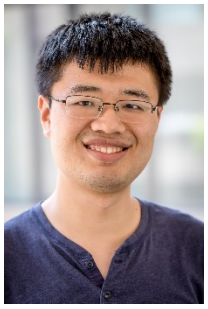
Joseph Taylor Graduate Student Fellowship

2017 Recipient



Xiao Mi is an experimentalist in condensed matter physics, working on quantum information processing using single electrons confined in silicon gate-defined quantum dots. The zero nuclear spin carried by the natural abundant isotope of silicon, ^{28}Si, minimizes the effects of hyperfine-induced dephasing of electron spins, which have extraordinarily long coherence times. Xiao works on coupling silicon spin qubits to single photons confined within superconducting cavities, which can be used for quantum non-demolition readout of spin qubits and serve as a quantum bus connecting distant spin qubits. He has demonstrated the first device achieving the strong-coupling regime between a semiconductor electron and a microwave photon, in which the photonic degree of freedom is coherently hybridized with the electron charge. More recently, he has used the new hybrid quantum device to perform high resolution spectroscopy of valley states in silicon and been working toward improving the device architecture to couple the spin state of a silicon electron to a cavity photon.

2015 Recipient

Max Hirschberger's research is in experimental condensed matter physics. In close collaboration with Professor Cava's Chemistry Department group, he has investigated heat transport phenomena related to the quantum-mechanical concept of the Berry curvature. He has studied the anomalous Lorentz-force in ferromagnetic insulators, where for certain crystal structures magnons can be deflected by a magnetic field - even though magnons have no electric charge. Similarly, he has shown that such a Lorentz force also exists in some frustrated magnets, where magnetic interactions are strong but there is no long-range order even at the lowest temperatures. The existence and magnitude of this anomalous Lorentz force in frustrated magnets can guide us to a better understanding of their quantum-mechanical ground state and elementary excitations. More recently, Max has devoted his time to the study of new electronic materials, the so-called Dirac and Weyl semimetals. These are 3-dimensional analogues of graphene. He is a graduate student in Professor Ong’s laboratory.

2014 Recipient

Vedika Khemani is a condensed matter theorist. Her research spans several topical and active areas of Condensed Matter Physics---the theory of topological phases, the role of entanglement in the quantum mechanics of many-body systems and the behavior of isolated quantum systems out of equilibrium. Her work has elucidated out of equilibrium behavior of systems near critical points including systems with topological order, established limits on the universality of the entanglement spectra of many-body quantum states and shown that large subsystems of even larger quantum systems can be described accurately by pure quantum states despite being entangled with their complements. Currently she is focused on better understanding the phenomenon of many-body localization in which certain quantum systems fails to obey statistical mechanics and are found generically in non-equilibrium states. Her work has elucidated ordering in such systems and established their surprising non-local response to local probes and she is engaged in developing computational tools to better understand their properties.

2013 Recipients

Jon Gudmundsson and **Alexandra (Sasha) Rahlin** share the inaugural award of the Joseph Taylor Graduate Student Fellowship. Jon and Alexandra work together and with colleagues on measuring and understanding the cosmic microwave background (CMB), the faint remnant radiation from the Big Bang. Their research uses the CMB to probe fundamental problems physics that blur the distinction between cosmology and particle physics. More specifically they work on SPIDER, a stratospheric balloon-borne millimeter wavelength polarimeter that is designed to image the temperature and polarization anisotropy in the CMB with unprecedented accuracy and sensitivity on scales larger than a half degree. SPIDER's primary goal is to measure or limit the presence of gravitation radiation generated in the very early universe. SPIDER is scheduled to fly from Antarctica on its maiden voyage in late 2013 or early 2014. In addition, both Jon and Alexandra work on the analysis of data from the HFI instrument aboard the Planck satellite. They are members of Prof. Jones's experimental cosmology group.