2015 JOPT research excellence award

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Editorial

2015 JOPT research excellence award

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Congratulations to researchers from Finland and Russia for being awarded the inaugural JOPT research excellence award, recognizing their major advancement in the field of optics and, more specifically, their innovative work on photovoltaics and metamaterials.

What constitutes a highly significant publication? How does one put a measure on the impact an article has on its research community? Is an article that reaches across inter-disciplinary fields more or less valuable than one that makes a major advance in a niche area? Over what timescale should importance be evaluated? And who is well equipped to define and assess the significance criteria?

Undoubtedly these questions are all open and subject to debate. Yet, publications (and indeed researchers themselves) are constantly being measured against how well they perform and are received by peers. Why? The answer is the need for assessment; for example, for grant proposals, career progression, stature and recognition within a community (e.g. society fellowships, research prizes).

So it brings us to how one recognizes the paper of choice for research excellence in *Journal of Optics* (JOPT), an award that we are initiating as part of the 2015 relaunch of the journal. There is no doubt that the award, given to a single article, does not dilute the importance of all the other publications in the journal to their respective readers. Instead, it is to celebrate the achievement of the winning authors in carrying out truly ground-breaking research.

Nowadays, with the technological and electronic advancements over the preceding two decades, article-level metrics are to the fore. Individual article usage (downloads, online access), interest by the public and press, online commentary, sharing by email and blogs, and even how an article is received by social media, are all measures of success. Yet one measure that has so far withstood the test of time is the number of citations an article receives, i.e. its direct impact on the research output of others. Indeed, journals themselves are benchmarked by, for example, their impact factor usually over a two-year window. And so we feel it only fitting to award the JOPT research excellence award to the article that has received the most citations in the past two years[*].

The 2015 award

We are pleased to announce that the inaugural 2015 JOPT research excellence award goes to authors Nefedov and Valaginnopoulos from Aalto University, Finland, and Melnikov from Saratov State Technical University, Russia, for their article:

- *Perfect absorption in graphene multilayers* [1]: the paper demonstrates that total light absorption can be achieved in a graphene-based hyperbolic metamaterial. The metamaterial consists of periodically arranged graphene layers that are tilted with respect to the interface. While fabrication of the

[*] Scopus has been used as the source of citation data in June 2015.

proposed graphene asymmetric hyperbolic metamaterial is a challenging mission, the authors believe that it is doable using modern technologies.

The work is regarded as an outstanding piece of research in this field and the paper has exceptional merit.

In assessing this prize, we surveyed the top 10 most-cited original research papers; therefore, it is appropriate to pay tribute to the others short-listed too, all of which have clearly made a profound difference to their individual communities. Ordered by subject matter, they are:

- *Design of multi-band metamaterial perfect absorbers with stacked metal–dielectric disks*, by Dayal and Ramakrishna [2]: Indian researchers have designed multi-band metamaterial absorbers composed of periodically patterned stacked metal/dielectric disk structures on top of a continuous dielectric and metallic film at infrared wavelengths. The stack gives rise to large absorbance at different frequencies that is reasonably independent of the incidence angle for both TE and TM polarizations, and can be adjusted by appropriate choice of the dielectric spacers.

- *Optical properties of Ag nanoparticle layers deposited on silicon substrates*, by Thouti *et al* [3]: an Indian research team have studied the optical properties, reflectance and extinction, of Ag nanoparticle layers deposited on silicon and glass substrates in a wide range of visible and near-infrared wavelength regions. They have found that quadrupolar resonance excitation in the Ag particle surface can be beneficial for solar cells in reducing the reflection of light from the silicon substrate in the visible region by increasing the forward scattering to improve the performance of silicon based solar cells. It is thus possible to exploit the metal nanoparticles' surface plasmons to trap the entire polychromatic solar spectrum if one understands the effects of metal nanoparticle size, shape and distance between them, and also the effect of the interface.

- *Unusual reflection of electromagnetic radiation from a stack of graphene layers at oblique incidence*, by Bludov *et al* [4]: a trio of Portugal-based researchers study the interaction of electromagnetic radiation with single-layer graphene and a stack of parallel graphene sheets at arbitrary angles of incidence. They have found that the behavior is qualitatively different for transverse magnetic (or *p*-polarized) and transverse electric (or *s*-polarized) waves. In the case of equal dielectric constants of the media above and beneath graphene, for grazing incidence graphene is almost 100% transparent to *p*-polarized waves and acts as a tunable mirror for the *s*-polarization. These effects are enhanced for a stack of graphene sheets, so the system can work as a broad band polarizer.

- *On the limits of the effective description of hyperbolic materials in the presence of surface waves*, by Tschikin *et al* [5]: a German and French collaboration have addressed the question of the validity of an effective description for hyperbolic metamaterials in the near-field region. The team show that the presence of localized modes such as surface waves drastically limits the validity of the effective description, and requires revisiting the concept of homogenization in the near-field.

- *Instabilities, solitons and rogue waves in $\mathcal{PT}$-coupled nonlinear waveguides,* by Bludov *et al* [6]: this collaboration between researchers in Portugal, Israel and Germany consider the modulational instability of CW backgrounds and

the emergence and evolution of rogue waves in the system of linearly coupled $\mathcal{PT}$-symmetric coupled nonlinear Schrödinger equations. Importantly they show that focusing the cross-phase-modulation nonlinear interactions extend the effective stability region for rogue waves of the Peregrine type, and that the system considered can support nondissipative rogue waves too.

- *Electromagnetic rogue waves in beam–plasma interactions*, by Veldes *et al* [7]: inspired by the ubiquity of the challenging phenomenon, a research team from Greece, Iran and the United Kingdom have undertaken an investigation, from first principles, of the occurrence of rogue waves (often known as freak waves) associated with electromagnetic pulse propagation interacting with a plasma. They have found that rogue waves appear in plasma dynamics.

- *Improved decryption quality and security of a joint transform correlator-based encryption system*, by Vilardy *et al* [8]: given the importance of optical encryption technology for security applications, Spanish researchers analyze the algorithm of some reported methods that optically implement double random phase encryption in a joint transform correlator. They show that it is possible to significantly improve the quality of the decrypted image by introducing a simple nonlinear operation in the encrypted function that contains the joint power spectrum. This nonlinearity also makes the system more resistant to chosen-plaintext attacks.

- *Generating, multiplexing/demultiplexing and receiving the orbital angular momentum* (*OAM*) *of radio frequency signals using an optical true time delay unit*, by Gao *et al* [9]: Chinese researchers have proposed a scheme for generating and/or eliminating the OAM of radio frequency signals based on the true time delay system for the first time. The system is convenient and supports multiplexing/demultiplexing and data exchange of the OAM states. This can be regarded as the analog of various other multiplexing technologies for increasing the capacity and efficiency of radio communication systems.

- *Subwavelength particles in an inhomogeneous light field: optical forces associated with the spin and orbital energy flows*, by Bekshaev [10]: a scientist from Ukraine has analyzed the ponderomotive action experienced by a small spherical particle immersed in an optical field, in relation to the internal energy flows (optical currents) and their spin and orbital constituents. They have established the main regularities relating different sources of the ponderomotive action of electromagnetic fields ('ponderomotive factors'): the energy density gradient and the energy flow (field momentum)—in particular, its orbital and spin parts. It is hoped that the results can be useful for the experimental study of optical currents and their spin and orbital constituents.

As review articles also play an important role in advancing science, providing a much-needed overview of a timely and developing field, we acknowledge the top five cited reviews published in JOPT over the same period. They are:

- *Chiral metamaterials: from optical activity and negative refractive index to asymmetric transmission*, by Li *et al* [11]: researchers from Turkey summarize the progress in the development and application of chiral metamaterials. They review some of their salient features, introduce some typical chiral structures and application, and explore a few directions for future research on chiral metamaterials.

- *Goos–Hänchen and Imbert–Fedorov beam shifts: an overview*, by Bliokh and Aiello [12]: a pair of researchers from Ireland and Germany consider reflection

and transmission of polarized paraxial light beams at a plane dielectric interface, and give a self-consistent tutorial description of the Goos–Hänchen and Imbert–Fedorov effects. They describe the field transformations upon beam interaction with a dielectric interface, examine the beam shifts and underpinning conservation laws for the higher-order vortex beams carrying intrinsic orbital momentum, and also give a brief overview of various extensions and generalizations of the basic beam-shift phenomena and related effects.

- *Fano resonances and topological optics: an interplay of far- and near-field interference phenomena*, by Luk'yanchuk *et al* [13]: this collaboration between Singapore and Australian researchers explores how Fano resonances observed for light scattering at the nanoscale are accompanied by the singular phase effects usually associated with singular optics, counter to normal practice where Fano resonances and optical vortices are usually considered independently. They also introduce and describe optical vortices with characteristic core sizes well below the diffraction limit.

- *Optical super-oscillations: sub-wavelength light focusing and super-resolution imaging*, by Rogers and Zheludev [14]: researchers from the UK review the history and basic physics behind the phenomenon of super-oscillation and its application in optics, overviewing recent results in creating optical super-oscillations using binary masks, spatial light modulators and planar metamaterial masks, and investigating the limits and competitiveness of super-oscillatory imaging. Such optical super-oscillations offer a promising route to optical super-resolution imaging and show potential for manufacturing with light and data-storage applications such as direct optical recording and heat assisted magnetic recording.

- *Single molecule localization microscopy for superresolution*, by Allen *et al* [15]: in a timely review, given the award of the 2014 Nobel Prize in Chemistry, researchers from the USA provide a brief overview of super-resolution microscopy, including a detailed discussion of stochastic optical reconstruction microscopy, including practical guidelines for sample preparation designed to help to make the technique more accessible to the non-specialist.

As a service to JOPT readers, and to deservedly give them added prominence, all articles featured will be free to access online over the coming 12 months so we hope you share our high opinion of them and find them useful for your own research.

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