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The Quantum World: Careers in Photonics

Photonics is the science and technology of light, from the strange quantum world where photons (the smallest unit of light energy) can act both like a wave, spreading out, and like a particle, transferring energy in tiny amounts - to the everyday technologies that power the internet, space exploration, manufacturing and medicine. In the UK, the photonics industry is worth over £18 billion a year and employs more than 80,000 people, with demand for tens of thousands more as the sector grows to £50 billion by 2035. There is a real skills shortage, which means exciting opportunities for young people who enjoy science—especially physics. By studying science at school and then continuing with physics and photonics at higher or further education, you can access a wide range of careers, from hands-on technical roles after GCSEs to cutting-edge research at PhD level.

Physics concepts and equations	Job roles	Relevant fields	Career earnings (£/hr and £/yr)	Image links
GCSEs only — Entry Pathways • $\theta_i = \theta_r$ → Law of reflection: light bounces at same angle. • $n = c/v$ → Refraction: light slows down in glass/water, causing it to bend.	• Optical Assembly Operative • QA Inspector Trainee	• Building cameras, microscopes, and laser tools for everyday science and healthcare. • Checking optical products are safe and accurate before use.	• £11/hr (£22k/yr) • £11.5/hr (£23k/yr)	• https://www.luxinar.com/ • https://www.luxinar.com/
A-Levels only — Pathway Roles • $n_1 \sin\theta_1 = n_2 \sin\theta_2$ → Light bends entering glass or water (Snell's Law). • $d \sin\theta = m\lambda$ → Diffraction/ interference patterns when light passes through slits.	• Junior Lab Assistant • Fibre Installer Trainee	• Helping set up experiments, supporting researchers, and preparing equipment. • Bringing faster internet and building smart cities of the future.	• £12/hr (£24k/yr) • £12.5/hr (£25k/yr)	• https://www.southampton.ac.uk/ • https://aquark-technologies.com/
Apprenticeships — Earn & Learn • $w(z) = w_0 \sqrt{(1+(z/z_r)^2)}$ → Describes how laser beams change shape as they travel. • $E = hf$ → Photons have energy linked to their colour/frequency.	• Lab Technician • Photonics Manufacturing Apprentice	• Supporting scientists in experiments with light and testing new ideas. • Learning to make laser parts used in hospitals, factories, and communication systems.	• £13/hr (£26k/yr) • £13.5/hr (£27k/yr)	• https://www.cornerstone.sotonfab.co.uk/ • https://www.cornerstone.sotonfab.co.uk/
Higher National Diploma (HND) / HNC — Technical Roles • $I = P/A$ → Laser power per area - vital for safety and precision cutting. • $2nt = m\lambda$ → Explains rainbow colours from thin film interference, like soap	• Laser Technician • Cleanroom Technician	• Using lasers for clean manufacturing and surgical tools. • Helping create chips and sensors powering the internet and communications.	• £15/hr (£30k/yr) • £16/hr (£32k/yr)	• https://noc.ac.uk/ • https://www.southampton.ac.uk/
Degree (Bachelor of Science)— Graduate Roles • Fraunhofer diffraction → Light spreads out and is reshaped with lenses and mirrors. • $l^c = \lambda^2/\Delta\lambda$ → Measures how well light waves line up	• Field Service Engineer • Optical Manufacturing Engineer	• Supporting hospitals with imaging tools, maintaining microscopes and diagnostic equipment. • Building lenses for satellites, VR headsets, and optical systems in everyday tech.	• £18/hr (£35k/yr) • £19/hr (£37k-40k/yr)	• https://www.uhs.nhs.uk/ • https://www.southampton.ac.uk/
Master's Degree — Advanced Engineering • $\nabla \times E = -\partial B/\partial t$ → Electric and magnetic fields interact to form light waves. • $V = (2\pi a/\lambda)\sqrt{(n_1^2 - n_2^2)}$ → Light guided inside fibres and chips, like water in a	• Optical Engineer • LiDAR Engineer	• Designing cameras, hospital scanners, and telescopes for science and society. • Helping cars and drones to move safely, mapping cities, and supporting environmental science.	• £22/hr (£45k/yr) • £23/hr (£48k/yr)	• https://www.microsoft.com/en-us/research/ • https://noc.ac.uk/
PhD — Quantum Research • $\|\psi\rangle = \alpha\|0\rangle + \beta\|1\rangle$ → Light as quantum bits - foundation of quantum computers. • $P = x^2E^2 + x^3E^3 + \ldots$ → High-power light changes materials, creating new colours	• Quantum Photonics Scientist • Laser Physicist	• Building future quantum computers, secure communications, and AI technologies. • Developing powerful lasers for space, clean energy, and medicine.	• £26/hr (£55k/yr) • £29/hr (£60k/yr)	• https://www.southampton.ac.uk/study/postgraduate-research/photonics-optoelectronics • https://www.xfel.eu/news_and_events/news/index_eng.html?openDirectAnchor=1781

Logos: Cornerstone, AQUARK, Microsoft, Photonics Leadership Group, Optical, SPIE, Ringwood School. Year 10 Consultant H Gravett.