UNIVERSITY OF LIVERPOOL

Physics with Medical Applications BSc (Hons)

COURSE DETAILS

- A level requirements: ABB
- UCAS code: F350
- Study mode: Full-time
- Length: 3 years

KEY DATES

- Apply by: 29 January 2025
- Starts: 22 September 2025

Course overview

Physics is helping to advance medical diagnosis and treatment, helping us to live longer. This programme provides the perfect foundation for a career in medical physics, with options for a year in industry or a year abroad.

INTRODUCTION

Physics research is helping us to live longer, healthier lives. It is helping us to develop new cures for disease and new ways to quickly diagnose health problems. For example, particle beams and detectors used in physics research have led to the development of proton cancer therapies and new diagnostic imaging technologies.
Combining the study of physics and selected topics in medical applications, this programme provides skills such as numeracy, problem solving, reasoning and communication that are attractive to the general employer, and it is an excellent preparation for a career in medical physics.

In addition to core physics modules you will also take mathematics, computing and experimental physics modules in support of these studies. There is a project on a medical physics topic in year three with involvement from the local hospitals and medical research centres. Staff from these institutions will also be involved with teaching.

This programme is available with a year in industry. Year three is spent on a paid placement within an organisation in industry, broadly defined. You will be supported by the Department of Physics throughout your placement, and you will be expected to complete a reflective written account of your experience.

WHAT YOU'LL LEARN

- Numeracy

- Problem solving
- Reasoning and communication
- Core physics principles
- Basic prinicples of lasers
- How to understand lenses and optical instruments
- Analytical skills
- How to understand the interaction between theory and experiment

ACCREDITATION

This course is accredited by the Institute of Physics.

Course content

Discover what you'll learn, what you'll study, and how you'll be taught and assessed.

YEAR ONE

The first year starts with a one-week project to familiarise you with the staff and other students. There will be two Maths modules in each of the first two years; these are designed to provide the Mathematical skills required by Physics students.

COMPULSORY MODULES

DYNAMICS AND RELATIVITY (PHYS101)

Credits: 15 / Semester: semester 1

The module provides an overview of Newtonian mechanics, continuing on from A-level courses. This includes: Newton’s laws of motion in linear and rotational circumstances, gravitation and Kepler’s laws of planetary motion. The theory of Relativity is then introduced, starting from a historical context, through Einstein’s postulates, leading to the Lorentz transformations.

THERMAL PHYSICS AND PROPERTIES OF MATTER (PHYS102)

Credits: 15 / Semester: semester 1

Einstein said in 1949 that "Thermodynamics is the only physical theory of universal content which I am convinced, within the areas of applicability of its basic concepts, will never be overthrown." In this module, different aspects of thermal physics are addressed: (i) classical thermodynamics which deals with macroscopic properties, such as pressure, volume and temperature – the underlying microscopic physics is not included; (ii) kinetic theory of gases describes the properties of gases in terms of probability distributions associated with the motions of individual molecules; and (iii) statistical mechanics which starts from a microscopic description and then employs statistical methods to derive macroscopic properties. The laws of thermodynamics are introduced and applied.

ELECTRICITY, MAGNETISM AND WAVES (PHYS103)

Credits: 15 / Semester: semester 2

Electricity, Magnetism and Waves lie at the heart of physics, being phenomena associated with almost every branch of physics including quantum physics, nuclear physics, condensed matter physics and accelerator physics, as well as numerous applied aspects of physics such as communications science. The course is roughly divided into two sections. The first part introduces the fundamental concepts and principles of electricity and magnetism at an elementary level and develops the integral form of Maxwell’s equations. The second part involves the study of oscillations and waves and focuses on solutions of the wave equation, the principles of superposition, and examples of wave phenomena.

FOUNDATIONS OF QUANTUM PHYSICS (PHYS104)

Credits: 15 / Semester: semester 2

This module illustrates how a series of fascinating experiments, some of which physics students will carry out in their laboratory courses, led to the realisation that Newtonian mechanics does not provide an accurate description of physical reality. As is described in the module, this failure was first seen in interactions at the atomic scale and was first seen in experiments involving atoms and electrons. The module shows how Newton's ideas were replaced by Quantum mechanics, which has been critical to explaining phenomena ranging from the photo-electric effect to the fluctuations in the energy of the Cosmic Microwave Background. The module also explains how this revolution in physicist's thinking paved the way for developments such as the laser.

INTRODUCTION TO COMPUTATIONAL PHYSICS (PHYS105)

Credits: 7.5 / Semester: semester 1

The "Introduction to computational physics" (Phys105) module is designed to introduce physics students to the use of computational techniques appropriate to the solution of physical problems. No previous computing experience is assumed. During the course of the module, students are guided through a series of structured exercises which introduce them to the Python programming language and help them acquire a range of skills including: algorithm development; Manipulating and plotting data in a variety of ways; simple Monte Carlo techniques. The exercises are based around the content of the first year physics modules, both encouraging students to recognise the relevance of computing to their physics studies and enabling them to develop a deeper understanding of aspects of their first year course.

PRACTICAL PHYSICS I (PHYS106)

Credits: 15 / Semester: whole session

This module teaches the laboratory side of physics to complement the taught material from lectures and to introduce key concepts of experimental physics.

MATHEMATICS FOR PHYSICISTS I (PHYS107)

Credits: 15 / Semester: semester 1

This module aims to provide all students with a common foundation in mathematics, necessary for studying the physical sciences and maths courses in later semesters. All topics will begin "from the ground up" by revising ideas which may be familiar from A-level before building on these concepts. In particular, the basic principles of differentiation and integration will be practised, before extending to functions of more than one variable. Basic matrix manipulation will be covered as well as vector algebra and an understanding of eigenvectors and eigenvalues.

MATHEMATICS FOR PHYSICS II (PHYS108)

Credits: 15 / Semester: semester 2

This module introduces some of the mathematical techniques used in physics. For example, differential equations, PDE's, integral vector calculus and series are discussed. The ideas are first presented in lectures and then the put into practice in problems classes, with support from demonstrators and the module lecturer. When you have finished this module, you should: Be familiar with methods for solving first and second order differential equations in one variable. Be familiar with methods for solving partial differential equations and applications. Have a basic knowledge of integral vector calculus. Have a basic understanding of Fourier series and transforms.

INTRODUCTION TO MEDICAL PHYSICS (PHYS115)

Credits: 7.5 / Semester: semester 2

Medical Physics is a diverse field that applies many areas of physics to diagnose and treat people. The course devolves into the physics of the human body including the loading of the skeletal system, visual and audio defects and corrective techniques and how the heart generates an electrical signal that can be measured using an electrocardiogram (ECG). Different types of diagnostic imaging techniques using both ionising and non-ionising radiation is investigated along with therapeutic delivery and the effect radiation has on biological systems.

Programme details and modules listed are illustrative only and subject to change.

YEAR TWO

In year two you will broaden your understanding of Physics, with modules designed to ensure you have mastered the full range of Physics concepts.

COMPULSORY MODULES

ELECTROMAGNETISM I (PHYS201)

Credits: 15 / Semester: semester 2

The study of classical electromagnetism, one of the fundamental physical theories. Several simple and idealised systems will be studied in detail, developing an understanding of the principles underpinning several applications, and setting the foundations for the understanding of more complex systems. Mathematical methods shall be developed and exercised for the study of physical systems.

CONDENSED MATTER PHYSICS (PHYS202)

Credits: 15 / Semester: semester 2

Condensed matter physics (CMP) is the study of the structure and behaviour of matter that makes up most of the things that surround us in our daily lives, including the screen on which you are reading this material. It is not the study of the very small (particle and nuclear physics) or the very large (astrophysics and cosmology) but of the things in between. CMP is concerned with the “condensed” phases of real materials that arise from electromagnetic forces between the constituent atoms, and at its heart is the necessity to understand the behaviour of these phases by using physical laws that include quantum mechanics, electromagnetism and statistical mechanics. Understanding such behaviour leads to the design of novel materials for advanced technological devices that address the challenges that face modern civilization, such as climate change.

QUANTUM AND ATOMIC PHYSICS I (PHYS203)

Credits: 15 / Semester: semester 1

The course aims to introduce 2nd year students to the concepts and formalism of quantum mechanics. The Schrodinger equation is used to describe the physics of quantum systems in bound states (infinite and finite well potentials, harmonic oscillator, hydrogen atoms, multi-electron atoms) or scattering (potential steps and barriers). Basis of atomic spectroscopy are also introduced.

NUCLEAR AND PARTICLE PHYSICS (PHYS204)

Credits: 15 / Semester: semester 1

This module introduces the basic properties of particles and nuclei, their stability, modes of decay, reactions and conservation laws. Recent research in particle physics is highlighted, and for nuclear physics some of the applications (such as nuclear power) are given. This module leads on to more specialist optional modules in Year 3, in particle physics, nuclear physics and nuclear power.

COMPUTATIONAL PHYSICS (PHYS205)

Credits: 15 / Semester: whole session

The "Computational Physics" (PHYS205) module is designed to further develop the computing skills Liverpool Physics students have acquired in their first year of study (in the "Introduction to Computational Physics module, PHYS105). The Python programming techniques covered in PHYS105 are first summarised and revised, then students apply these to a range of physics-based problems which they tackle by analysing data, carrying out small Monte Carlo simulations and using graphing and data presentation methods as appropriate. In the second section of the course, students work in small groups, each of which is given a project to tackle. The groups must first understand the problem they have been given and work out how they can use their computing skills to solve it. They must also manage their work, ensuring that together they develop the algorithms and code they need in the time available. Finally, each group presents their work to their peers and writes a report on their project.

PRACTICAL PHYSICS II (PHYS206)

Credits: 15 / Semester: whole session

The module "Practical Physics II" covers experimental techniques in broad range of physics phenomena which include measurements of fundamental constants, optics, nuclear physics and electronics. The experimental techniques and analysis methods are appropriate for Year 2 courses. Successful students will achieve improved practical skills and experience a detailed understanding of the fundamental physics behind the experiments, increased confidence in setting up and calibrating equipment, familiarity with IT package for calculating, displaying and presenting results, enhanced ability to plan, execute and report the results of an investigation, the skills to assemble, test and debug electronic circuits involving the use of both passive and active electronic components, the skills to write scientific papers

MATHEMATICS FOR PHYSICISTS III (PHYS207)

Credits: 15 / Semester: semester 1

This module extends the previous treatment of vector calculus and linear algebra (vectors and matrices). It provides essential mathematical tools for electrodynamics and quantum mechanics.

ACCELERATORS AND RADIOISOTOPES IN MEDICINE (PHYS246)

Credits: 15 / Semester: semester 2

This module provides an introduction to applications of accelerators and radioisotopes in medical imaging and tumour therapy. Concepts are developed from a simple physics perspective to provide an insight into the principles and practices of these modern medical applications. The lectures are complemented by workshops in which students can work collaboratively on problems to solve set problems. Experimental demonstrations to reinforce concepts also take place in the workshops. As well as being of interest to students considering careers in medical physics or nuclear-related industries, this module should also appeal to those curious to see how physics can be applied in a multidisciplinary approach to other areas of science.

Programme details and modules listed are illustrative only and subject to change.

YEAR THREE

The third year comprises a mix of core modules and many optional modules in Physics. You will undertake a research project with a member of staff and one of our partner companies on an aspect of Medical Physics.

COMPULSORY MODULES

RADIATION PHYSICS ADVANCED PRACTICAL (PHYS380)

Credits: 7.5 / Semester: semester 1

• To give further training in laboratory techniques, in the use of computer packages for modelling and analysis, and in the use of modern instruments

• To develop the students' independent judgement in performing radiation physics experiments

• To encourage students to research aspects of physics complementary to material met in lectures and tutorials

• To consolidate the students ability to produce good quality work against realistic deadlines.

• To introduce the students to writing professional scientific reports in advance of final-year projects.

MEDICAL PHYSICS PROJECT (PHYS386)

Credits: 30 / Semester: whole session

Individual projects in Medical Physics

QUANTUM AND ATOMIC PHYSICS II (PHYS361)

Credits: 15 / Semester: semester 1

This module concerns the study of quantum mechanics and its application to atomic systems. The description of simple systems will be covered before extending to real systems. Perturbation theory will be used to determine the detailed physical effects seen in atomic systems.

ELECTROMAGNETISM II (PHYS370)

Credits: 15 / Semester: semester 2

The module builds on first and second year modules on electricity, magnetism and waves to show how a wide variety of physical phenomena can be explained in terms of the properties of electromagnetic radiation. The module will also explore how these properties follow from the relationships between electric and magnetic fields (and their interactions with matter) expressed by Maxwell's equations, and how electromagnetism fits into the theory of Special Relativity.

STATISTICAL PHYSICS (PHYS393)

Credits: 7.5 / Semester: semester 2

The problem to understand blackbody radiation opened the door to modern physics. In this module an understanding of thermodynamics is developed from a quantum mechanical and statistical description of the three fundamental gases: The Maxwell-Boltzmann ideal gas in the classical limit, and the Fermi-Dirac and Bose-Einstein gases in the quantum limits for fermions and bosons, respectively. A statistical understanding of thermodynamic quantities will be developed together with a method of deriving thermodynamic potentials from the properties of the quantum system. Applications are shown in solid state physics and the Planck blackbody radiation spectrum.

MEDICAL APPLICATIONS (PHYS384)

Credits: 15 / Semester: semester 2

In this module, students will develop an understanding of the principles of radiotherapy and treatment planning. Topics include interaction of radiation with biological matter, radiation transport, biological modelling, beam modelling, medical imaging, electron transport and treatment planning.

OPTIONAL MODULES

PHYSICS INTERNSHIP (PHYS309)

Credits: 15 / Semester: summer

The physics internship module is designed to give students the experience of working in a STEM related working environment or setting that is different from any project work that they undertake in the Department of Physics. It should provide an insight into how students may apply skills and experiences later in their career; whether working abroad or in any other non-UoL, off-campus scientific or secondary school setting.

COMPUTATIONAL MODELLING (PHYS305)

Credits: 15 / Semester: semester 2

Computational methods are at the heart of many modern physics experiments and mastering these techniques is invaluable also beyond fundamental research. In this module we introduce students to object-oriented concepts of a modern programming language (Python) and employ this to model experiments. A combination of Monte Carlo methods (based on random trials) and deterministic methods to solve differential equations are used. Students will then apply their knowledge in a small-group project connected to the state-of-the-art research done in the department. The project topics are taken from different areas of particle, nuclear or accelerator physics and range from analyses situated at the Large Hadron Collider to medical applications of proton beams.

NUCLEAR PHYSICS (PHYS375)

Credits: 7.5 / Semester: semester 1

This module gives an introduction to nuclear physics. Starting from the bulk properties of atomic nuclei different modes of radioactivity are discussed, before a closer look at the nucleon-nucleon interaction leads to the development of the shell model. Collective models of the nucleus leading to a quantitative understanding of rotational and vibrational excitations are developed. Finally, electromagnetic decays between excited states are introduced as spectroscopic tools to probe and understand nuclear structure.

PARTICLE PHYSICS (PHYS377)

Credits: 7.5 / Semester: semester 2

Introduction to Particle Physics. To build on the second year module involving Nuclear and Particle Physics. To develop an understanding of the modern view of particles, of their interactions and the Standard Model.

SOLID STATE PHYSICS (PHYS363)

Credits: 7.5 / Semester: semester 1

Condensed Matter Physics (CMP) is the largest subfield of physics with practical applications that has changed our everyday life such as semiconductor devices, magnetic recording disks, Magnetic resonance imaging. It deals with the study of the structure and physical properties of large collection of atoms that compose materials, which are found in nature or synthesized in laboratory. This particular module aims to advance and extend the concepts on solids introduced in Year 1 and Year 2 modules. Especially, it focuses on the atomic structure and behaviour of electrons in crystalline materials, which are essential for understanding of physical phenomena in complex systems.

MATERIALS PHYSICS AND CHARACTERISATION (PHYS387)

Credits: 7.5 / Semester: semester 1

Preparation and characterisation of a range of materials of scientific and technological importance.

MAGNETIC PROPERTIES OF SOLIDS (PHYS399)

Credits: 7.5 / Semester: semester 2

The magnetic properties of solids are exploited extensively in a wide range of technologies, from hard disk drives, to sensors, to magnetic resonance imaging, and the development of magnetic materials is a multi-billion pound industry. Fundamentally, magnetism in condensed matter also represents one of the best examples of quantum mechanics in action, even at room temperature and on a macroscopically observable scale. In this module we will explore how the interactions between electrons in solids can result in the magnetic moment, and how this relates to the quantum mechanical property of spin. We will use these tools to probe the complicated processes that allow spontaneous magnetism to exist within certain select materials, and their implications for future technologies and our theoretical understanding of the nature of solids.

SEMICONDUCTOR APPLICATIONS (PHYS389)

Credits: 7.5 / Semester: semester 1

This module develops the physics concepts describing semiconductors in sufficient details for the purpose of understanding the construction and operation of common semiconductor devices.

STATISTICS FOR PHYSICS ANALYSIS (PHYS392)

Credits: 15 / Semester: semester 1

Statistical Methods in Physics Analysis: Understanding Statistics and its application to data analysis

ENERGY GENERATION AND STORAGE (PHYS372)

Credits: 7.5 / Semester: semester 2

Producing sufficient energy to meet the demands of an expanding and increasingly power-hungry society, whilst striving not to exacerbate the impacts of climate change, is a significant challenge. This module looks at the key physical concepts which underpin a range of energy generation sources, from traditional fossil fuel fired turbine generation to photovoltaic solar cells. This builds on prior knowledge of thermodynamics, fluid behaviour and semiconductors to show how these concepts can be practically applied to power generation and storage systems.

NUCLEAR POWER (PHYS376)

Credits: 7.5 / Semester: semester 2

This module focuses on nuclear reactors as a source of energy for use by society. After reviewing the underlying physics principles, the design and operation and nuclear fission reactors is introduced. The possibility of energy from nuclear fusion is then discussed, with the present status and outlook given.

PHYSICS OF GALAXIES (PHYS373)

Credits: 15 / Semester: semester 1

This module covers the physics and observational techniques of the field of Galactic Astrophysics

RELATIVITY AND COSMOLOGY (PHYS374)

Credits: 15 / Semester: semester 2

The course covers the concepts required to connect special relativity, Newtonian gravity, general relativity, and the cosmological metrics and dynamical equations. The main part of the course is focussed on cosmology, which is study of the content of the universe, structure on the largest scales, and its dynamical evolution. This is covered from both a theoretical and observational perspective.

SURFACES AND INTERFACES (PHYS381)

Credits: 7.5 / Semester: semester 2

This module gives a brief introduction into the physics of solid surfaces their experimental study. Surfaces and interfaces are everywhere and many surface-related phenomena are common in daily life (texture, friction, surface-tension, corrosion, heterogeneous catalysis). Here we are concerned with understanding the microscopic properties of surfaces, asking questions like: what is the atomic structure of the surface compared to that of the bulk? What happens to the electronic properties and vibrational properties upon creating a surface? What happens in detail when we adsorb an atom or a molecule on a surface? This module will mostly concentrate on simple model systems like the clean and defect-free surface of a single-crystal substrate.

PLANETARY PHYSICS (PHYS355)

Credits: 7.5 / Semester: semester 2

This course considers the application of physics to the study of planets, with a focus on the application of fundamental physical principles rather than providing detailed planetary descriptions. The first four weeks address the planets of our solar system, including what constraint is provided on their physics from studies of our own planet, Earth. We consider particularly insights from observations of orbits, gravitational field, rotation, thermal properties and magnetic field, with brief coverage of formation,composition, and seismology. The focus is on application of basic physical principles rather than detailed observational descriptions, and on methods that might (eventually) be of use in the study of exoplanets. The final two weeks considers exoplanets specifically, particularly the methods of their detection,and our current understanding of planetary systems in general.

Programme details and modules listed are illustrative only and subject to change.

HOW YOU'LL LEARN

Our research-led teaching ensures you are taught the latest advances in cutting-edge physics research. Lectures introduce and provide the details of the various areas of physics and related subjects. You will be working in tutorials and problem-solving workshops, which are another crucial element in the learning process, where you put your knowledge into practice. They help you to develop a working knowledge and understanding of physics. All of the lecturers also perform world class research and use this to enhance their teaching.

Most work takes place in small groups with a tutor or in a larger class where staff provide help as needed. Practical work is an integral part of the programmes, and ranges from training in basic laboratory skills in the first two years to a research project in the third or fourth year. You will undertake an extended project on a research topic with a member of staff who will mentor you. By the end of the degree you will be well prepared to tackle problems in any area and present yourself and your work both in writing and in person. In the first two years students take maths modules which provide the support all students need to understand the physics topics.

HOW YOU'RE ASSESSED

The main modes of assessment are coursework and examination. Depending on the modules taken you may encounter project work, presentations (individual or group), and specific tests or tasks focused on solidifying learning outcomes.

LIVERPOOL HALLMARKS

We have a distinctive approach to education, the Liverpool Curriculum Framework, which focuses on research-connected teaching, active learning, and authentic assessment to ensure our students graduate as digitally fluent and confident global citizens.

Careers and employability

A physics degree is a great starting point for a physics related career, engineering and computing careers.

Physicists are trained to solve a wide range of problems. That is why graduates have gone on to explore careers in such diverse areas such as:

- telecommunications
- microelectronics
- nuclear power and instrumentation
- cryogenics
- astronomy
- geophysics
- medical physics
- materials science
- computing
- teaching
- business, finance and management.

88% **OF PHYSICS STUDENTS FIND THEIR MAIN ACTIVITY AFTER GRADUATION MEANINGFUL.**

Graduate Outcomes, 2018-19.

Fees and funding

Your tuition fees, funding your studies, and other costs to consider.

TUITION FEES

UK fees (applies to Channel Islands, Isle of Man and Republic of Ireland)	
Full-time place, per year	£9,250
Year in industry fee	£1,850
Year abroad fee	£1,385

International fees	
Full-time place, per year	£27,200
Year in industry fee	£1,850
Year abroad fee	£13,600

Fees shown are for the academic year 2024/25. Please note that the Year Abroad fee also applies to the Year in China.

Tuition fees cover the cost of your teaching and assessment, operating facilities such as libraries, IT equipment, and access to academic and personal support. Learn more about paying for your studies..

ADDITIONAL COSTS

We understand that budgeting for your time at university is important, and we want to make sure you understand any course-related costs that are not covered by your tuition fee. This could include buying a laptop, books, or stationery.

Find out more about the additional study costs that may apply to this course.

SCHOLARSHIPS AND BURSARIES

We offer a range of scholarships and bursaries to provide tuition fee discounts and help with living expenses while at university.

Check out our Liverpool Bursary, worth up to £2,000 per year for eligible UK students. Or for international students, our Undergraduate Global Advancement Scholarship offers a tuition fee discount of up to £5,000 for eligible international students starting an undergraduate degree from September 2024.

Discover our full range of undergraduate scholarships and bursaries

Entry requirements

The qualifications and exam results you'll need to apply for this course.

Your qualification	**Requirements** About our typical entry requirements
A levels	ABB Applicants with the Extended Project Qualification (EPQ) are eligible for a reduction in grade requirements. For this course, the offer is **BBB** with **A** in the EPQ. You may automatically qualify for reduced entry requirements through our contextual offers scheme. If you don't meet the entry requirements, you may be able to complete a foundation year which would allow you to progress to this course. Available foundation years: • Physical Sciences (4 year route including a Foundation Year at Carmel College) BSc (Hons)
GCSE	4/C in English and 4/C in Mathematics
Subject requirements	For applicants from England: For science A levels that include the separately graded practical endorsement, a "Pass" is required.
BTEC Level 3 National Extended Diploma	Applications considered alongside A levels. Please contact the University for further information.
International Baccalaureate	33 points that must include 6 points each from Physics and Mathematics at Higher level.
Irish Leaving Certificate	H1, H2, H2, H2, H3, H3 including Physics and Mathematics at H2 or above.

Your qualification	**Requirements** About our typical entry requirements
Scottish Higher/Advanced Higher	Advanced Highers accepted at grades ABB including Physics and Mathematics.
Welsh Baccalaureate Advanced	Accepted at grade B, including Mathematics and Physics A Levels at AB.
Access	45 Level 3 credits in graded units in a relevant Diploma,including 30 at Distinction and a further 15 with at least Merit. GCSE grades 4/C in English and 4/C in Mathematics also required. 15 Distinctions are required in each of Mathematics and Physics.
International qualifications	Many countries have a different education system to that of the UK, meaning your qualifications may not meet our entry requirements. Completing your Foundation Certificate, such as that offered by the University of Liverpool International College, means you're guaranteed a place on your chosen course.

ALTERNATIVE ENTRY REQUIREMENTS

- If your qualification isn't listed here, or you're taking a combination of qualifications, contact us for advice
- Applications from mature students are welcome.

THE ORIGINAL REDBRICK

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