

Science Talks

Sunday, 22 January 2023 10:00 (1 hour)

1 - 1:30: Claire Gmachl, “Quantum Cascade Ring Lasers and Related Systems”

Monolithic integrated photonics is a large field of active research interests, both foundational and for applications as varied as sensing or computing. Our interests in this area are especially directed towards active integrated photonics, where the light-guiding waveguides are at the same time functioning as light sources – lasers and spontaneous emitters – or detectors. Furthermore, we are focusing on the mid-infrared spectral range. We have designed and fabricated monolithic, $\lambda \sim 8\mu\text{m}$ quantum cascade ring lasers evanescently coupled either to linear waveguides for light coupling or to a second ring laser. For the lasers coupled to waveguides, injection of spontaneous emission from the coupled waveguide arms selects the clockwise or counter-clockwise mode with great fidelity. Without such injection the uniform ring laser shows bi-stability between the two rotational modes. Lasers coupled to another ring laser show complex rotational mode selection behavior not explained by straightforward mode-coupling. Besides mid-infrared, active, integrated photonics, recent research also explores the potential of applications of machine learning to quantum cascade laser design.

Delilah Gates, 1:30 - 2, “Red Light, Blue Light: Emission from Sources Orbiting Spinning Black Holes”

Black holes provide the strongest gravity environments in our universe. While the region the region of space-time near the event horizon is at large gravitational redshift relative to distant observers, matter orbiting in this region travels at relativistic speeds and can impart a significant Doppler shift to its electromagnetic emission. Hence emission from sources near a black hole can be observed with a net redshift or blueshift. Here we discuss features of photon emission from circular equatorial orbiters around black holes which help provide constraints on the black hole spin and inclination.

Presenters: GMACHL, Claire (Princeton University); GATES, Delilah (Princeton University)

Session Classification: Workshops