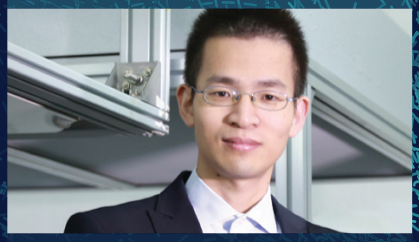
A Look Ahead

"In the next 12 months, the biggest advance in quantum technology will be building intermediate-scale quantum devices, using superconducting circuits or photons, to show, for the first time, quantum-computational speedup for some well-defined tasks compared with classical computers."

—Chao-Yang Lu

University of Science and Technology of China, Hefei, China



QUANTUM TECHNOLOGY

" We have only recently started to create super-chiral light and used it to enhance light-matter interactions ... We are not far off from having full control of matter's chirality through chiral light. If we can control the chiral nature of matter with super-chiral light, it would open new avenues in photochemistry."

— Andrew Forbes

University of the Witwatersrand, Johannesburg, South Africa

SUPER-CHIRAL LIGHT

"In 2020, a big advance in nano-photonics will be expanding the phase-space of quantum materials that can show strong-coupling with nanocavities. These hybrid or polariton states have been realized with model systems, but the ability to create new states with crystalline nanomaterials or molecular solids can pave the way for new types of coupling that could be used to modify chemical reactions."

—Teri W. Odom

Northwestern University, Evanston, Ill., USA

NANOCAVITIES

OPTICS in 2020 & BEYOND

Each December, OPN looks at interesting research results of the past year. But what about the year ahead? We asked several contributors to our "Optics in 2019" feature for thoughts on areas that might advance in 2020.

POLARIZATION CONTROL

"2020 will be the year of tailoring focal vector fields. We will witness, on the one hand, new discoveries on knots and networks of knots of polarization singularities, and on the other hand their full control. With that in hand, a number of applications in nanoparticle excitation, micromachining and plasmonic trapping will emerge."

—Cornelia Denz

University of Muenster, Muenster, Germany

OPTOMECHANICS

"In the next three to five years, the ability to prepare nonthermal states of a levitated optomechanical system will allow for new approaches to matter-wave interferometry. This will permit tests of quantum mechanics at larger mass and length scales ... Approaches to precision metrology with levitated optomechanical sensors are becoming a reality."

— Nick Vamivakas

University of Rochester, Rochester, N.Y., USA

IMAGING EXOPLANETS

"One advance in interferometric imaging of exoplanets will be a new vortex fiber nulling instrument now being implemented as part of the new Keck Planet Imager and Characterizer (KPIC). This instrument will be able to perform targeted single-mode high-resolution spectroscopy on brighter exoplanets, thus bringing several new techniques on-line capable of accessing very close-in exoplanets."

—Gene Serabyn

Jet Propulsion Laboratory, Pasadena, Calif., USA

Researcher photos: courtesy of researchers; Thumbnails: Getty Images; Infographic: Alessia Kirkland and Stewart Wills