he turned to shorter wavelengths and found that these rays of 'high refrangibility' (ultra-violet) caused photochemical reactions. The resulting clouds of small particles scattered visible light to produce colours and in particular the vivid blue of the sky, known frequently as 'Tyndall blue'. His pioneering investigations into scattering have led him to be honoured by the term 'Tyndall scattering' deriving from particulate matter. Tyndall made an impressive and comprehensive experimental study of the phenomenon, including polarisation studies. He pointed out with amazing prescience that space would be black, and produced (1869) 'A cometary theory' to explain the tail of a comet. His paper 'A new series of chemical reactions produced by light' (1869) was ground-breaking work in photochemistry, following the earlier work of Draper.

This revolt against Newtonian establishment was sparked through the continental developments from Thomas Young's revolutionary researches of the Royal Institution. In London subsequent university developments began with the radical University College in the 1820s that was not modelled on the English, establishment universities but rather the Trinity College Dublin's "examination" university for external examinations. The development of UCL linked subsequently to the growth in Britain of Mechanics Institutes. Dionysius Lardner took his successful TCD "grind volumes" to London to launch a veritable textbook/examination publishing revolution starting in UCL. The Tories established King's College to counter UCL and Lardner left to go independent and promote and edit his books. These developments in the introduction of their examination of the Society of Arts, led by TCD's the Rev. James Booth, linked directly to the later City and Guilds examination development in the second half of the nineteenth century. Tyndall's impressive development of his heuristical textbooks for school physics became the most important textbooks in

the second-level system because they were all based on the "tried-and-tested" Royal Institution tradition of public demonstration lectures. In Dublin the political struggle led to attempts to the reform of the non-denominational facilities RDS used by bureaucracy in the government to centralise their power and saw the emergence of the Royal College of Science (hereafter RCS). There were largely failed attempts by Catholics to develop the Catholic University on St Stephens Green and before the end of the century the establishment of the Dublin Institute of Technology (hereafter DIT). In TCD there were under Fitzgerald's urging "Maxwellian" physics textbooks by Thomas Preston and others to present a new paradigm in physics. Preston took a position in UCD and there helped established their impressive spectroscopic tradition. With the revolutionary developments in the early part of the 20th century UCD was established and RCS that was evolving as an outpost of Imperial College was taken over by Jesuits. Trinity was left without any governmental support.

Tyndall toured the USA for a year in 1872 and 1873. Quite remarkably, the wave theory of light was still ultra-controversial when Tyndall evangelized this in his published "Six Lectures On Light". Young's work was presented as the backbone of the spectroscopic studies of Bunsen and Kirchhoff and Tyndall's own revolutionary advance with Stokes of nephelometric methods of founding fluorescence and IR spectroscopies that collectively are the initial development of the first nanoscience of nephelometric science. The Stokes fluorescence and Tyndall's colour series of thirteen scattering colours, from the unscattered white to the complete scattered loss of all photons with black, are experimental discoveries that are eternal, being the Baconian foundations of what is called today "dynamic light scattering" (hereafter DLS). These colours are the first experimental nano-quantitation in science. The scattering colour indicate the particle/molecular size, nanoparticle-concentration or nanoparticle-state. To underline the importance of these contributions made by these two Irishmen, this demarks the first

nanospectroscopic measurement tools. The work of Hutchinson Syngé in 1931 in Dublin marks the nanopositioning advance with a proposed raster analysis for Nanoscience analysis of surfaces allowing nanosignal measurements below the optical diffraction limit.

Tyndall in Belfast was aware of the merciless mauling by the French Medical Profession of his collaborator Louis Pasteur for his temerity in proposing his germ theory as a criticism of then medical practice. The Frenchman was destroyed because he could not report reproducible experiments and sought help from Tyndall. Tyndall's intermittent heating extended the inadequate single stage sterilization heating of what today is called pasteurization to establish the required rigorous sterilization and tyndallization (1877) is the absolute reproducible methodology required for establishing the "Baconian science" of Bacteriology. His monumental researches were published as *Essay on floating matter of the air in relation to putrefaction and disease* (1881). The Frenchman was the theoretical founder of bacteriology/microbiology. Tyndall proved the germ theory in collaboration with Thomas Henry Huxley. They avoided a mauling by the British Medical establishment by working with a fully qualified and young medical researcher Joseph Lister, who later developed his chemical sterilization researches in Glasgow.

This work led Tyndall directly from the spectroscopic analysis of molecules in his IR measurements to optical techniques to support his cleanroom "sterilization", heat preparation, filtration and chemical treatments which monitoring technologies developed in his collaboration with Louis Pasteur. Abiogenesis (spontaneous generation) held that living organisms could arise from inorganic matter. Tyndall, after incredible commitments of time over nearly a full decade, succeeded in devising methods of rigorous sterilisation and was thus able to prove the germ theory by reproducible bacteriological experiments. Tyndall was flagging in Belfast these collaborations with the obvious unstated message that Evolution begins with the most basic biological forms of life based on research opened up by Woese's New-Tree-

of-Life extending from LUCA (last universal common ancestor)¹.

In his Presidential speech in Belfast to the British Association for the Advancement of Science (hereafter BAAS) he was attempting uncharacteristically to tread carefully and be political savvy. He avoid ultra-contentious terms such as 'Darwinian Hypothesis' by focussing rather on what he called the "Mystery" of human consciousness. 'Mystery' is an unscientific term that has from Tyndall's first usage been accepted into the great library of scientific terms and used importantly, in our own time, by the Nobel Laureate Roger Penrose to badge his own theories on consciousness. In retrospect, this choice of terminology can be seen as Tyndallic genius, given quantum physics emerged from Faraday's work and his disciple Tyndall's work on Molecular Physics. Their work in the Royal Institution of Great Britain, linked with the Dublin advances of Fitzgerald and Stoney, leading to the contribution of John Bell celebrated in the 2022 Nobel Award in Physics to his disciples Alain Aspect, John Clauser and Anton Zeilinger. Tyndall's **Lectures on Optics** delivered in East Coast cities led to the republication of Thomas Young's forgotten 1802 publication detailing his dispute with Edinburgh's social reformer Lord Brougham whose attack on Young was in defence of Newtonian optics. It was Young's double-beam experiment that in 1926 led to the discovery by Davisson and Germer of electron diffraction and then quantum mechanics. This makes Tyndall's lectures of particular importance. Sir George Porter, then President and Director of the Royal Society, helped the author establish the **Tyndall Schools Lectures** in 1977 and in 1982 he wrote to Richard Feynman asking if he could undertake the lecture series and informing him of Tyndall's lectures. It may be a coincidence that Feynman's lecture series in New Zealand entitled **QED: The Strange Theory of**

1. Woese C.R. & Foxe G.E., Phylogenetic structure of the prokaryotic domains. The primary kingdoms. Proc. Natl. Acad. Sci. USA **74**. 5088-5900(1977) Quammen D. The Tangled Tree: A Radical New History of Life (William Collins, 2008).

Light and Matter is an adaptation for the general reader of four lectures on quantum electrodynamics published in 1985 by the Nobel laureate. The author is not sure whether he was aware of Tyndall's lecture series before this communication.

Tyndall is indelibly connected to his Belfast Address, delivered 19 August 1874, which was a demand for reform of British science continuing and echoing the deceased Prince Albert's campaign two decades before. The enigma of Tyndall is that he was a proud Irishman with an obvious undisguised Carlow accent but open in his support for the Empire and some of its worst actions. Tyndall the contrarian delighted in making his "Proclamation of the Independence of Science" in Belfast on the August 19, 1874 as President of the BAAS. Here exists a beautiful contradiction, with the dye-in-the-wool Unionist Tyndall being the "Republican of Science".

Mulvey has with her celebration of Tyndall separated and focussed on his indelible contribution: the scientific discoveries which we see today as opening up nanoscience, in the 1870s the extreme of science. These fundamentals of course lead directly to quantum reality that we are beginning to understand. Tyndall presented these in such a beautiful way to the general public that he was known as the "poet of science". Now from his own birthplace his cloud and sunset visions with his Tyndallic colour series have been set to music.

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NOTES ON THE MUSIC

The six pieces in this collection all in some way reflect the work of the prominent physicist, explorer and poet John Tyndall (1820-93), a native of my home town of Leighlinbridge, Co. Carlow, Ireland. They are not intended to be programmatic, nor do they form a "cycle" but rather take their initial inspiration from some aspect of Tyndall's work, developing thereafter as purely abstract music.

Diffractions for orchestra (2014)

The starting point for *Diffractions* was Tyndall's lectures on sound and light. The effect of diffraction on a composite waveform (or obstacle) is to cause it to separate out according to wavelength - a familiar example is the rainbow seen when light reflects off a CD or DVD. The piece opens with a loud, confused "white noise" band with no discernible pitch or rhythm. Gradually the conflicting elements begin to resolve themselves into distinct harmonic, rhythmic and timbral components. Once separated, each element can be developed independently or recombined with others to create new "hybrid" material. Eventually, these too resolve into a series of microtonally-inflected chords derived from the harmonic series. There are eight sub-sections in this one movement piece.

Interference Patterns (2014)

This short piano piece is also inspired by Tyndall's research into diffraction.

It was commissioned for the 2015 Dublin International Piano Competition, where it was brilliantly played by three of the finalists: Alexander Beyer, Alexander Bernstein (who was awarded the RTE Lyric FM Prize for his performance) and overall winner Nathalia Milstein, whose competition performance is featured on this recording and who has subsequently performed it many times.

It is structured loosely as a form of "variations on a ground" though the underlying theme is not always explicitly present in each variation.

It opens in the lowest register of the piano and gradually the ground filters through the other registers producing different harmonic implications and different timbres. Just as different colours appear in the spectrum when light encounters an obstacle, so there is a correlation between the various registers on the piano and the harmonic spectrum.

LUCA (2017)

For the Hard Rain Soloist Ensemble

The title refers to the conjectured Last Universal Common Ancestor; a single cell organism that lived between 3.5 and 3.8 billion years ago and is the most recent ancestral organism from which all life on Earth is descended. Tyndall was a passionate advocate of Darwin's theory of evolution. The idea that all living things are related—if somewhat distantly—had, and continues to have, profound philosophical consequences.

In this piece, I sought to reflect this fundamental interconnectedness by using material that, although superficially contrasted, is all derived from a single source; as with much of my recent work that source is the harmonic series.

The material is in a constant state of flux, of “becoming”. The opening is deliberately amorphous and chaotic; clusters in the extreme upper register of the piano are combined with high string harmonics and diffuse noise effects. Discernible pitches begin to appear, first individually then in small groups. These “germs” gradually grow and spread out, eventually encompassing the ensemble's entire combined tessitura. Eventually the texture thins out again, as the individual pitches combine into recognisable thematic gestures. These then undergo their own development, as the “new” materials take on their own life. After reaching a peak of complexity, the music gradually dissipates until the piece ends in silence.

Calorescence (2013)

“Calorescence” was the term—analogueous to *fluorescence*—coined by Tyndall for the supposed process by which matter absorbs infrared radiant energy and emits visible light in its place. Although later research showed that this is not a single phenomenon, being accounted for by any of several processes, I chose it as a title both to honour Tyndall's achievements and because it is analogueous to some of the processes that generate the musical material in the piece; in particular, the constant transformation of deliberately blurred and amorphous material introduced in the lowest register of the piano to produce melodic and harmonic material across the full

range of the instrument.

Sun of Orient Crimson with Excess of Light (2020)

Although remembered mainly as a scientist and mountaineer, Tyndall was also a poet, inspired by his avid reading of Shelley, Keats, Byron, Wordsworth, Cowper, Campbell, Burns and, especially, Tennyson, Emerson and Goethe. His own forays into writing poetry started early in his career.

The particular inspiration for this piece is a passage from Tyndall's poem *A Morning on Alp Lusen*, from the final section of his 1882 collection of essays and memoirs, *New Fragments*, evoking his sense of wonder at the majesty of the landscape; images of sheer, steep declines, the hot sun and lush vegetation.

The sun has cleared the peaks and quenched the flush

Of orient crimson with excess of light.

The tall grass quivers in the rhythmic air

Without a sound; yet each particular blade

Trembles in song, had we but ears to hear.

The hot rays smite us, but a quickening breeze

Keeps languor far away. Unslumbering,

The soul enlarged takes in the mighty scene.

The plummet from this height must sink afar

To reach yon rounded mounds which seem so small.

Musically, this suggested the idea of combining the conventionally played live piano against a range of sampled and treated “extended” piano sounds on tape, especially timbres obtained from inside the piano: plucked and muted strings, harmonics, bowed sounds...

This piece was written for Isabelle O'Connell, who has made a speciality of works for electronics and piano, who gave the premiere in March 2020, at the *Finding A Voice* Festival, in Clonmel. My thanks to festival directors,

Róisín and Cliona Maher and to sound engineer Eoin Barry. It was subsequently honoured as Outright Winner of the Composition Prize at the IX ULJUS International Piano Competition, Smederevo, Serbia, in 2022. It is dedicated with grateful thanks and appreciation to Isabelle.

Cello Concerto - *Excursions and Ascents*

This concerto takes its title from Tyndall's 1860 book on mountaineering, *The Glaciers of the Alps, Being a Narrative of Excursions and Ascents, an Account of the Origin and Phenomena of Glaciers and an Exposition of the Physical Principles to Which They Are Related*. Again, the title should not be seen as directly programmatic, save perhaps for the idea of a solitary explorer overwhelmed by the vastness of his surroundings. The inspiration in this piece was rather the illustrations which Tyndall (an expert draughtsman in addition to his other achievements) provided of the glacial landscapes, in particular the "frozen wave" ice formations of the "Mer de glace".

The concerto is in three sections, played continuously. In the first, the soloist engages in dialogues with the various sections of the orchestra. This is perhaps the only "programmatic" part, with the soloist/explorer encountering different terrains and challenges as he ascends. The second section is a reflection on the play of light on the ice. The cello plays almost entirely on high harmonics, while the stillness of the scene is portrayed by the use of sustained bowed percussion effects. The concerto ends with a depiction of the slopes and the peaks and troughs of the landscape, in all its beauty and its violence.

The concerto was commissioned by the RTÉ National Symphony Orchestra of Ireland for their principal cellist Martin Johnson, to whom it is dedicated. Many thanks to Martin, the NSO and to conductor Gavin Maloney.

Gráinne Mulvey

NATIONAL SYMPHONY ORCHESTRA IRELAND



The National Symphony Orchestra has been at the centre of Ireland's cultural life for 75 years. Formerly the RTÉ National Symphony Orchestra, it was founded in 1948 as the Raidió Éireann Symphony Orchestra. In 2022, the Orchestra transferred from RTÉ to the remit of the National Concert Hall.

Resident orchestra of the National Concert Hall since its opening in 1981, it is a leading force in Irish musical life through year-long programmes of live music – ranging from symphonic, choral and operatic to music from stage and screen, popular and traditional music, and new commissions – alongside recordings, broadcasts on RTÉ and internationally through the European Broadcasting Union. Its innovative educational projects and mentoring scheme for young musicians extends the orchestra's reach.

Since making his debut as Chief Conductor in 2019, Jaime Martín has broadened the orchestra's repertoire and responded to the Covid-19 pandemic with an admired series of live-streamed concerts that reached new audiences at home and abroad. The NSO's acclaimed catalogue of recordings – on the RTÉ lyric fm, Naxos, BIS and Toccata Classics labels among others – include core works by Rachmaninov, Mendelssohn and Nielsen, the complete symphonies of Malcolm Arnold, and *Composers of Ireland*, a landmark series co-funded by RTÉ and The Arts Council. Other major recordings include Robert O'Dwyer's Irish-language opera *Eithne* (in partnership

with Irish National Opera), José Serebrier's *Symphonic BACH Variations*, the world premiere of Gerald Barry's *The Bitter Tears of Petra von Kant* (co-commissioned by RTÉ and English National Opera).

Recent significant events include a concert presentation of Raymond Deane's *The Alma Fetish* in association with the National Concert Hall, Mary Black *Orchestrated*, and the Irish premieres of Wagner's *Tristan and Isolde* and John Adams' Nixon in China with *Wide Open Opera*. Film and television scores include composer-conductor Michael Giacchino's *Lost in Concert* and directors John Boorman's *Queen and Country* and Lenny Abrahamson's *The Little Stranger*. The 2022/2023 season saw the NSO celebrate its own 75th birthday and Ireland's 50 years in the European Union, and make long-overdue returns to Cork, Galway, Waterford and Wexford.

With more than 30 concerts and assorted events for families and schools, the 2023/24 season includes concerts in Dublin, Limerick, Waterford and Galway, with Jaime Martín conducting nine concerts, including the season's curtain raiser, Berlioz's spectacular *Symphonie fantastique*, and its finale, Verdi's towering Requiem. A highlight promises to be his reuniting with flamenco virtuoso Rebeca Sanchez for their return to Falla's flamenco-infused *El amor brujo* (Love, the Magician), a huge hit when streamed during the pandemic lockdown.

The season will see debut appearances by mezzo-soprano Elina Garanča, cellist Sheku Kanneh-Mason, and pianist Wayne Marshall, with a host of top-tier conductors and musicians returning, including conductors Marin Alsop, Maxim Vengerov, Leonard Slatkin, Mihail Gerts and Anja Bihlmaier, soprano Danielle de Niese, pianists Gabriela Montero and Barry Douglas, and violinist Ray Chen. Making their NSO debuts are exciting new talents violinists Karen Gomyo and Leia Zhu, and conductor, Julio Garcia-Vico.

The cream of Irish artists will be in plentiful abundance, with appearances by sopranos Ailish Tynan, Celine Byrne and Claudia Boyle, mezzo-sopranos Niamh O'Sullivan and Paula Murrihy, tenor Gavin Ring, baritone Benjamin Russell, pianist Finghin Collins, Mark Redmond on uilleann pipes, Catriona Ryan and Emer McDonough on flute, harpist Triona Marshall, vocalist Rita Connolly,

and conductor David Brophy. Irish composers also feature prominently, with music by Irene Buckley and Linda Buckley, Siobhán Cleary and Ina Boyle, two NSO commissioned world premieres by Brian Byrne and Shaun Davey, and the Irish premiere of Gerald Barry's double bass concerto, *From The Bitter Tears of Petra von Kant*.

The season's other premiere is the first performance in Europe of Australian composer Joe Chindamo's trombone concerto, *Ligeia*. In the centenary year of his death, Dublin-born Charles Villiers Stanford is remembered in the three-concert series, Stanford 100, and we celebrate the 175th anniversary of the Royal Irish Academy of Music

NATHALIA MILSTEIN, PIANO



Born in 1995 to a family of musicians, Nathalie Milstein started the piano at the age of 4 with her father Serguei Milstein, and completed her studies with Nelson Goerner at the Geneva Haute Ecole de Musique as well as with Sir Andrés Schiff at the Barenboim-Said Akademie in Berlin.

Nathalia launched her international career in 2015 by winning 1st Prize at the Dublin International Piano Competition and has since then been invited to renowned halls such as the Victoria Hall in Geneva, the National Concert Hall in Dublin, the Zankel Hall in New York, the Wigmore Hall in London, the Gewandhaus in Leipzig, the Pierre Boulez Saal in Berlin or the Radio France Auditorium in Paris, as well as to perform with orchestras such as the Radio France Philharmonic

Orchestra, the WDR Sinfonieorchester, the Orchestre de la Suisse Romande, the RTÉ National Symphony Orchestra, the Orchestre de Paris, the Deutsche Kammerakademie Neuss, the Boulez Ensemble, the Paris and Geneva Chamber Orchestras, with among other conductors Jonathan Nott, Mikko Franck, Matthias Pintscher, John Storgårds, Christoph Koncz or Arie van Beek. In 2017 she was also awarded the Young Soloist Prize by the Médias Francophones Publics.

Throughout her studies, Nathalie Milstein has received valuable advice from renowned professors and pianists such as Daniel Barenboim, Menahem Pressler, Mikhail Voskressensky, Emanuel Krasovsky, Elena Ashkenazy, Jan Wijn or Enrico Pace.

Nathalia performs in France and abroad, giving recitals all over Europe, appearing in major festivals such as Klavier-Festival Ruhr, La Roque d'Anthéron, Piano aux Jacobins, the Hitzacker Summer Music Festival, Flâneries Musicales de Reims, Grachtenfestival, New Ross Piano Festival, Zaubersee Festival or Radio France Festival.

In 2021/22, Nathalie has been playing in various venues across Europe as part of the "Building Bridges" concert program curated by Sir Andrés Schiff.

A keen chamber musician, Nathalie also performs regularly with renowned musicians and is invited to international chamber music events, such as the Jerusalem International Chamber Music Festival, Berlioz Festival, Festspiele Mecklenburg-Vorpommern, Intonations Festival in Berlin, the West Cork Festival in Ireland, Lavaux Classic in Switzerland, the Schiermonnikoog Festival in the Netherlands. She also appears on the last CD recording of the Prazak Quartet dedicated to works of Smetana.

Furthermore, Nathalie owns already a rich discography : supported by the Safran Foundation (Paris) and the Foundation "Tempo" (Geneva), Nathalie's debut solo CD, featuring works of Prokofiev and Ravel, was released in 2018 on Mirare. Her second album « Visions Fugitives » was released in September 2021 and was awarded the critic's prize « Choc Classica » as one of the best recordings of 2021. She also recorded Stravinsky's

Capriccio with Mikko Franck and the Radio France Philharmonic Orchestra, released on Alpha Classics in September 2022 as part of an album dedicated to the composer.

For several years she has been playing in duo with her sister violinist Maria Milstein, with whom she recorded two albums together - "La Sonate de Vinteuil" (2017) and "Ravel Voyageur" (2019) - both on the French label Mirare and praised by international critics.

HARD RAIN SOLOISTENSEMBLE



Hard Rain Soloist Ensemble is a world class group of musicians based in Belfast, dedicated to the performance of modern and contemporary music. The ensemble was founded by composer Greg Caffrey in 2013 and recently celebrated their 10th anniversary season.

In addition to their well-established concert series at home, and having performed at major festivals around Ireland, Hard Rain have also featured internationally at Musicahora Festival (Chile), Nieuwe Noten concert series (Amsterdam) and at Birmingham Conservatoire (UK), often incorporating workshops and masterclasses. As Ensemble in Residence at Queen's University Belfast, Hard Rain are dedicated Industry Professionals and are based at the Sonic Arts Research Centre, a state of the art facility opened by Karlheinz Stockhausen in 2004.

Hard Rain's mission is to give a platform and visibility to

the vibrant community of local composers, performing their work alongside the music of leading exponents of contemporary music worldwide. Through extensive commissioning and programming of cutting edge contemporary music, HRSE gives audiences access to music and composers' voices that would otherwise not be heard. The group's activities serve as a showcase for the talent of highly specialist performers, inspiring and developing the next generation of composers, musicians and audiences through innovation, ideas and enthusiasm.

THÉRÈSE FAHY, PIANO



Dublin-born Thérèse Fahy, one of Ireland's foremost pianists, enjoys an active performing and teaching career at home and abroad. Her regular recital and concerto appearances throughout Europe and the United States have met with critical acclaim, as have her numerous broadcasts for both RTÉ and BBC.

In recent years, Thérèse has toured the east coast of the United States, with a recital-programme of solo Irish contemporary piano music supported by Culture Ireland and the Fulbright Commission, and in 2012 with performances of the 24 Debussy *Préludes*, to celebrate the 150th anniversary of the composer's birth. This programme was toured extensively through Europe and Ireland.

Other engagements over recent years have included solo recitals, lecture-recitals and masterclasses in France, UK,

Italy, Poland, Spain, Portugal, USA, the Czech Republic, Holland, Israel, Ethiopia and Ireland, as well as serving on international juries including Dublin International Piano Competition, the Manchester International Concerto Competition in Great Britain, the Baltic International Piano Competition and the Scriabin International Piano Competition, Italy.

Thérèse Fahy, as the only professional Irish pianist to specialise in the performance of French music, has performed the complete works for solo piano by Debussy at Dublin's Hugh Lane Gallery. She has also recorded a documentary, 'The Snow is Dancing', on his life and piano music for Ireland's national broadcasting station, RTE Lyric FM. She is particularly identified with the performance of Olivier Messiaen's piano music, having given the Irish premieres of *Reveil des Oiseaux* (2008) with the National Symphony Orchestra of Ireland, under its Principal Conductor, Gerhard Markson, at Dublin's National Concert Hall, and, *Visions de l'Amen* (1990) for two pianos. Her performances of the solo works of Messiaen have been described by The Irish Times as a "tour de force".

In 2014, Thérèse received a major Music Project Award from the Arts Council for her especially commissioned collection of six solo piano pieces for small hands, entitled *Handprint*, from Irish composers Bill Whelan, Raymond Deane, Siobhan Cleary, Michael Holohan, Grainne Mulvey and Benjamin Dwyer. The world première recital of all six pieces was an acclaimed highlight of the New Music Dublin Festival in March 2014, followed by a uniquely curated series (*Handprint: Before and Beyond*, incorporating each new piece into a non-contemporary recital setting) in Dublin's Hugh Lane Gallery. *The Handprint Collection* was recorded by RTE Lyric FM, and was broadcast over six weeks at the end of 2014.

In 2018, one hundred years after the death of Claude Debussy, Thérèse Fahy, with the support of another Music Project Award from the Arts Council, brought an exciting festival to the National Concert Hall, Dublin in May and June 2018, and the Centre Culturel Irlandais, Paris in October 2018. Entitled '*Ireland's Tombeau to Debussy*', the series of three concerts in both cities included world-premières of seven newly-commissioned Irish works

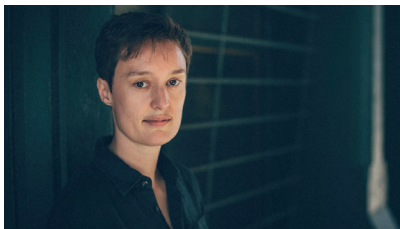
inspired by Debussy, as well as performances of the original 1920 '*Tombeau de Debussy*', interwoven with Debussy's own masterpieces. Thérèse also performed a solo recital at Debussy's birthplace, La Maison Natale de Claude Debussy, on March 25th 2018, the anniversary-day of the composer's death.

In November 2019, the French Government bestowed on Thérèse Fahy the award of *Chevalier des Arts et des Lettres*.

2024 engagements include recitals of the 24 Debussy Preludes at the Steinway Artists' Series in Florida and at the birthplace of Debussy in Saint Germaine-en-Laye, France.

A graduate of Trinity College Dublin, a Fulbright scholar, French Government scholar and Italian Government Scholar, Thérèse Fahy is Professor of Piano at the Royal Irish Academy of Music, and former Director of Chamber Music there for ten years. Her students have been First Prizewinners and Finalists in many international competitions, including the Shanghai International Piano Competition, Hammamatsu International Piano Competition, EU International Piano Competition, the Hong Kong International Piano Competition, the Maria Canals Competition in Barcelona (2012), the Beethoven Competition in Bonn (2013), César Franck Competition in Brussels

ISABELLE O'CONNELL, PIANO



Since her New York debut recital at Carnegie's Weill Hall in 2002, Dublin-born pianist Isabelle O'Connell has developed an international career that has taken her across four continents. As soloist and chamber musician she has performed around the United States, Canada, Japan, Australia, New Zealand, France, Germany, Italy, U.K. and Ireland, to venues such as Lincoln Center, the Kennedy Center, Chicago Cultural Center, Cleveland Museum of Art, Detroit Institute of Art, the Gilmore Keyboard Festival, Belfast Festival, St David's Hall, Cardiff and the National Concert Hall, Ireland.

Receiving a standing ovation at her New York Debut recital at Carnegie Hall's Weill Recital Hall in January 2002, the New York Concert Review wrote: "She has the technical prowess... and a spirit and intelligence to bring it all together." Isabelle has a reputation for being a dynamic interpreter and energetic advocate of music by 20th and 21st century composers, regularly commissioning and premiering new works. She has worked with John Adams, John Luther Adams, Meredith Monk, Julia Wolfe, Michael Gordon, Missy Mazzoli, Morton Subotnick, Kevin Volans, Bunita Marcus, Donnacha Dennehy, Dan Trueman, amongst many others. In 2007, Isabelle was co-Artistic Director of "New Music, New Ireland, New York", a concert that showcased contemporary Irish composers at Carnegie's Weill Recital Hall. Her debut solo album RESERVOIR featuring solo piano music by contemporary Irish composers was released to critical acclaim in 2010 and the New Yorker called her "the Irish piano phenom".

As concerto soloist Isabelle has performed with the National Symphony Orchestra of Ireland under conductors William Eddins, Gerhard Markson and Gavin Maloney. Her recording of Kevin Volans' Concerto No. 1 for Piano and Winds with the NSO was released on the Lyric FM label in 2014. Most recently Isabelle premiered Kevin Volans' Concerto No.4b with the RTÉ Concert Orchestra at the New Music Dublin festival in 2023.

Isabelle is co-founder of GrandBand, New York's new music piano sextet, described by the New York Times as: "six of the finest, busiest pianists active in New York's contemporary-classical scene". Making their debut at the Bang on a Can Marathon in New York in 2012, they have since performed around the United States and U.K. at the

Detroit Institute of the Arts, the Gilmore Piano Festival, Le Poisson Rouge, New York, the Rite of Summer Music Festival, Vale of Glamorgan Festival, Sheffield University and Cornerstone Festival, Liverpool. In 2018 Grand Band was the recipient of a Chamber Music America commissioning grant for a new work by Missy Mazzoli.

As chamber musician, Isabelle has performed with John Adams at Carnegie's Zankel Hall, with Meredith Monk at the Bang on a Can Summer Festival and with the New Zealand String Quartet at the Banff Centre for the Arts in Canada. Isabelle has performed with CRASH ensemble, joining them on tours of Australia and the United States, performing at the Canberra International Chamber Music Festival, Sydney Conservatoire, Kennedy Center, Princeton University, Peak Performances Montclair, Virginia Tech, Le Poisson Rouge in New York and the Galway International Arts Festival, Reich Effect Festival and Sounds of a Safe Harbor Festival, Ireland. She is currently a member of Evlana ensemble and has performed with Alarm Will Sound, Contemporaneous, the Da Capo Chamber Players, American Symphony Orchestra, Friends of MATA ensemble, Ergodos ensemble, the New Zealand and ConTempo String Quartets.

Isabelle has also worked with: Grammy award-winning vocalist Susan McKeown, featuring on her album *Singing in the Dark*; Nate Wooley on *Seven Storey Mountain VI* recorded on Pyroclastic Records; and with composer Jenny Olivia Johnson on several albums for Innova Records.

In addition to winning an award from Artists International in 2001, Isabelle was the recipient of the Tibor Paul Medal, the 1998 Mabel Swainson Pianoforte Award at the Feis Ceoil (which led to her debut recital at the John Field Room in Dublin) and the Ulster Bank Music Foundation Piano Award (making a television appearance on the "Late Late Show"). Some of her other awards have included a Fulbright scholarship, Bank of Ireland Millennium Scholarship, John F. Kennedy scholarship, Music Network Touring awards and multiple awards from the Irish Arts Council and Culture Ireland.

Isabelle has recorded for the Diatribe, Innova, NMC and Lyric fm labels. She has appeared on television and

radio on both sides of the Atlantic, with performances broadcast on WNYC, WQXR, WFMT Chicago, BBC3, RTE, TV3 and Lyric FM radio.

Isabelle currently serves on the faculty of Bard College and Conservatory of Music (NY) as Artist-in-Residence. She is also a faculty member at The Diller-Quaile School of Music in New York City. She is a former faculty member of the Manhattan School of Music Prep and the Kaufman Center's Lucy Moses School, NY. Isabelle has given masterclasses and workshops around the world, including at Princeton University, Queen's University Belfast, Montclair University, the New Zealand School of Music, Dublin Institute of Technology and the European Piano Teachers' Association.. Isabelle is a graduate of the Manhattan School of Music and the Royal Irish Academy of Music in Dublin. She also studied privately with Zitta Zohar in New York.

MARTIN JOHNSON, CELLO



Martin studied Cello at the Royal College of Music, London under the direction of Anna Shuttleworth, a former student of Pablo Casals, Andrew Shulman, Principal Cello – The Philharmonia Orchestra, and the British Soloist Alexander Baillie.

In 2000, he joined the RTÉ National Symphony Orchestra and has been their Section Leader for almost two decades – broadcasting most of the orchestral cello solo repertoire to date. In 2006 Martin was invited to become a lifetime member of the World Philharmonic

Orchestra and is also a regular Guest Principal with the major orchestras in Ireland and the UK.

Martin made his Irish debut as a soloist with the RTÉ National Symphony Orchestra in January 2008, performing Saint-Saëns' *Concerto No. 1 in A minor, Op.33* and has appeared as soloist with the NSO on more than twenty occasions since then.

Under the esteemed direction of Conductors Sir Kenneth Montgomery, Kees Bakels, Alan Buribayev, Douglas Boyd, Finnegan Downie-Deer, George Jackson, Gavin Maloney and Robert Houlihan, live solo broadcasts across Ireland and the UK have included concerti by Frank Corcoran (recorded for Lyric FM CD154, 2017), Grainne Mulvey, Anne-Marie O'Farrell, Bloch, Elgar, Robert Schumann, Tchaikovsky, Joseph Haydn, Lalo, Saint-Saëns, Sir Michael Tippett, Delius, Corelli, Jacques Ibert, Beethoven's Triple Concerto and notably Richard Strauss's finest tone poem 'Don Quixote' op.35 for 'Cello and Orchestra with the RTÉ NSO and Maestro Pascal Rophé at Ireland's National Concert Hall, Dublin.

Martin began teaching in Ireland in 2006 and many of his students have gone on to lead the cello in NYOI, win international competitions (most recently The Royal Overseas League Chamber Music Prize 2022) as well take up scholarships for further study in European and UK Conservatoires. He has enjoyed teaching at the Royal Irish Academy of Music since 2020 – both RIAM Junior and Degree level students – and is focussed on the RIAM Professional Mentorship programme for post-graduate cellists.

Martin is a UCD Arts and Humanities Faculty Creative Fellow, a Countess of Munster Scholar, an IT President's Prize Winner (for a Thesis on Richard Strauss's Don Quixote) and has been supported by the Musical Instruments Loan Fund and Music Network's Music Capital Scheme in Ireland. He plays a fine cello by Thomas Kennedy of London c.1810 and an exquisite bow by legendary archetier Eugene Sartory made for the World Exhibition of 1908 in Paris/London.

GAVIN MALONEY, CONDUCTOR



Gavin Maloney is Associate Principal Conductor of the RTÉ Concert Orchestra. He also has a long-standing relationship with the National Symphony Orchestra and Choirs. He received his training at the Royal Northern College of Music in Manchester and the Mozarteum, Salzburg. At the age of 21 he successfully competed for the position of Assistant Conductor of the then RTÉ National Symphony Orchestra. He was the inaugural beneficiary of the Bryden Thomson Trust, through whose support he studied at the Danish National Opera and the Lucerne Festival Academy of Pierre Boulez.

Gavin has conducted all the leading orchestras and ensembles in Ireland. He has also conducted in Germany, France, Italy, and the UK. He has made many distinguished collaborations with artists including Gabriela Montero, Tara Erraught, Barry Douglas, Ailish Tynan, John O'Connor, Chloë Hanslip, Hugh Tinney and Sir James Galway. In 2017 Gavin featured for the first time in the International Concert Series of Dublin's National Concert Hall, appearing with Maxim Vengerov, who has described him as 'a great maestro'.

Gavin's recordings, on the NMC and Lyric FM labels, have earned critical acclaim, including that of *Gramophone* magazine. His live recording of Nicola LeFanu's *Threnody* (NMC) was recently released. Gavin has worked closely with Crash Ensemble and the EQ Ensemble, and for three years he directed the National Symphony Orchestra's signature contemporary music series, *Horizons*. His

ballet credits include *Swan Lake* with the RTÉ Concert Orchestra and Ireland's national ballet company. Gavin's concerts have been broadcast by the BBC, RTÉ, the European Broadcasting Union, Shanghai East Radio, and radio stations in North America and Australia.

Gavin lectures in Conducting and Analysis at the RIAM.

SINEAD HAYES, CONDUCTOR



Irish orchestral conductor Sinead Hayes is emerging as one of Ireland's leading interpreters of contemporary music and opera, with a particular interest in the work of emerging and established Irish composers. She is a Britten Pears Young Artist 23/24, participating in The Conductor as Dramaturg course run by the Royal Opera House and Britten Pears Arts, with conductors Sian Edwards & Kanako Abe. From January 2024 she is a member of the Royal Philharmonic Society's Women's Conducting Excel Programme run with the Royal Northern Sinfonia.

The 2023/24 season is her tenth as conductor of the Hard Rain Soloist Ensemble (HRSE) in Belfast, and her third season as conductor of the Royal Irish Academy of Music Symphony Orchestra. In February 2022 she was appointed principal guest conductor of Galway's professional orchestra The Luminosa String Orchestra.

She has worked with all the major professional orchestras in Ireland including the Ulster Orchestra, RTE Concert Orchestra, Irish Chamber Orchestra & National

Symphony Orchestra. In opera she has conducted productions for Northern Ireland Opera, Irish National Opera and Opera Collective Ireland.

She completed her MMus in conducting at the Royal Northern College of Music and her BMus in violin and composition at City University, London. Sinead also participated in masterclasses with Johannes Schlaefli, Sylvain Cambreling & Sir Roger Norrington among others. In 2014 she was one of three finalists in the Interaktion Conducting Workshop, chosen by the players of the Critical Orchestra Berlin (leader: Lothar Strauss), whose players are drawn from the Berlin Staatskapelle and Berlin Philharmonic Orchestras. She has worked as assistant conductor to James Lowe (Halle Harmony Orchestra), Alex Ingram (British Youth Opera), André de Ridder (Irish National Opera) and others.

Sinead's award winning education work has been funded by the Irish Arts Council (Agility Award & Artist Bursary) and the Galway County Arts Office, and includes two projects for youth string orchestras fusing classical and Irish traditional music "The Baroque Session" and "Carolan's Rambles"

Sinead divides her time between Galway, Belfast and London, and is also active as a violinist, performing with various chamber ensembles.

www.sineadhayes.net

DR NORMAN MCMILLAN



Dr Norman McMillan a Canadian whose professional training was in the UK, working and developing products, prototypes that in retrospect are of some international importance. He qualified with a German style Diplom-Ingenieur B.Sc. degree from Portsmouth University that included four industrial training periods where he made some significant contributions. These contributions chronologically were: 1964 National Physics Laboratory with Dr Frank J.J. Clarke one of the first chopped-beam UV-visible spectrometer; 1965 Royal Radar Establishment (RRE) in Malvern developing the etching of the junction for the world's first solid state gallium arsenide laser working under with Cyril Hilsom (1925 -) and Rodney Loudon (1934-2022) and importantly, his technique revealed the reason for the IR oscillations and failure of lasing of these devices with work connected to J B Gunn (1928-2008) in his development of what was called "Gunn-diodes"; 1966 Ferranti Ltd. developing industrial ferrite communication switching devices; 1967 ICL Ltd subsidiary of Elliott Automation Ltd. inventing a non-volatile memory system using permalloy layered structured. In 1970 he obtained a PhD from Nottingham University Andrew's Magnetic Resonance Group supervised by Stan Clough and entitled 'Electron Spin Resonance Study of Tunnelling Rotation of Methyl Groups'. Here he attempted the radical development of quantum-to-classical spectral switching by pressure transitioning modulating the spectral state established by existing temperature control systems.

McMillan's professional career begun in Ireland with appointed in 1969 as the first-ever Post-Doctoral Fellow in Dublin University. This project notably was a successful nationally important project 'commercial project in which he identified the manufacturing problem for carpet fibres and other polypropylene extrusions in Irish Ropes Ltd. in Newbridge. Subsequently, he was the first-ever lecturer in the entire RTC-system in 1972 to be given a contract to undertake research on his appointment as Head of Physics specifying such work be undertaken outside of the RTC and in his own time. The initial studies in RTC Carlow were in material science extending with Irish

Ropes and later working with Jack Ryan after he founded Athlone Mouldings from his base as Production manager of Irish Ropes.

McMillan's most significant research contributions began in 1980s while working in Carlow that developed pioneering imaging products. These researches were inspired by Nottingham's Nobel Prize Winning Magnetic Resonance Imaging (MRI) work of Peter Mansfield. These product developments exploited the then unique Cambridge's Acorn Reduced Instruction Set (RISC) processor making real-time imaging possible for the first time.. This resulted from 1984 in the development of the SWIFT (First commercial European microscope camera imaging processing system); the SUCA (First-ever fully automated quality-assurance robotic crystal analysis system for microscope for sugar and industrial diamond); The patented prototype the Axial Symmetric Dropshape Analyser (ADSA) being a PC camera-analysis imaging technology for surface-science pendant and sessile droplet samples. There were in addition by the mid-1980s separate commercial 'gaming' products developed being the first-ever physics based complex sport's simulation beyond those of snooker and pool. These Sport-Champ products were based on patented keyboard overlays for surf boards and skis while the electronic controlled interfaces were required for Sailing Champ product with model sailing dinghies. The international sports associations sponsored these products. Acorn failed in 1981 making commercial exploitations impossible despite an impressive array of products, which were all described in the published literature and displayed at commercial exhibitions.

McMillan is a Chartered "Optical/Electronic Engineer" and a Fellow of Engineers Ireland (via accreditation to The Institute of Electrical Engineers), a Fellow of Institute of Physics and Royal Society of Arts and Chartered Engineer, Chartered Physicist and Chartered member of European Engineering Society FEANI. In 1992 he founded the science of tensiospectroscopy in work recognized in Top Paper of the Year Award in Measurement Science and Technology (IOPP, Bristol largest selling science journal

in world). In 1996 established the Optical Engineering Society of Ireland (OESI) as the Irish Chapter of SPIE. Subsequently, in 2007 June he reported the first-experimental observations of protein multilayers and many droplet effects including surface guided waves and the dynamic monitoring of protein reformation and crystallisation on polymer substrates. The paper was rejected in 2006 by editor who refused to accept that bilayer existed as claimed. This paper was submitted to Colloids and Surfaces A Physicochemical and Engineering Aspects A, but following subsequent reports of bilayers of protein by another leader in the field, this paper was published in a special edition of this journal: The work at thus time was still in advance of the published reports as this tensiography study reported both bi and tri layers of the protein BSA and in addition reported monitoring of all the crystallisation processes. This is a major contribution to nanoscience and science.

McMillan has many patents and commercialised for each products. The products including the recent nanotensiospectroscopic Raman and Fluorescence "Flipper" instruments. The most important patent he has developed is a new quantitative method for spectroscopy to replace the famous Beer Lambert law working above and vitally, below the diffraction limit. McMillan's technology has led a successful 5thFramework EU Project AquaSTEW (Surveillance Techniques for Early Warning) and he supervised 12 PhDs in the decade from 1998 when IT Carlow first registered postgraduate students until his retirement. He published as one of the Chairs of the MP1106 Smart and Green the Review paper for that Action in Colloid and Surfaces and as Chair of the workgroup in MP1308 defined a new objective approach to defining the training of ESRs in nanoscience in the EU library and information journal Liber Quarterly. The three volume De Gruyter textbook (Berlin, 2022-23) on "Optical Nanospectroscopy" has been published. McMillan led in the IT Carlow the development of the first comprehensive suite of photonics and Optical Engineering courses for technician, technologist, degree and professional level researchers. With exactly 150 graduates from a joint B.Sc. in Physical Optoelectronics

developed by Carlow and Essex University in a decade from 1990 it was notable for being without a single failure. After that programme came to an end, McMillan in the Institute of Technology Carlow was Chair of two Bachelor in Engineering submissions in 'Optical Engineering' and 'Electronics Engineering' with the former being the first such Chartered Engineering programme in Europe.

McMillan is well recognised for his pioneering work in the Carlow Tyndall-Dargan Committee that from 1972 transformed the appreciation of the Irish S&T heritage with numerous publications on Irish S&T including the Millennium book "Prometheus's Fire: History of Irish Technological Education from Earliest Times" (Carlow, 2000) presented to all technological schools in Ireland by Irish Vocational Education Committee. The landmark book on John Tyndall: Essays on a Natural Philosopher (The 250th Anniversary RDS Book) remained as the chief Tyndall reference perhaps until Jackson's recent biography of the Carlowman. He was Director of the Tyndall Centenary in 1993 run by the County Council and Royal Institution of GB. He was founder of the National Committee for Commemorative Plaques in Science & Technology (NCCPST) established in 1997 by Bord Fáilte and based in TCD and Carlow. The NCCPST now boasts over 80 national plaques erected to Irish men and women that have made an international contribution to science and technology. His work in education, research, extends to popularisation of science via 'amongst other things the annual National Tyndall Schools Lecture Series established in 1977 with then Sir George Porter then President of the Royal Society and Director of the RI which ran from 1981 and extended in 1983 to the IOP School lecture Series for UK. He is a founder of the Green Party in Ireland and Carlow Kilkenny Green Party. Two of his pupils Henry Byrne and Emma Donnellan were supreme champions in the 1986 Young Scientist of the Year.

McMillan is the chief-editor of a series of articles documenting the Carlow VEC background history of the Regional Technological Colleges, which was republished in full as the introduction to the 'History of the Carlow

VEC'. This study formed Part 1 of the Carloviana series on the 'History of the RTC and IT Carlow' now running to thirteen parts. This is the first-ever history in the world written/oral accounts by the men and women who developed the academic programmes of a third-level institute. This study details the personal accounts of the work of the leading academics in Carlow and is a unique history describing all the vital contribution from the Principal Mr John Gallagher down. The national RTC system was developed from the VEC in Carlow by its CEO Austin Waldron working with the Sugar Company. Teagasc, Keenans and Thompsons plus Engineers Ireland. It is planned that this study will run to two further parts and then will be published as a book under the title "First Amongst Equals: The History of Carlow RTC/ITC". He is the only Irish Representative of the Tyndall Correspondence Project and an editor of Volume 6 of this 21 volume series. The TCP owes a considerable debt to the Tyndall-Dargan Committee.

BEN RAWLINS, ENGINEER



Ben Rawlins is a GRAMMY award winning recording engineer and mixer. He has worked on numerous critically acclaimed albums, films, award-winning radio broadcasts, music festivals and live projects with composers and musicians from the classical, traditional, and contemporary music scenes. He has also produced content for radio, television, and online media both in Ireland and abroad, in addition to numerous projects for

individual groups and artists and is in constant demand as a recording, mixing and mastering engineer.

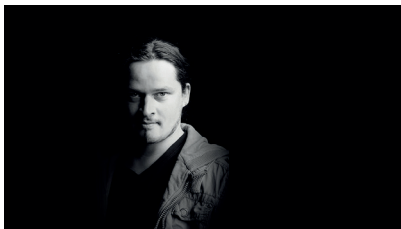
Ben has been the resident sound recordist with the TU Dublin Conservatoire since 1999. With a vast collection of new and vintage microphones, a fully treated mastering suite in Churchtown and a Prism Audio mobile system for location recordings, he can cater for any chamber or large-scale recording projects. He just recently won a Grammy for recording and mixing "They're Calling Me Home" by Rhiannon Giddens and Francesco Turrisi in the Best Folk Album Category at the 2022 GRAMMY Awards ceremony in Las Vegas.

Clients include Nonesuch Records, Audible, Universal Music, Métier-Divine Art Recordings, Big Machine Records, Oh Boy Records, RTÉ, Windmill Lane Pictures.

In May 2017 he set up Jiggery Pokery Productions, an Irish-based audio recording company with music producer Laoise O'Brien. The company specialises in location recordings of classical, traditional, and folk music.

Clients include RTÉ lyric fm, Chamber Choir Ireland, Music Network, Kilkenny Arts Festival, Music Generation, The National Youth Orchestra of Ireland, Irish National Opera, NUI Maynooth, Notre Dame University, The Pro Cathedral, Dublin, in addition to ensembles and solo artists.

MIHAI CUCU, COVER DESIGNER



Mihai Cucu was born in Romania. He holds a degree in Art Restoration and Conservation from the University of Fine Arts "George Enescu", Iasi, Romania, and he studied ceramics at Falmouth College of Arts, Cornwall, England.

Mihai has worked extensively as a video artist at festivals in many countries, including Romania, Ireland, UK, Germany, Netherlands and Greece, amongst others. He has created and presented videos for many composers and performers: International Week of New Music Festival - Bucharest, Meridian Festival, InnerSound Festival-Bucharest, Music for Galway Festival, The Galway Music Residency National Tour 'Different trains'-Ireland, Theatre of Sound - Dublin, New Music, New Audiences - Galway City Museum, Catsheuvell Festival - The Hague, De Nieuwe Regentes Theater - Netherlands, Porta Theater - Athens etc.

In addition to creating visuals for contemporary music performance and directing short films, Mihai has worked prolifically as a photographer, video editor and lecturer in iconography. Thus, creating video art, photography, filming and editing short films, painting, art restoration and teaching have consumed his recent years in Ireland. His work has been widely acclaimed both by the media and the artistic community."

GRÁINNE MULVEY, COMPOSER



Gráinne Mulvey is an Irish composer who writes for many different mediums, including acoustic, orchestral, electroacoustic, electronic, installation and operatic music. Much of her work is centred on the natural world, women's rights, politics and science as a means of inspiration. She is interested in sound for itself, particularly exploring the extremes of timbre and register and its boundaries and in the harmonic series—evident in her orchestral and electronic works.

Her music has been widely performed both in Ireland and abroad and she has received many broadcasts of her work by radio stations across the globe including RTE Lyric FM, BBC Radio 3 and 4, WRPB Radio 103FM Princeton, USA, Slovenian, German, French, Dutch Radio, New York, Columbian and Australian stations among others. One of She has been represented on the International Rostrum of Composers in 1994, 2004 and in 2015 with *Diffractions* for orchestra, in Slovenia. She was represented at the Finnish Biennale in 2002 with her work *Sextet Uno*, which was performed by the Tampere Raw Ensemble. She was a featured composer in the 2007 *Horizons* concert series, with the RTÉ National Symphony Orchestra, conductor Robert Houlihan and again in 2015 with conductor Gavin Maloney. She was selected for the ISCM World Music Days in consecutive years with *Akanos*, for orchestra (Lithuania, 2008) and *Stabat Mater*, for 17 voices a cappella (Växjö, Sweden, 2009).

She has won many prestigious competitions, nationally and internationally. She is a joint winner with visual artist Mihai Cucu, in the Music Video category of The Cutting Edge Film Festival 2016, in the USA, for her electronic piece *Proclamation*.

She won first prizes in the Academia Musica European Composition Competition in Vienna and in the Franz Schubert European Composer's Competition in September 2021 and in 2022.

She won 1st Prize and Laureate Absolute Winner prize in the IX Smederevo ULJUS International Piano Composition Competition Category IV, Serbia, for her piano and electronic piece *Sun of Orient Crimson with Excess of Light* in 2022. Her piece *Round of Applause* featured in visual artist Fion Gunn's VR piece called *Roller Coaster* was exhibited for a month at the NAMOC in Beijing, China, during February 1st, until the 1st of March 2022.

She has received many commissions and performances, notably from Concorde, the RTÉ National Symphony Orchestra, the Ulster Orchestra, the Northern Sinfonia (UK), the Romanian Radio Chamber Orchestra, the Lithuanian National Symphony Orchestra, the Hradec Králove Philharmonic Orchestra (Czech Republic), Orchestre De Lorraine, France, pianists Cheryl Pauls (Canada) and Slawomir Zubrzycki (Poland), Matthew Schellhorn, (UK), David Bremner, (UK), soprano Elizabeth Hilliard, the Chamber Choir Ireland, the Bruce Gbur Bassoon Ensemble (USA), the TampereRaw Ensemble (Finland), trombonist Barrie Webb, BlackHair (UK), the Sepia Ensemble (Poland), flautist Joe O'Farrell, cellist Martin Johnson, (principal, RTÉ National Symphony Orchestra), Palomar Ensemble (USA) Hard Rain Soloists Ensemble, MISE-EN Ensemble, Platypus Ensemble, Fergal Dowling of Music Current, soprano Alison Fisher Smart, Music Network, Culture Ireland, The Dublin International Piano Competition and Dublin International Chamber Music Festival, Culture Ireland, Splinter Reeds Ensemble, Airborne Ensemble, Darragh Morgan, violinist and Mary Dullea, pianist, among others.

Her music was recorded by the Concorde Ensemble, on the Black Box label in 1999. Her *Soundscape* for violin, cello, percussion and tape, was issued on CD by the Avantgarde Akademie in Schwaz, Austria in 1996. Akanos was included on the CD *Contemporary Music from Ireland, Vol 7* (CMC). Her piece *Calorescence*, (2013), for piano is released on the new CMC label: *New Music: New Ireland Vol. 2*. The Gothic CD released by the pianist Mary Dullea includes her piece *Étude, Phonology Garden* and *Eternity Is Now*, recorded by soprano Elizabeth Hilliard, have been issued on the CD *Sea To The West* on the Métier Label. Her portrait CD *Akanos* is out on the Navona label Cat: NV5943 by PARMA Recordings Llc, since February 2014. Her piece for installation *Aeolus* was released in 2018 on the Metier Label and another piece *Proclamation* was released on the Audior 5 volume of electronic music in Italy, Dec. 2018. She won placements on CDs for her pieces: *Interference Patterns*, *Interstices* and *The Shoulder* which were released by RMN Music Ltd in September 2018 and in 2020. Her piano piece *The Thriving Part of Ros XII* was released by the New Ross Piano Festival Committee in September 2018, her *Great Women* was released on the Métier label in 2021 and *LUCA* was released by Diatribe Records in 2021 also. Petrichor Records released *Diffractions* (2014) version and *Phonological Loop* (2012). She is represented by the CMC Ireland, AIC, IMRO, IAWM, (International Alliance for Women in Music,) BabelScores, Contemporary Music Online Library, Donne In Musica, Universal Edition and is a member of *Aosdána*, Ireland's affiliation of creative artists and was elected to the Toscaireacht in 2019. She holds a PhD from the University of York and is head of composition at TUD, Ireland.

www.grainnemulvey.eu

THANK YOU

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To Evonne Ferguson, Director of the Contemporary Music Centre many thanks for the kind permission for the release of *Calorescence*, mastered by Sound Engineer, Chris Corrigan, from new music::new Ireland two.

To Nick Roth, Director of Diatribe Records, Dublin, many thanks for the kind permission for the release of *LUCA* from the album *A terrible Beauty*, performed by the Hard Rain SoloistEnsemble, Conductor Sinead Hayes, reproduced with kind permission from Diatribe Records, Dublin. © All Rights Reserved and many thanks to the Recording Engineers: Chris Corrigan, Oisín Jayat, Chanel McManus, Caolan McCauley, Amber Rhodes, Ross Lavery, mixed by Chris Corrigan, produced by Nick Roth for Diatribe Records, Dublin at SARC, Belfast, Northern Ireland, 2020.

Many thanks to the National Symphony Orchestra of Ireland for kind permission to release *Diffractions* and the *Cello Concerto Excursions and Ascents*, recorded by

RTÉ Sound Engineers in 2015 and 2017, mastered by Grammy Award winning Sound Engineer Ben Rawlins, Jiggery Pokery Productions, Dublin, 2024. Many thanks to NSOI Orchestral Manager Anthony Long for his kindness and consideration and to Robert Read, CEO of the National Concert Hall Dublin, Ireland, for his support and kindness.

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Pietsch of BBC Radio 3.

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CARLOW COUNTY COUNCIL

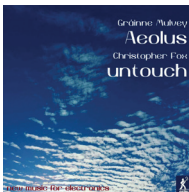
ALSO AVAILABLE FROM GRÁINNE MULVEY



Great Women Work for voice and electronics by Gráinne Mulvey Elizabeth Hilliard, soprano

“An astonishing performance of Gráinne Mulvey’s intense and impassioned song of praise. Hilliard’s wonderfully adaptable voice heighten[s] the pervasive air of urgency that Mulvey’s piece so effectively conveys.”
—Julian Cowley, *The Wire*

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Aeolus-untouch Gráinne Mulvey & Christopher Fox

“Mulvey’s attractive and satisfying exploration of this unique sound world... is music to sit back to, close one’s eyes and simply enjoy.” —John France, *Music Web International*

Métier MDS 29006

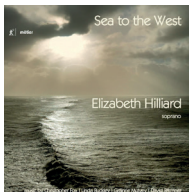


Gothic: New Piano Music From Ireland

Benjamin Dwyer, David Fennessy, Ed Bennett, Frank Lyons, Gráinne Mulvey, John McLachlan, Jonathan Nangle
Mary Dullea, piano

“Dynamically, harmonically, rhythmically gripping.” —Kraig Lamper, *American Record Guide*

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Sea to the West Contemporary Music for Voice *Christopher Fox, David Bremner, Gráinne Mulvey, Linda Buckley* Elizabeth Hilliard, soprano

“The works here are all for solo soprano. But the overall effect is anything but solo, with electronics providing independent background as well as accumulations of Elizabeth Hilliard’s pure voice.” —Michael Dervan, *Irish Times*

Métier MSV 28551

Diffractions performed by the National Symphony Orchestra, Ireland, conductor Gavin Maloney, recorded by NSOI Sound Engineers on 07-11-2017, at the National Concert Hall, Dublin, Ireland and mastered by Grammy Award Winning Sound Engineer, Ben Rawlins, Jiggery Pokery Productions, Dublin, Ireland, March 2024.

Interference Patterns performed by Pianist Nathalia Milstein, recorded by NSOI Sound Engineers on 23-05-2015, at the National Concert Hall, Dublin, Ireland, as part of the Dublin International Piano Competition and mastered by Director Rick Romano of RMN Music, UK.

LUCA performed by the Hard Rain SoloistEnsemble, Conductor, Sinead Hayes, recorded and mastered by Sound Engineer Chris Corrigan, Belfast, Northern Ireland, at the Sonic Arts, Research Centre, (SARC,) Queen's University, Belfast, Northern Ireland, 19-01-2021 on the Diatribe Records label. LUCA reproduced with permission from Diatribe Records, Dublin. © All Rights Reserved.

Calorescence performed by Pianist Thérèse Fahy and recorded and mastered by Sound Engineer Chris Corrigan, Belfast, Northern at the Sonic Arts, Research Centre, (SARC,) Queen's University, Belfast, Northern Ireland, 25-09-2014, on the Contemporary Music Centre CD collection; New Music Ireland, Volume 2.

Sun of Orient Crimson with Excess of Light performed by Pianist Isabelle O'Connell, at St. Mary's Church, Clonmel, Ireland, as part of the Finding A Voice festival, 07-03-2020, recorded and mastered by Sound Engineer Eoin Barry, tape part mastered by Sound Engineer Kevin Mulvey, remastered by Rick Romano, of RMN Music, UK.

Cello Concerto - Excursions and Ascents performed by Martin Johnson, Cello and the National Symphony Orchestra, Ireland, conductor Gavin Maloney, recorded by NSOI Sound Engineers on 13-01-2015, at the National Concert Hall, Dublin, Ireland as part of the Horizons Contemporary Music Series and mastered by Grammy Award Winning Sound Engineer, Ben Rawlins, Jiggery Pokery Productions, Dublin, Ireland, March 2024.

All works published by CMC Ireland, BableScores.

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