Stanford

Felipe Jornada

Assistant Professor of Materials Science and Engineering

Bio

BIO

Felipe Jornada's research aims at predicting and understanding excited-state phenomena in quantum and energy materials. In order to make reliable predictions on novel materials, he relies on high-performance computer calculations based on parameter-free, quantum-mechanical theories that are developed in his group. He is interested in studying fundamental aspects of these excitations – their lifetimes, dynamics, and stability/binding energies – and how they can be engineered in novel materials, such as nanostructured and low-dimensional systems. His ultimate goal is to use insights from atomistic calculations to rationally design new materials with applications in energy research, electronics, optoelectronics, and quantum technologies.

Felipe received his Ph.D. degree in physics from UC Berkeley in 2017 under the advice of Prof. Steven G. Louie. His Ph.D. research focused on the prediction of the electronic and optical properties of new quasi-two-dimensional materials, such as graphene and monolayer transition metal dichalcogenides. In his postdoc, he studied a number of problems related to multiparticle excitations in low-dimensional materials, including biexcitons and plasmons. Felipe joined the Stanford faculty in January 2020 and an assistant professor in the Department of Materials Science and Engineering.

ACADEMIC APPOINTMENTS

- Assistant Professor, Materials Science and Engineering

HONORS AND AWARDS

- Jagdeep & Roshni Singh Faculty Fellow, Stanford University (2020 – 2022)
- Best Thesis Prize, Kavli Energy NanoScience Institute, UC Berkeley (2017)

PROFESSIONAL EDUCATION

- Ph.D., UC Berkeley , Physics (2017)
- M.S., Federal University of Rio Grande do Sul, Brazil , Physics (2010)
- B.A., Federal University of Rio Grande do Sul, Brazil , Physics (2007)

Teaching

COURSES

2022-23

- Materials Science Colloquium: MATSCI 230 (Aut, Win, Spr)
- Quantum Theory of Electronic and Optical Excitations in Materials: MATSCI 341 (Spr)
- Waves and Diffraction in Solids: MATSCI 195, MATSCI 205, PHOTON 205 (Win)

2021-22

- Materials Science Colloquium: MATSCI 230 (Win)
- Quantum Theory of Electronic and Optical Excitations in Materials: MATSCI 341 (Win)
- Waves and Diffraction in Solids: MATSCI 195, MATSCI 205, PHOTON 205 (Spr)

2020-21

- Quantum Theory of Electronic and Optical Excitations in Materials: MATSCI 341 (Spr)
- Waves and Diffraction in Solids: MATSCI 195, MATSCI 205, PHOTON 205 (Aut)

2019-20

- Quantum Theory of Electronic and Optical Excitations in Materials: MATSCI 341 (Spr)

STANFORD ADVISEES

Doctoral Dissertation Reader (AC)

Settasit Chaikasetsin, Rupini Kamat, Sze Cheung Lau, Aidan O'Beirne

Orals Chair

Adrien Descamps

Postdoctoral Faculty Sponsor

Chris Ciccarino, Sudipta Kundu

Doctoral Dissertation Advisor (AC)

Aaron Altman, Johnathan Georgaras, Zachary Mauri, Akash Ramdas

Orals Evaluator

Elissa Klopfer

Master's Program Advisor

Laura Madril, Swetha Vaidyanathan, Su Zhao

Doctoral Dissertation Co-Advisor (AC)

Daisy O'Mahoney, Maritha Wang, Gregory Zaborski

Publications

PUBLICATIONS

- **Optical absorption of interlayer excitons in transition-metal dichalcogenide heterostructures.** *Science (New York, N.Y.)*
  Barre, E., Karni, O., Liu, E., O'Beirne, A. L., Chen, X., Ribeiro, H. B., Yu, L., Kim, B., Watanabe, K., Taniguchi, T., Barmak, K., Lui, C. H., Refaely-Abramson, et al
  2022; 376 (6591): 406-410

- **Structure of the moire exciton captured by imaging its electron and hole.** *Nature*
  Karni, O., Barre, E., Pareek, V., Georgaras, J. D., Man, M. K., Sahoo, C., Bacon, D. R., Zhu, X., Ribeiro, H. B., O'Beirne, A. L., Hu, J., Al-Mahboob, A., Abdelrasoul, et al
  2022; 603 (7900): 247-252

- **Giant exciton-enhanced shift currents and direct current conduction with subbandgap photo excitations produced by many-electron interactions** *PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES OF THE UNITED STATES OF AMERICA*
  Chan, Y., Qiu, D. Y., da Jornada, F. H., Louie, S. G.
  2021; 118 (25)

- **Experimental measurement of the intrinsic excitonic wave function.** *Science advances*
  Man, M. K., Madeo, J., Sahoo, C., Xie, K., Campbell, M., Pareek, V., Karmakar, A., Wong, E. L., Al-Mahboob, A., Chan, N. S., Bacon, D. R., Zhu, X., Abdelrasoul, et al
  2021; 7 (17)
- **Universal slow plasmons and giant field enhancement in atomically thin quasi-two-dimensional metals.** *Nature communications*
  da Jornada, F. H., Xian, L., Rubio, A., Louie, S. G.
  2020; 11 (1): 1013
- **Origins of Singlet Fission in Solid Pentacene from an ab initio Green's Function Approach** *PHYSICAL REVIEW LETTERS*
  Refaely-Abramson, S., da Jornada, F. H., Louie, S. G., Neaton, J. B.
  2017; 119 (26): 267401
- **Environmental Screening Effects in 2D Materials: Renormalization of the Bandgap, Electronic Structure, and Optical Spectra, of Few-Layer Black Phosphorus** *NANO LETTERS*
  Qiu, D. Y., da Jornada, F. H., Louie, S. G.
  2017; 17 (8): 4706–12
- **Optical Spectrum of MoS2: Many-Body Effects and Diversity of Exciton States** *PHYSICAL REVIEW LETTERS*
  Qiu, D. Y., da Jornada, F. H., Louie, S. G.
  2013; 111 (21): 216805
- **Using dynamic mode decomposition to predict the dynamics of a two-time non-equilibrium Green's function** *JOURNAL OF COMPUTATIONAL SCIENCE*
  Yin, J., Chan, Y., da Jornada, F. H., Qiu, D. Y., Louie, S. G., Yang, C.
  2022; 64
- **Intralayer charge-transfer moire excitons in van der Waals superlattices.** *Nature*
  Naik, M. H., Regan, E. C., Zhang, Z., Chan, Y., Li, Z., Wang, D., Yoon, Y., Ong, C. S., Zhao, W., Zhao, S., Utama, M. I., Gao, B., Wei, et al
  2022; 609 (7925): 52-57
- **Quasiparticle energies and optical excitations of 3C-SiC divacancy from GW and GW plus Bethe-Salpeter equation calculations** *PHYSICAL REVIEW MATERIALS*
  Gao, W., da Jornada, F. H., Del Ben, M., Deslippe, J., Louie, S. G., Chelikowsky, J. R.
  2022; 6 (3)
- **Identifying Hidden Intracell Symmetries in Molecular Crystals and Their Impact for Multiexciton Generation.** *The journal of physical chemistry letters*
  Altman, A. R., Refaely-Abramson, S., da Jornada, F. H.
  1800: 747-753
- **Discovering and understanding materials through computation.** *Nature materials*
  Louie, S. G., Chan, Y., da Jornada, F. H., Li, Z., Qiu, D. Y.
  2021; 20 (6): 728-735
- **The 2021 Ultrafast Spectroscopic Probes of Condensed Matter Roadmap.** *Journal of physics. Condensed matter : an Institute of Physics journal*
  Lloyd-Hughes, J., Oppeneer, P., Pereira Dos Santos, T., Schleife, A., Meng, S., Sentef, M. A., Ruggenthaler, M., Rubio, A., Radu, I., Murnane, M., Shi, X., Kapteyn, H., Stadtmuller, et al
  2021
- **Solving the Bethe-Salpeter equation on a subspace: Approximations and consequences for low-dimensional materials** *PHYSICAL REVIEW B*
  Qiu, D. Y., da Jornada, F. H., Louie, S. G.
  2021; 103 (4)
- **Reproducibility in G(0)W(0) calculations for solids** *COMPUTER PHYSICS COMMUNICATIONS*
  Rangel, T., Del Ben, M., Varsano, D., Antonius, G., Bruneval, F., Jornada, F. H., van Setten, M. J., Orhan, O. K., O'Regan, D. D., Canning, A., Ferretti, A., Marini, A., Rignanese, et al
  2020; 255
- **Accelerating Large-Scale Excited-State GW Calculations on Leadership HPC Systems** *SC20*
  Del Ben, M., Yang, C., Li, Z., da Jornada, F. H., Louie, S. G., Deslippe, J.
  2020: 11

- **Accelerating GW-Based Energy Level Alignment Calculations for Molecule-Metal Interfaces Using a Substrate Screening Approach** *JOURNAL OF CHEMICAL THEORY AND COMPUTATION*
  Liu, Z., da Jornada, F. H., Louie, S. G., Neaton, J. B.
  2019; 15 (7): 4218–27
- **Electron-Phonon Coupling from Ab Initio Linear-Response Theory within the GW Method: Correlation-Enhanced Interactions and Superconductivity in Ba1-xKxBiO3** *PHYSICAL REVIEW LETTERS*
  Li, Z., Antonius, G., Wu, M., da Jornada, F. H., Louie, S. G.
  2019; 122 (18): 186402
- **Static subspace approximation for the evaluation of G(0)W(0) quasiparticle energies within a sum-over-bands approach** *PHYSICAL REVIEW B*
  Del Ben, M., da Jornada, F. H., Antonius, G., Rangel, T., Louie, S. G., Deslippe, J., Canning, A.
  2019; 99 (12)
- **A dielectric-defined lateral heterojunction in a monolayer semiconductor** *NATURE ELECTRONICS*
  Utama, M., Kleemann, H., Zhao, W., Ong, C., da Jornada, F. H., Qiu, D. Y., Cai, H., Li, H., Kou, R., Zhao, S., Wang, S., Watanabe, K., Taniguchi, et al
  2019; 2 (2): 60–65
- **Large-scale GW calculations on pre-exascale HPC systems** *COMPUTER PHYSICS COMMUNICATIONS*
  Del Ben, M., da Jornada, F. H., Canning, A., Wichmann, N., Raman, K., Sasanka, R., Yang, C., Louie, S. G., Deslippe, J.
  2019; 235: 187–95
- **Low-lying excited states in crystalline perylene** *PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES OF THE UNITED STATES OF AMERICA*
  Rangel, T., Rinn, A., Sharifzadeh, S., da Jornada, F. H., Pick, A., Louie, S. G., Witte, G., Kronik, L., Neaton, J. B., Chatterjee, S.
  2018; 115 (2): 284–89
- **A STRUCTURE PRESERVING LANCZOS ALGORITHM FOR COMPUTING THE OPTICAL ABSORPTION SPECTRUM** *SIAM JOURNAL ON MATRIX ANALYSIS AND APPLICATIONS*
  Shao, M., da Jornada, F. H., Lin, L., Yang, C., Deslippe, J., Louie, S. G.
  2018; 39 (2): 683–711
- **Accelerating Optical Absorption Spectra and Exciton Energy Computation via Interpolative Separable Density Fitting**
  Hu, W., Shao, M., Cepellotti, A., da Jornada, F. H., Lin, L., Thicke, K., Yang, C., Louie, S. G., Shi, Y., Fu, H., Tian, Y., Krzhizhanovskaya, V. V., Lees, et al
  SPRINGER INTERNATIONAL PUBLISHING AG.2018: 604–17
- **Ab initio Modelling of Plasmons in Metal-semiconductor Bilayer Transition-metal Dichalcogenide Heterostructures** *ISRAEL JOURNAL OF CHEMISTRY*
  Sener Sen, H., Xian, L., da Jornada, F. H., Louie, S. G., Rubio, A.
  2017; 57 (6): 540–46
- **Nonuniform sampling schemes of the Brillouin zone for many-electron perturbation-theory calculations in reduced dimensionality** *PHYSICAL REVIEW B*
  da Jornada, F. H., Qiu, D. Y., Louie, S. G.
  2017; 95 (3)
- **Direct observation of the layer-dependent electronic structure in phosphorene** *NATURE NANOTECHNOLOGY*
  Li, L., Kim, J., Jin, C., Ye, G., Qiu, D. Y., da Jornada, F. H., Shi, Z., Chen, L., Zhang, Z., Yang, F., Watanabe, K., Taniguchi, T., Ren, et al
  2017; 12 (1): 21–25
- **Excitation spectra of aromatic molecules within a real-space GW-BSE formalism: Role of self-consistency and vertex corrections** *PHYSICAL REVIEW B*
  Hung, L., da Jornada, F. H., Souto-Casares, J., Chelikowsky, J. R., Louie, S. G., Ogut, S.
  2016; 94 (8)
- **Low rank approximation in G (0) W (0) calculations**
  Shao MeiYue, Lin Lin, Yang Chao, Liu Fang, Da Jornada, F. H., Deslippe, J., Louie, S. G.
  SCIENCE PRESS.2016: 1593–1612
- **Screening and many-body effects in two-dimensional crystals: Monolayer MoS2** *PHYSICAL REVIEW B*
  Qiu, D. Y., da Jornada, F. H., Louie, S. G.
  2016; 93 (23)
- **Structure preserving parallel algorithms for solving the Bethe-Salpeter eigenvalue problem** *LINEAR ALGEBRA AND ITS APPLICATIONS*

Shao, M., da Jornada, F. H., Yang, C., Deslippe, J., Louie, S. G.
2016; 488: 148–67

- **Optimizing Excited-State Electronic-Structure Codes for Intel Knights Landing: A Case Study on the BerkeleyGW Software**
  Deslippe, J., da Jornada, F. H., Vigil-Fowler, D., Barnes, T., Wichmann, N., Raman, K., Sasanka, R., Louie, S. G., Taufer, M., Mohr, B., Kunkel, J. M.
  SPRINGER INTERNATIONAL PUBLISHING AG.2016: 402–14

- **Probing the Role of Interlayer Coupling and Coulomb Interactions on Electronic Structure in Few-Layer MoSe2 Nanostructures** *NANO LETTERS*
  Bradley, A. J., Ugeda, M. M., da Jornada, F. H., Qiu, D. Y., Ruan, W., Zhang, Y., Wickenburg, S., Riss, A., Lu, J., Mo, S., Hussain, Z., Shen, Z., Louie, et al
  2015; 15 (4): 2594-2599

- **Numerical integration for ab initio many-electron self energy calculations within the GW approximation** *JOURNAL OF COMPUTATIONAL PHYSICS*
  Liu, F., Lin, L., Vigil-Fowler, D., Lischner, J., Kemper, A. F., Sharifzadeh, S., da Jornadad, F. H., Deslippe, J., Yang, C., Neaton, J. B., Louie, S. G.
  2015; 286: 1–13

- **Giant bandgap renormalization and excitonic effects in a monolayer transition metal dichalcogenide semiconductor** *NATURE MATERIALS*
  Ugeda, M. M., Bradley, A. J., Shi, S., da Jornada, F. H., Zhang, Y., Qiu, D. Y., Ruan, W., Mo, S., Hussain, Z., Shen, Z., Wang, F., Louie, S. G., Crommie, et al
  2014; 13 (12): 1091-1095

- **Tuning Many-Body Interactions in Graphene: The Effects of Doping on Excitons and Carrier Lifetimes** *PHYSICAL REVIEW LETTERS*
  Mak, K. F., da Jornada, F. H., He, K., Deslippe, J., Petrone, N., Hone, J., Shan, J., Louie, S. G., Heinz, T. F.
  2014; 112 (20)

- **Modeling of amorphous carbon structures with arbitrary structural constraints** *JOURNAL OF PHYSICS-CONDENSED MATTER*
  Jornada, F. H., Gava, V., Martinotto, A. L., Cassol, L. A., Perottoni, C. A.
  2010; 22 (39): 395402