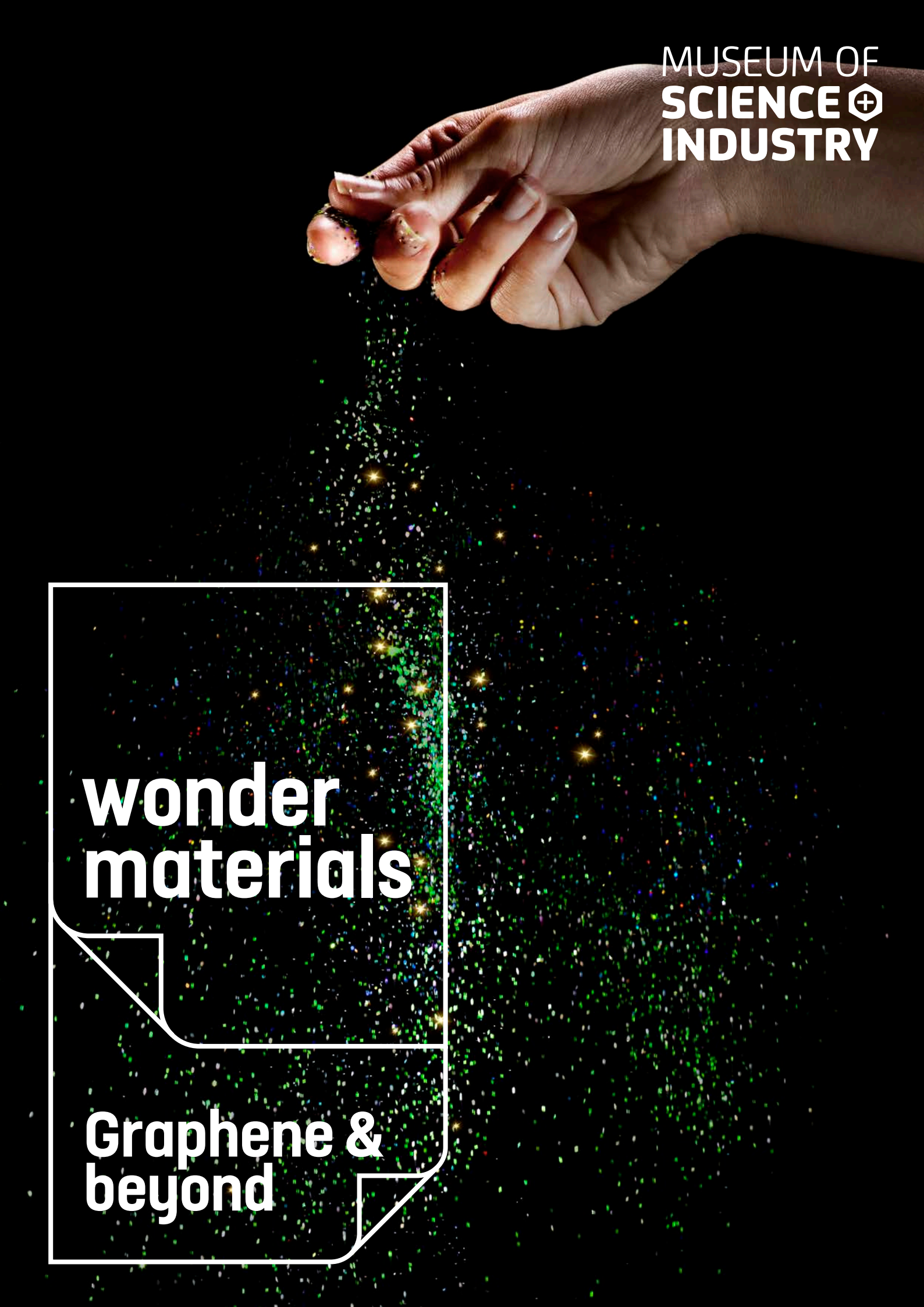
MUSEUM OF SCIENCE + INDUSTRY



wonder materials

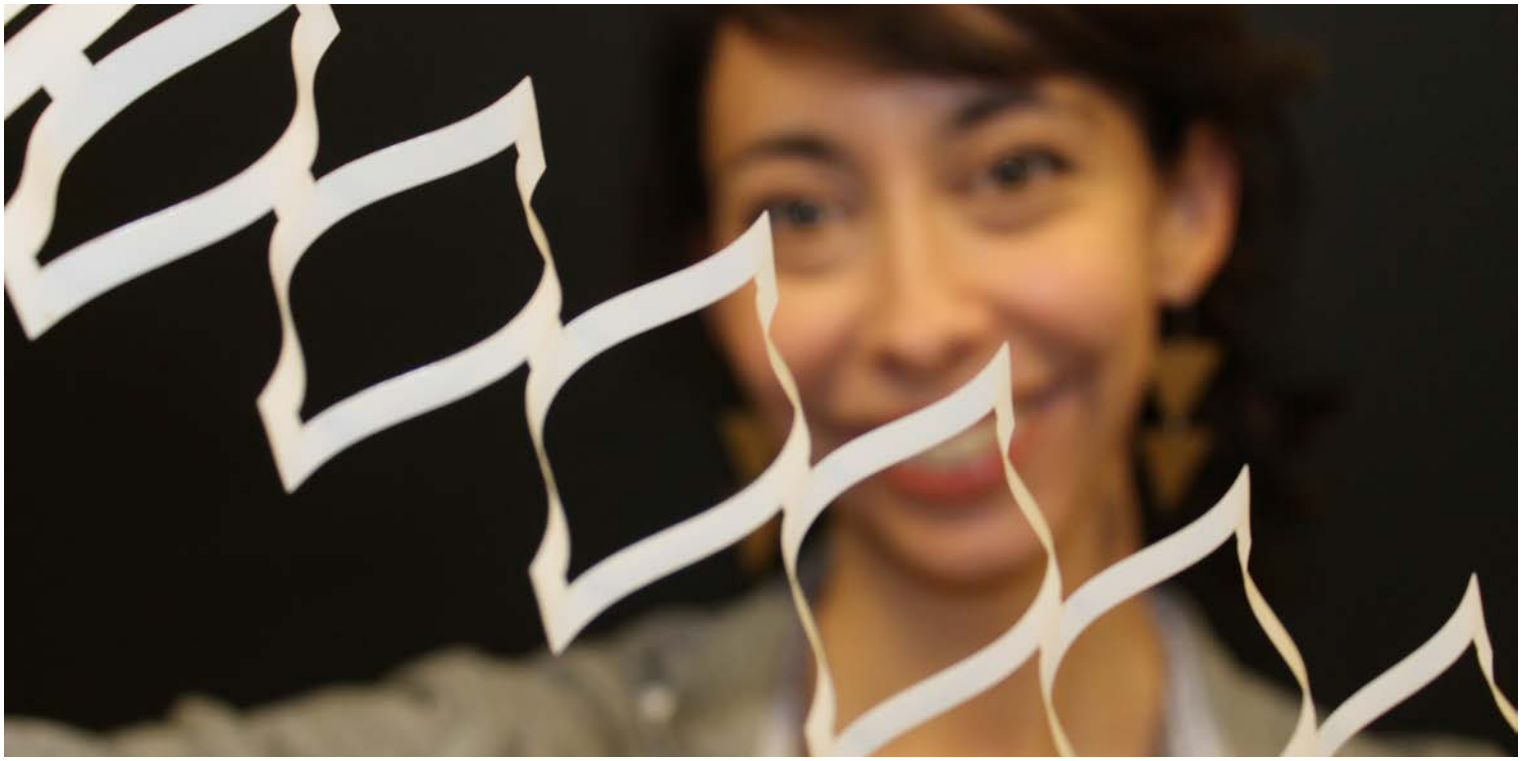
Graphene & beyond

Reveal the invisible

What's invisible to the human eye, thinner than a human hair and 200 times tougher than steel? Graphene. First isolated by scientists in 2004, graphene is made up of a single layer of carbon atoms. It is super lightweight, super conductive and super strong.

This 21st-century wonder material has the potential to radically reshape the way we think, design and manufacture in a host of areas – from racing cars to rust-free paint, from mobile phones to medical science.

In this ground-breaking turnkey exhibition, discover the history of graphite and graphene, journey with scientists and artists exploring the cutting edge of materials technology, and immerse yourself in the wonders of a two-dimensional world.



The art of discovery

Wonder Materials: Graphene and Beyond takes the audience on a scientific journey of discovery through the past, present and into the potential future of graphene. In addition to fascinating objects, photographs and films, the exhibition highlights the sense of playfulness, dedication and international collaboration among scientists researching applications for this and other wonder materials. Visitors are encouraged to look at the links between science and industry, and consider how new 2D materials can change the world.

Unveil the potential of 2D materials

Wonder Materials offers a stunning, intriguing and memorable experience that makes materials science accessible to a wide, non-specialist audience. This immersive exhibition is delivered in 2D and 3D design structures, audiovisual content, object-led displays, films and commissioned interactives.

The interactive exhibits inspire visitors to think imaginatively about the future and encourage them to ask the big question – what could graphene mean for me?

Working in partnership with the National Graphene Institute at the University of Manchester, the approach is to use a range of interpretive methods to bring to life museum-curated content and an exemplar learning programme in an engaging and accessible way.

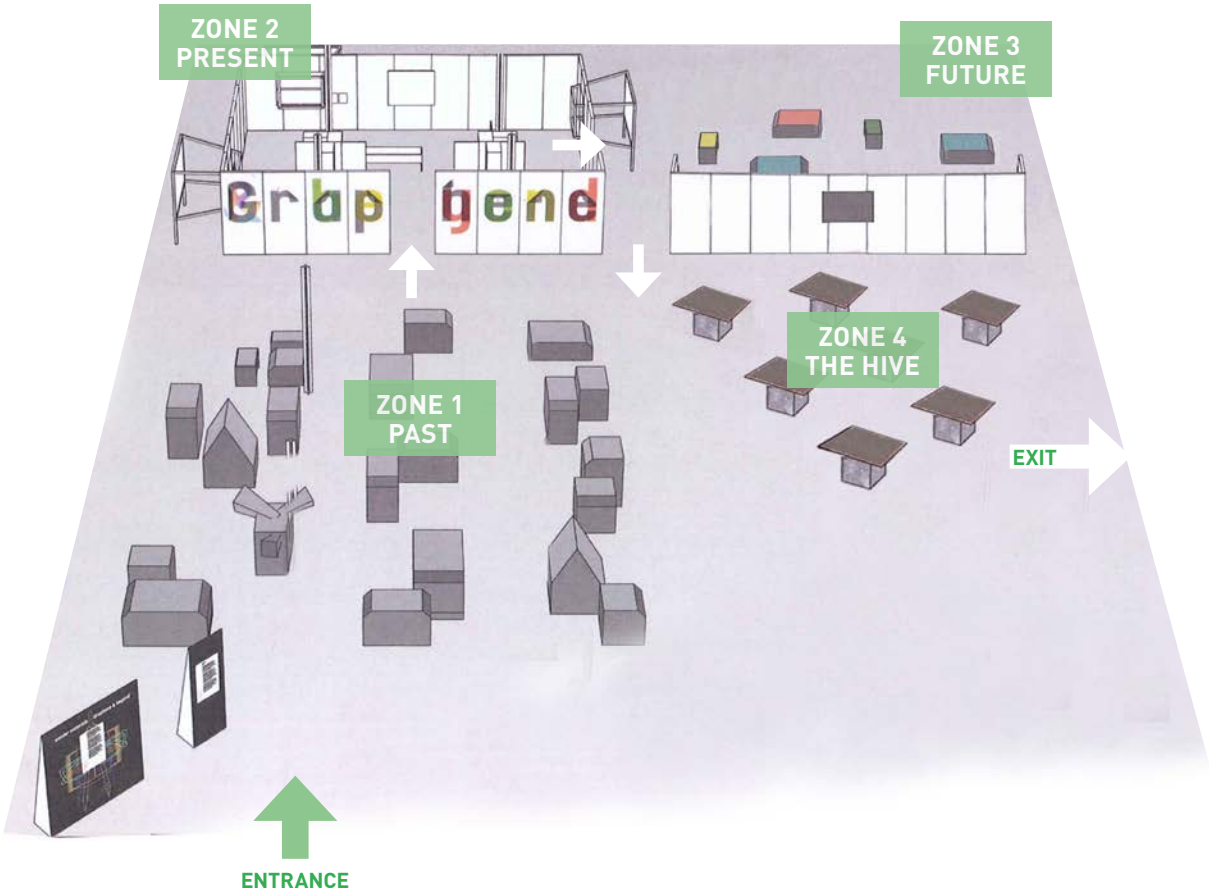
From tangible to intangible

The exhibition is divided into four main sections:

- Zone 1 – Past
- Zone 2 – Present
- Zone 3 – Future
- Zone 4 – The Hive (learning space)

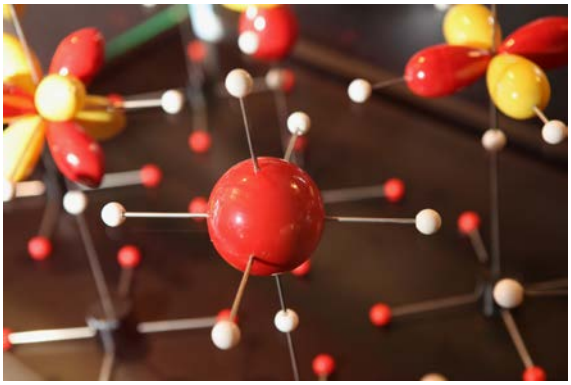
Features:

- Over 100 historical objects and atomic models
- Nine interactives
- Seven films
- Two artistic commissions



ZONE 1 PAST

In this zone, visitors delve into the surprisingly quirky history of graphite and discover the curious events that led to the isolation of graphene. Zone 1 introduces Andre Geim and Konstantin Novoselov, the Nobel Prize-winning physicists who first isolated graphene from graphite in 2004 at the University of Manchester – a feat that many thought impossible. The items in this section provide historical context to the exhibition, giving adults without a scientific background the key knowledge they need to understand the development of graphene research.



'As old as the hills' and cutting-edge technology

Long before its new role in nanotechnology, graphite was used to make pencils for self-expression and to cast smoother, better cannonballs that won wars. Visitors engage with beautiful atomic models that showcase how scientists have unleashed their creative side to model the invisible, super-tiny world of atoms and atomic structure.

Zone 1 includes over 100 atomic models, historic objects and artworks, three short films, three mock microscopes and two art pieces inspired by graphene. Visitors encounter an interactive model of layers of graphene, which they can touch and peel back, historic graphite samples, early pencils, a cannonball and a beautiful historic ship model. Film 1 demonstrates the 'Scotch Tape Method and Visualisation of Graphene'. Film 2 is a short documentary introducing visitors to the wonders of graphene. Film 3 shows the levitating frog experiment, for which Geim won an Ig Nobel Prize in 2010.

ZONE 2 PRESENT

Graphene is unlike any other material because it has so many desirable properties all in one. Zone 2 explores graphene's extraordinary relative properties, and presents the wonders and difficulties of working at the nanoscale. Visitors are introduced to six cutting-edge graphene scientists from around the world who are working on research inspired by art, electronic efficiency and environmental sustainability. Meet the scientist who is using a Japanese paper-cutting technique (kirigami) to test graphene's flexibility, a researcher creating graphene pompoms for batteries, and a team of engineers who developed a sustainable method of producing high-quality graphene in the lab.

Moving from the lab to industry

Taking visitors from the lab to the real world, this zone engages with the challenges of scaling up graphene production for industrial applications. Zone 2 includes four films, three examples of how graphene is currently used in industry and six scientists' 'lockers' containing images, personal items, research items and videos about their projects. The introductory film offers the opinions of academics, researchers and industrialists about the potential impact 'wonder materials' will have beyond the lab and into everyday life. The other three films highlight the real-life experiences of engineers and scientists as they consider the game-changing potential of graphene and other 2D materials.

ZONE 3 FUTURE

Entering Zone 3, visitors encounter two showcases presenting eight pioneering products that have the potential to make our lives easier and reduce our environmental impact by incorporating graphene into their design. Products include flexible electro-luminescent displays, biosensors, a water filtration membrane and a graphene light bulb. The Future Wall provides a colourful backdrop to the showcases. As many uses for graphene are still in the research stage, this feature helps audiences imagine the incredible ways graphene might change the world. The bright interactive wall, created by Hirsch & Mann, is printed using conductive graphene ink, creating a tactile piece that will appeal especially to children. Visitors are invited to consider the future of graphene and share their own ideas on the wall, serving as a thought-provoking bridge into Zone 4.

ZONE 4 THE HIVE

Wonder Materials takes visitors on a journey between the past, present and possible future of our relationship with graphene.

The exhibition's learning space, The Hive, can be used for active programming or a non-programmed, contemplative space as determined by the venue's needs. A welcome film and three low-intervention activities encourage visitors to deepen their knowledge and understanding of what graphene is and the potential impacts of the discovery.

We hope that visitors will enjoy and delight in the exhibition and that it might inspire them to:

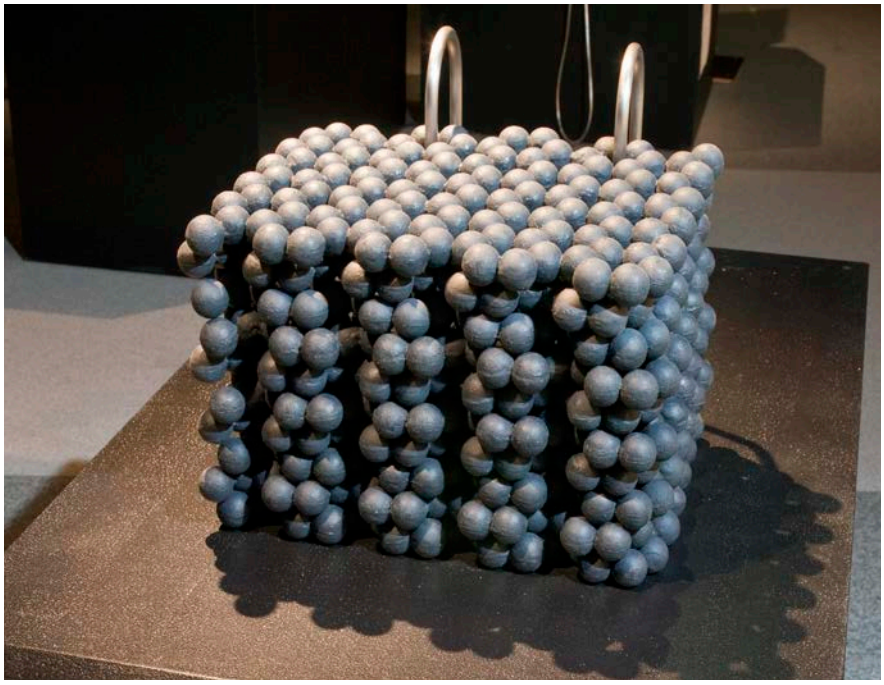
- Recognise and value creativity and experimentation within the scientific process
- Make personal connections with the story of graphene
- Have a positive perception of being a scientist
- Value creativity and experimentation within the scientific process
- Be more confident to analyse, explore and interact with contemporary science
- Have an opinion about graphene and its future impact on our lives
- Participate in imagining that future

In addition to the self-led activities, the exhibition contains a set of activities that your learning team can run with visitors.

EXHIBITION OBJECTIVES

The objectives of the exhibition are to:

- Deliver surprising, thought-provoking and compelling experiences and stories for our visitors, featuring key objects from the Museum of Science and Industry and Science Museum's collections
- Offer an integrated learning space, purpose-built for the delivery of learning and public programmes and a contemplative curated space outside of programmed activity
- Introduce key loans, commissions and significant objects to the public for the first time
- Introduce graphene and put it into a wider context as the first 2D material
- Explore graphene's significance as a potentially revolutionary material, its global impact in scientific research and its historical roots within Europe



Interactive model of graphene layers

Specifications

Suitable for venues able to provide:

- Minimum 500 m² indoor display space
- Transport costs
- Storage for object cases
- Object preparation space during installation and deinstallation
- Insurance
- Staff and equipment to assist with installation and deinstallation
- Gallery staff or volunteers during operating hours
- Translation and production of graphics with text if not displaying in English
- Translation and production of subtitles for digital and video components if not displaying in English
- Production of promotional and press-related material

Hire fee includes

- Licence to display the exhibition
- Set structure including cases, backdrops and props
- Lighting equipment
- Audiovisual displays and hardware
- Objects from the Science Museum Group's collections and loaned items
- Installation Coordinator to manage the installation and deinstallation processes
- Specialist conservator/courier to undertake object handling, installation and deinstallation
- Exhibition installation kit

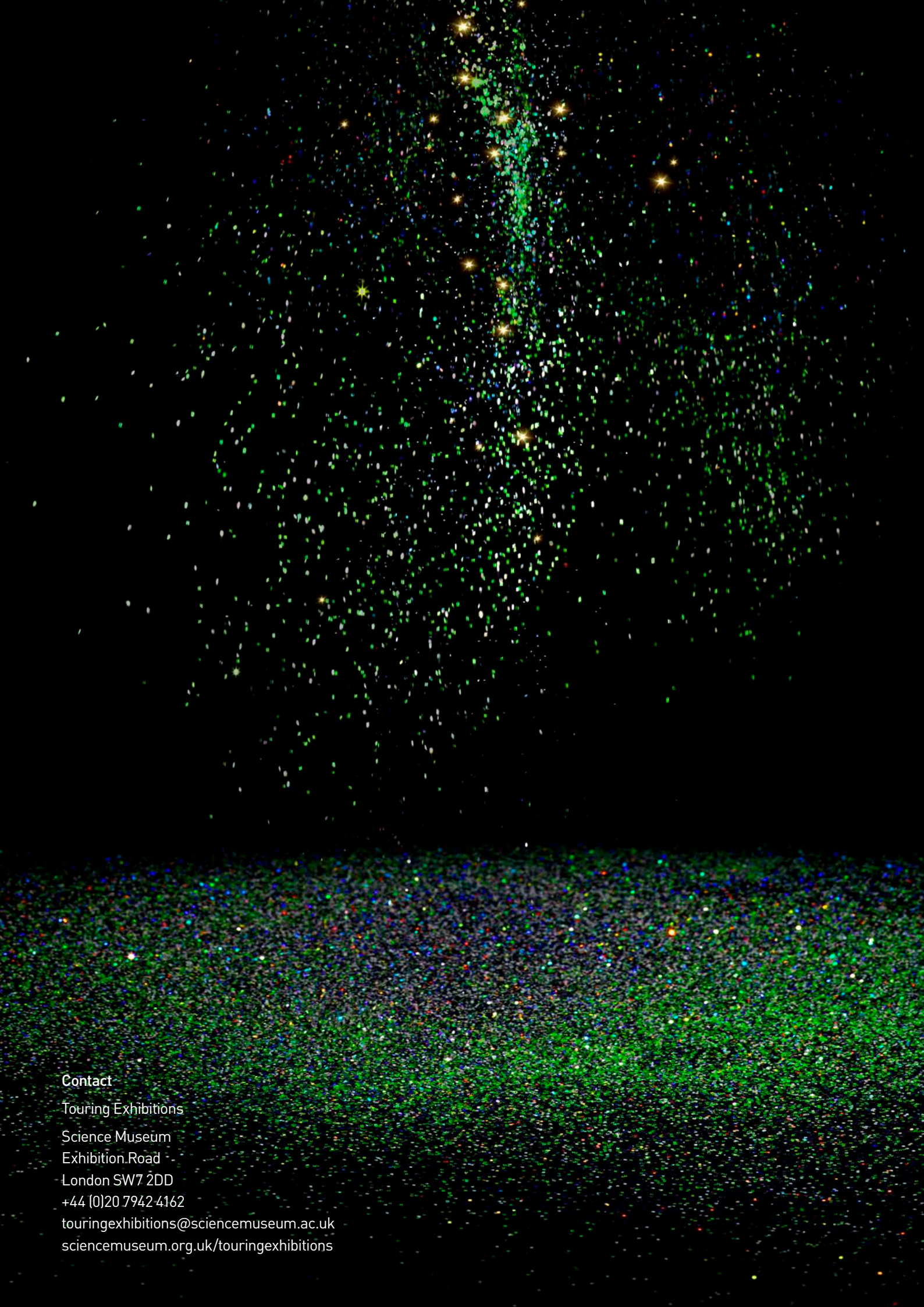
Background

The exhibition was produced by the Museum of Science and Industry (MSI), part of the Science Museum Group. The Group comprises the Science Museum in London, the Museum of Science and Industry in Manchester, the National Railway Museum in York and Shildon, and the National Media Museum in Bradford. Together these museums are visited by over 5 million people annually. The common bond between all the component parts is the story of human ingenuity in the fields of science, technology, medicine, transport and media.

Wonder Materials: Graphene and Beyond launched in Manchester in July 2016 as part of the European City of Science celebrations, focusing on the ways in which science and technology challenge the way we think and act, and impact on our lives. MSI worked with the European City of Science Local Organising Committee to make *Wonder Materials* the flagship exhibition of the Science in the City public engagement programme.

MANCHESTER 1824

National Graphene Institute



Contact

Touring Exhibitions

Science Museum
Exhibition Road
London SW7 2DD
+44 (0)20 7942 4162
touringexhibitions@sciencemuseum.ac.uk
sciencemuseum.org.uk/touringexhibitions