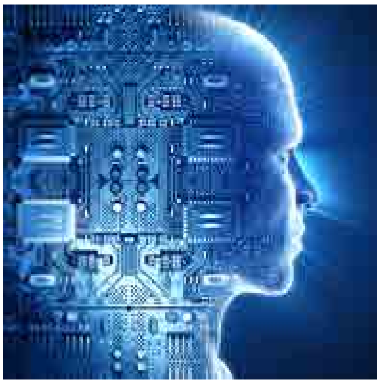
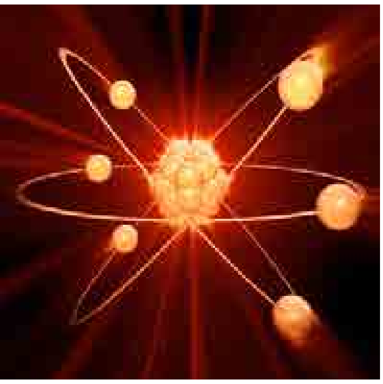
Scientific Tracks & Sessions
August 23, 2018

Physics 2018





3rd International Conference on

Applied Physics

August 23-24, 2018 | London, UK

Cavity collapse and jet generation during the droplet impact

Ken Yamamoto
Tokyo University of Science, Japan

Free surface of a droplet impacting on a surface deforms significantly within a timescale of milliseconds. This large deformation leads various phenomena such as spreading, splashing, etc. It is well known that which phenomenon will be occurred is determined by the impact velocity, liquid viscosity, atmospheric pressure, surface tension, and the surface characteristics. For instance, the droplet behaviour is completely different when a droplet is dropped on a hydrophilic surface and when it is dropped on a superhydrophobic surface. On superhydrophobic surfaces, the droplet bounces off the surface like a rubber ball at low Weber number (which indicates a significance of inertia over surface tension), whereas the droplet spreads and sticks on hydrophilic surfaces at the same impact condition. The bounce motion on superhydrophobic surfaces can be explained by low adhesive force of the wall surface and surface tension that exerts on liquid interface to make it have less surface area. However, if we increase the impact velocity, we can observe interesting phenomenon: jetting. The jet, specifically the Worthington jet, is generated because of a collapse of an air cavity formed at the centre of the droplet. Furthermore, we found that the jet velocity and the characteristic radius depends on the impact velocity, which results from oscillations of the droplet cap caused by the impact.

Speaker Biography

Ken Yamamoto has completed his PhD at the age of 29 years from Tokyo Metropolitan University, Japan. He is an assistant professor of Tokyo University of Science, Japan. He has over 10 publications that have been cited over 80 times.

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Developing terahertz radiation sources for particle acceleration: A route to future table-top accelerators

Darren Graham
University of Manchester, UK

Radio-frequency (RF) accelerating cavities used in current particle accelerators are limited to accelerating gradients of 100 MVm-1. To achieve the desired increase in acceleration gradient for future particle accelerators while enabling a reduction in the size and cost requires a fundamentally new approach. Free-space acceleration with ultrafast laser driven terahertz radiation sources offers a promising alternative. Such terahertz radiation sources can provide electromagnetic pulses with electric field strengths in excess of 100 MVm-1 and they have an oscillation period which matches the particle bunch lengths produced in RF accelerators.

The challenge in using freely propagating electromagnetic radiation for particle acceleration is in maximising the interaction length between the radiation and the particle beam. The phase slippage of the radiation with respect to the particle bunch velocity, v, can limit the effective interaction length as $v < c$. In comparison to using optical frequencies, the use of terahertz frequency radiation is attractive because the particle bunches and radiation pulses can remain in phase over longer distances.

In this talk I will present our work on developing ultrafast laser-driven terahertz radiation sources suitable for the acceleration of charged particles and our work in realizing a proof-of-principle terahertz acceleration experiment. This will include a discussion of our work on developing sources which can produce radiation with a novel polarization state aligned along the direction of beam propagation and our more recent work on developing a terahertz source with a sub-luminal phase velocity that can be tuned to match the velocity of a particle beam.

Speaker Biography

Darren Graham is a lecturer in the School of Physics and Astronomy at the University of Manchester. He uses ultrafast laser-based THz techniques to develop novel THz frequency radiation sources and exploits THz radiation to manipulate particle beams. He has published over 35 papers, with 833 citations and has a h-index of 13. He has held several international collaborative grants with researchers in Japan, Germany, and Ireland, and sits on the committee of the Institute of Physics Quantum Electronics and Photonics group.

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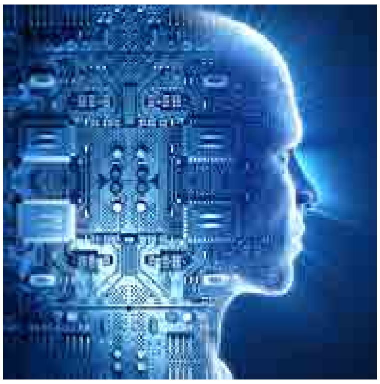

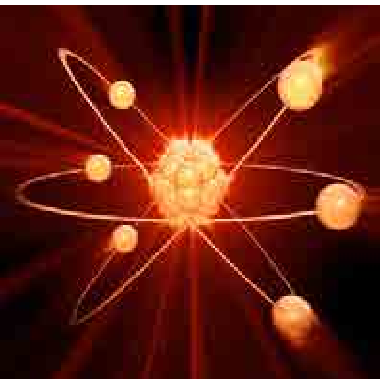

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Fluorescence and amplification in quantum systems with violated symmetry

Nikolai Bogolubov
V A Steklov Mathematical Institute of the RAS, Russia

One-electron multi-level atom model with violated symmetry, driven by external semi-classical monochromatic high-frequency electromagnetic field and interacting with a heat bath simultaneously, was studied under the assumption that its transition dipole operator possesses permanent diagonal matrix elements and not all of them are equal to each other, which assumption amounts to the violation of the spatial inversion symmetry. A general formula for the intensity of the electromagnetic field radiated from such a system in the far-distant zone was derived which does not contain contributions stemming from these non-zero permanent diagonal matrix elements of the transition dipole moments explicitly. Hence, it can be concluded that the dynamics of these diagonal matrix elements may affect the system fluorescence only indirectly through the alteration of the time dependence of the non-diagonal matrix elements due to quantum processes of higher orders. As an example, radiative properties of a monochromatically driven two-level quantum system with permanent non-equal dipole moment diagonal matrix elements were thoroughly analyzed. The central part of this work results are the (plausible) conditions under which this system driven by external monochromatic high-frequency laser field can radiate continuously at much lower frequency. It was also discussed how such a system could be realized in practice. The absorption-amplification response to the weak probe field in this system driven by external laser field at resonant frequency was studied too. It was found that this system is able to amplify low-frequency EM radiation for a broad enough range of frequencies. It is reasonable to assume that these results may be of use in various fields of nano-electronics and can be employed in development of practically useful devices dedicated for generation and amplification of relatively low-frequency (terahertz) EM radiation.

Speaker Biography

Nikolai Bogolubov is a chief scientific researcher at the VA Steklov Mathematical Institute of the RAS. His scientific interests are in general mathematical problems of equilibrium and non-equilibrium statistical mechanics and applications of modern mathematical methods of classical and quantum statistical mechanics to the problems of the polaron theory, super radiance theory, and the theory of superconductivity. His main works belong to the field of Theoretical and Mathematical Physics, Classical and Quantum Statistical Mechanics, Kinetic theory. He has published more than 150 works in the field of Statistical Mechanics, Theoretical and Mathematical Physics.

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Prospects for fibre-optic underwater sensing networks

Jolyon De Freitas
UK

Fibreoptic sensors for underwater applications have been developed for nearly 50 years mainly by the military. High precision designs have now been deployed in seismic underwater Oil & Gas, Defence and Climate Change applications. This talk gives a brief review of fibreoptic sensing technology in the underwater Oil & Gas, Defence and Climate Change applications. It highlights multiplexing of large-scale fibreoptic sensors up to a few thousands, current challenges, and future prospects for the technology.

Speaker Biography

Jolyon De Freitas is an optical engineer with over 25 years experience in high precision interferometry, optical metrology and fibre-optic sensing. He was involved in the design, development and high precision measurement of the optical homogeneity of gyroscope blanks for the readout system of the Stanford University/NASA Gravity Probe B satellite test of Einstein's General Theory of Relativity. He has worked both in academia as a lecturer in physics and as an optical specialist in the defence industry with QinetiQ and Atlas Elektronik UK. He has 8 patents and 25 peer-reviewed articles. He holds a PhD in Optical Metrology from Aberdeen University, Scotland.

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