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Postdoctoral Positions available in the Yuen-Zhou group at UCSD

The Yuen-Zhou group at the University of California San Diego (UCSD) is a theoretical chemistry research group working at the intersection of quantum optics, condensed matter theory, and physical chemistry. We are interested in designing and studying new synergistic materials and phenomena that emerge by interfacing molecular systems with novel photonic nano and microstructures, solid state architectures, and quantum and classical electromagnetic fields. Current research interests broadly include polariton chemistry, topological states of matter, quantum dynamics, and quantum information science.

We are looking to hire three postdoctoral fellows (negotiable starting date, but positions are available ASAP and open until filled) to work on the following funded projects:

(a) DOE EC: The emergent photophysics and photochemistry of molecular polaritons
This DOE focuses on uncovering photophysical and photochemical processes that can be altered by collective strong light-matter coupling, and which can be exploited for the energy sciences. Topics of interest include energy and charge transfer and excitonic photophysics, and stimulated-scattering processes through nonequilibrium polariton condensates.

REFERENCES:

S. Pannir-sivajothi, J. A. Campos-Gonzalez-Angulo, L. A. Martínez-Martínez, S. Sinha, and J. Yuen-Zhou, Driving chemical reactions with polariton condensates, Nat. Commun. 13, 1645 (2022).

B. Xiang, R.F. Ribeiro, M. Du, L. Chen, Z. Yang, J. Wang, J. Yuen-Zhou, and W. Xiong, Intermolecular vibrational energy transfer enabled by microcavity strong light-matter coupling, Science 368, 6491 (2020).

(b) MURI: Polariton Chemistry
This AFOSR interdisciplinary funded project aims to uncover the emerging physicochemical properties of a new type of hybrid light-matter system consisting of solutions of IR and UV-visible molecular chromophores in resonant optical cavities. The modes featured by these systems (molecular polaritons) have intriguing properties including capabilities of remote energy transfer, anomalous nonlinear optical properties and modified chemical reactivity. This project is a collaborative team project involving the

Xiong (UCSD), Giebink (PSU), Menon (CCNY), Alú (CCNY), and Isborn (UCM) groups, and will leverage our work on theoretical chemistry with work on spectroscopy and photonics.

REFERENCES:

R. F. Ribeiro, J. A. Campos-González-Angulo, N. C. Giebink, W. Xiong, and J. Yuen-Zhou, Enhanced optical nonlinearities under strong light-matter coupling, Phys. Rev. A 103, 063111 (2021).

M. Du, R. F. Ribeiro, L. A. Martínez-Martínez, and J. Yuen-Zhou, Remote control of chemistry in optical cavities, Chem 5, 5, 1167 (2019).

(c) A Synthetic Electronics Route to Scalable and Competitive Molecular Qubit Systems

This is a project funded through the DOE as part of the effort of Materials and Chemical Sciences Research for Quantum Information Science. In collaboration with the Cushing (Caltech), Hadt (Caltech), Chen (UF), Dong (UChicago), Xiong (UCSD), our project will develop molecular qubit architectures for sensing and quantum information processing tasks. As theorists in this project, we aim to develop quantum optical frameworks to interpret nontrivial quantum correlations in spin, vibrational, and electronic degrees of freedom.

REFERENCES:

M. R. Wasielewski, M. D. E. Forbes, N. L. Frank, K. Kowalski, G. D. Scholes, J. Yuen-Zhou, M. A. Baldo, D. E. Freedman, R. H. Goldsmith, T. Goodson III, M. L. Kirk, J. K. McCusker, J. P. Ogilvie, D. A. Shultz, S. Stoll, K. B. Whaley, Exploiting chemistry and chemical systems for quantum information science, Nat. Rev. Chem. 4, 490 (2020).

Qualified candidates should be theorists holding a PhD in Chemistry, Physics, Materials Science, or related physical sciences. Strong analytical and computational skills are desired. Interested individuals should send a resume to Professor Joel Yuen-Zhou at joelyuen@ucsd.edu. UCSD is located in La Jolla, a seaside community within the city of San Diego, California, a city which invariably ranks high in terms of livability, good weather, and recreational activities (e.g., see here).