Antoine Georges
Main Scientific Results and Publications

Anomalous Diffusion in Disordered Systems. As part of my PhD, I identified (with in particular Jean-Philippe Bouchaud and Pierre Le Doussal) the fundamental mechanisms leading to non-Brownian diffusion and obtained analytical solutions of several models of diffusion in disordered environments leading to subdiffusive or superdiffusive behaviour. The review article co-authored on this topic [1] is to this date my second most cited article.

Statistical Physics in Large Dimensions. With Jonathan Yedidia, I devised a systematic method to perform expansions of the Gibbs free-energy of models in statistical mechanics, generalizing to arbitrary order in the inverse temperature the Thouless-Anderson-Palmer equations and unraveling the connections between high-temperature series expansion, mean-field theories and expansions in the inverse of dimensionality [2]. This led to an exact solution of the fully frustrated Ising model in the limit of infinite dimensions [3] and to a proof that the free energy of a classical Ising spin-glass on an infinite-dimensional cubic lattice coincides with that of the fully connected Sherrington-Kirkpatrick model [4]. To a large extent, these works prepared me for the subsequent investigation of correlated fermions in the limit of large dimensions and the elaboration of dynamical mean-field theory.

Dynamical Mean-Field Theory. Gabriel Kotliar and myself established the Dynamical Mean Field Theory (DMFT) framework for strongly correlated electrons by introducing a mapping which associates a local quantum impurity model to a given lattice model of interacting electrons [5]. These basic DMFT equations provide a solution to the Hubbard model in Metzner and Vollhardt's infinite dimensional limit. DMFT is now recognized as a conceptual framework to understand materials with strong correlations as well as a powerful computational method for understanding and predicting their physical properties. The review article I co-authored on this topic [6] has been cited more than 7400 times as of 07/2022.

Theory of the Mott transition. An early success of DMFT has been to provide a complete theory of the Mott transition, treating on equal footing low-energy Fermi liquid quasiparticles and high-energy atomic-like excitations (Hubbard bands). With Werner Krauth, in independent and parallel work to that of Rozenberg and Kotliar, we identified this transition and investigated its nature using both analytical and computational methods [7, 8]. Together with the work of Jarrell, these two sets of work were also the first ones in which a controlled numerical solution of the DMFT equations were obtained using a Quantum Monte Carlo algorithm. In [8], we also predicted that the correlated metal can display a Pomeranchuk effect (increased localisation by heating) - a related effect has recently been observed in experiments on twisted bilayer graphene (Rozen et al., Nature 592, 214 (2021); Saito et al. Nature 592, 220 (2021)).

Several years later, in a collaboration with Patrice Limelette and the experimental group of Denis Jérome in Orsay, we revealed for the first time the universal scaling properties associated with the Mott critical endpoint, using V_2O_3 under pressure as a platform, and found them to be consistent with that of a liquid-gas (Ising) transition in agreement with the predictions of DMFT and with general symmetry considerations [9]. I also explored the transition and crossovers associated with Mott physics in the context of the κ-BEDT organic materials [10].

More recently, I have shown with Xiaoyu Deng and coworkers that DMFT provides a full description of the crossover between a Fermi liquid metal at low temperature and a bad metal at high temperature, revealing an intermediate temperature regime with 'resilient' quasiparticles above the strict Landau Fermi liquid crossover scale [11].

Kondo impurity models.

Solution of the 2-impurity 2-channel Kondo model. With Anirvan Sengupta, we obtained the first solution of the two-impurity two-channel Kondo model using a combination of conformal invariance and bosonisation techniques [12, 13]. We showed the existence of manifold of non-Fermi liquid fixed points in this model, with critical exponents depending continuously on two parameters, and established a description of these fixed points in terms of Majorana fermions.

Exact Large-N solutions. With Olivier Parcollet and coworkers, we obtained controlled large-N solutions of overscreened multi-channel Kondo models, and showed how properties of the non-Fermi liquid fixed points such as the universal fixed point entropy can be extracted from the integral equations that hold in this limit[14]. We also showed how a transition from overscreening to underscreening can be obtained for bosonic (symmetric) representations in this limit [15].

Double quantum dot. With Yigal Meir, I mapped out the conductance properties of a double dot quantum device, revealing signatures of the crossover between the limit in which the local moment on each dot is independently screened to the one in which an inter-dot singlet is formed [16]. This stimulated subsequent experiments on double dot devices.

Auxiliary particle representations of interacting fermions. Over the years, I have invented and applied several auxiliary ('slave') particle methods extending and generalizing the original ones. These new methods range from great simplicity - the 'slave rotor' method [17] in which a single phase variable is introduced dual to the total charge, to more sophisticated approaches aimed at treating more complex multi-orbital interactions, such as the 'slave spin' [18] and the 'rotationally invariant' slave boson method [19]. The latter is now being used in realistic calculations of correlated electron materials in combination with electronic structure methods. I also pointed out that slave boson methods yield two parametrically distinct energy scales in the context of the Kondo lattice or heavy fermion systems: a scale associated with the onset of screening of individual local moments, and a lower scale corresponding to collective Fermi liquid coherence [20].

Very recently, with Javier Robledo-Moreno and coworkers, we drew inspiration from such methods to propose a neural variational wave-function for fermions which is competitive and sometimes outperform other variational methods [21].

Sachdev-Ye-Kitaev Models. With Olivier Parcollet, we performed the first investigation of the physics of doped carriers in the Sachdev-Ye (SY) random exchange spin liquid, revealing the Fermi liquid crossover (now known as the SYK_4 to SYK_2 to crossover) and the bad metal regime with T-linear resistivity above this crossover [22]. In the same work, we argued that the SY model displays conformal invariance at low energy and placed ω/T scaling in this context. With S.Burdin and D.Grempel [23], I generalized this work to the Kondo lattice, obtaining a spin-liquid phase with a small Fermi surface in which the Kondo coupling is irrelevant - this work partly provided inspiration for Sachdev, Senthil and Vojta's proposal of the FL* phase.

Elaborating on the techniques that we had previously developed for large-N Kondo models (see above) Parcollet, Sachdev and myself showed that the SY model has an extensive entropy in the zero-temperature limit and derived an analytical expression of this entropy as a function of the size of the representation (or particle number) [24, 25]. Famously, this entropy has now been interpreted as the Bekenstein-Hawking entropy of a black hole in the context of the holographic dual of the SYK model. In the same works we obtained an analytical solution of the bosonic SY model in its spin-glass phase.

Very recently, I have been involved in several collaborations which addressed doped SY models for physical SU(2) spin-1/2 electrons. We showed in particular that the quantum critical point separating the quantum spin-glass phase from the Fermi liquid one upon doping hosts a strange metal with marginal Fermi liquid local spin dynamics and 'Planckian' (T-linear) behaviour of the inverse quasiparticle lifetime [26]. With Nikita Kavokine and Olivier Parcollet, we are currently investigating the spin glass phase with full replica symmetry breaking.

Two-dimensional Hubbard model, the peudogap and cuprate superconductors. With several coworkers (in particular Michel Ferrero) and along with several other groups, I have contributed [27, 28, 29] to the study of the two-dimensional Hubbard model using cluster extensions of dynamical mean-field theory. This line of work has established that at low doping the model displays a pseudogap that opens up below a crossover temperature which decreases as doping is increased and selectively removes spectral weight from the antinodal regions of the Brillouin zone. The opening of the pseudogap is associated with increased magnetic correlations but, in the strong coupling regime, a large magnetic correlation length is not required.

Recently, I have been involved in a series of works that address the physics of the two-dimensional Hubbard model using a combination of controlled numerical techniques. With Wei Wu and coworkers, we have been able to enter the pseudogap regime using diagrammatic Monte Carlo, confirming the above physical picture, and establishing quantitative agreement between this unbiased method and cluster DMFT methods extrapolated to large cluster sizes[30]. In work with Alexander Wietek and coworkers leveraging on the development of the Minimally Entangled Typical State method, we have clarified how this pseudogap regime dominated by spin correlations eventually evolves into a stripe charge ordered state at a lower temperature[31]. This work and related ones establish a 'handshake' between methods exploiting locality on the high-temperature side (as does cluster DMFT) and wave-function method such as tensor networks/DMRG exploiting entanglement properties of wave-functions. I have also initiated an extensive 'multi-method multi-messenger' study of the crossovers and spin fluctuation physics of the two-dimensional Hubbard model at weak coupling, led by Thomas Schäfer[32].

I have collaborated with several experimental groups on the physics of cuprate high-temperature superconductors, most notably in a Raman scattering study by M.Le Tacon and the Sacuto group revealing the presence of two separate energy scales in the superconducting state[33].

Screening and strong correlations from first principles: GW+DMFT and constrained RPA. Over the years, I have taken an active part in developing the combinations between DMFT and electronic structure methods, aimed at a realistic description of materials with strong electronic correlations. With Silke Biermann and Ferdi Aryasetiawan, we proposed to combine DMFT with the GW method (i.e. ab initio RPA) in order to provide a description of screening from first principles and avoid the arbitrariness associated with the so-called double counting correction [34]. I also took part in the collaboration which proposed the constrained-RPA method for the determination of of the matrix elements of the screened local interaction for a given target set of orbitals [35].

My group was also among the first to implement the combination of DMFT and density functional theory methods with Wannier functions constructed from a restricted set of bands and released the first open-source code implementing the DFT+DMFT approach (a dozen such codes are now publicly available) [36]. This code was developed by Markus Aichorn, Leonid Pourovskii and Veronica Vildosola and released within the TRIQS software library (created by Parcollet, Ferrero, now Wentzell and coworkers).

Electronic structure of materials with strong electronic correlations. Over the years, I have been interested with many collaborators in the physical properties of a number of materials with strong electronic correlations, often performing electronic structure studies of these materials using DMFT. I collaborated with many experimental groups, interpreting and explaining experimental observations and making several predictions for future experiments.

I have, for example, explored the Mott/Peierls interplay in VO_2 [37]; explained that the mechanism behind the metal-insulator transition of the 113 vanadates and titanate perovskites crucially involves the lifting of orbital degeneracy [38]; provided a low-energy description [39] of the 113 rare-earth nickelates $RNiO_3$ naturally leading to the observed disproportion instability in these materials and consistent with the Park-Millis-Marianetti picture of a 'site-selective Mott transition' ; emphasized the key role of entropy in the α-γ transition of Cerium [40] and predicted early on that FeSe displays orbital selectivity with very different quasiparticle coherence scales for the different orbitals [41].

I have had particular interest in metallic systems in which the Hund's coupling is distinctly responsible for strong electronic correlations - a set of materials now commonly refereed to as '*Hund's metals*' and encompassing in particular the iron-based superconductors as well as most of the transition metals of the 4d series. With Luca de' Medici and Jernej Mravlje, we emphasized the dual effect of the Hund's coupling, which reduces the effective Coulomb interaction for non half-filled shells but strongly suppresses the quasiparticle weight and coherence scale [42]. This leads to a new route to strong correlations, which does not require proximity to the Mott transition. Together, we wrote a review article on this topic [43], cited more than 650 times as of 07/2022.

With Jernej Mravlje and coworkers, we showed [44] that the Hund's coupling plays a crucial role in accounting for the electronic correlations in the normal state of Sr_2RuO_4, an additional important effect being the proximity of the γ-band to the van Hove singularity. I have had a productive collaboration with Jernej over the years, involving also a number of theory and experimental colleagues, resulting in a rather complete understanding of the normal state properties of Sr_2RuO_4. We calculated and interpreted infra-red optical spectra [45], calculated the Seebeck coefficient, pointed out that its value at intermediate temperature signals the characteristic regime of Hund's metals in which orbital are quenched but spin fluctuates and made predictions (later verified experimentally) for the c-axis Seebeck coefficient [46], explained the remarkable temperature dependence of the Hall coefficient [47] and predicted the correlation-induced enhancement of the spin-orbit splitting (along with Zhang, Pavarini et al.) [48]. Recently, with Manuel Zingl and the Geneva photoemission group (Felix Baumberger, Anna Tamai) we validated this prediction experimentally and showed that the self-energy directly extracted from the high-resolution ARPES data is angular independent in the orbital basis, hence providing a direct experimental confirmation of the DMFT ansatz [49].

Recently, with Hugo Strand and coworkers, we were able to calculate the full momentum-dependent spin response from DMFT, obtaining excellent agreement with neutron spectra and emphasizing key limitations of the RPA approximation [50]. Progressing towards lower energy scales, we are currently trying to reach a microscopic description of the pairing symmetry of the superconduting state.

Light control of quantum materials. From 2013 until 2019 I was one of the PIs of an ERC-Synergy collaboration exploring the control of quantum materials by ultra-short light pulses. One of the notable achievements has been the elaboration, in collaboration with Alaska Subedi and Andrea Cavalleri, of a first-principles theory of 'non-linear phononics'[51], which explains the transient structural change of a material thanks to the anharmonic coupling of the excited dipolar active mode to structurally relevant Raman active modes. In a related field, I was also involved in the theory part of one the very first study of a correlated material by femtosecond time-resolved spectroscopy[52].

Ultra cold atomic gases.

Pomeranchuk cooling of fermionic gases. Building on the Pomeranchuk effect that Krauth and myself predicted earlier for the Hubbard model, I proposed with Felix Werner and coworkers an adiabatic cooling mechanism for cold fermions in optical lattices [53]. To the best of my knowledge, this work is also the first one in which the iso-entropy curves of the Hubbard model as a function of temperature and interaction strength were considered. The proposed mechanism was later evidenced experimentally by the Kyoto group for fermionic Ytterbium thanks to the large entropy associated with SU(6) symmetry (Taie et al., Nature Physics 8, 825 (2012)).

Cooling by trap shaping. With Jean-Sébastien Bernier, Corinna Kollath and coworkers, we proposed a cooling mechanism relying on the creation of low-entropy and high-entropy regions by adequately shaping the trapping potential[54]. Variants of this mechanism have been implemented in recent experiments demonstrating the formation of Mott insulating and antiferromagnetic states of cold fermions in optical lattices (see e.g. Greif et al. Science 351, 953 (2016).

Outcoupling spectroscopy - an analogue of photoemission. With Lam Dao, Jean Dalibard and coworkers, we proposed a procedure realizing an analogue of angular-resolved photoemission spectroscopy in cold atomic quantum gases [55]. Although our proposal involved Raman transitions, a simpler setup using radio-requency spectroscopy was later used by Deborah Jin and coworkers in the first experimental demonstration of momentum-resolved outcoupling spectroscopies in atomic gases.

Thermolectric transport in quantum gases. With Charles Grenier and Corinna Kollath, we proposed a framework to measure transport properties involving a coupled flow of particles and entropy and collaborated with the group of Tilman Esslinger (Jean-Philippe Brantut and coworkers), resulting in the first experimental demonstration of these effects and realizing an ultra-cold gases 'thermoelectric heat engine'[56].

Interaction-induced slowing down of decoherence. With D.Poletti, J-S Bernier and C.Kollath, we showed that interaction effects can slow down the dynamics of decoherence in systems of ultra-cold bosonic gases coupled to a dissipative environement [57, 58]. This effect was later demonstrated experimentally by Bouganne et al. (Nature Physics, 16, 21 (2020)).

Main Publications[1]

[1] J.-P. Bouchaud and A. Georges, "Anomalous diffusion in disordered media: Statistical mechanisms, models and physical applications," *Physics Reports*, vol. 195, no. 4, pp. 127–293, 1990.

[2] A. Georges and J. S. Yedidia, "How to expand around mean-field theory using high-temperature expansions," *Journal of Physics A: Mathematical and General*, vol. 24, pp. 2173–2192, may 1991.

[3] J. S. Yedidia and A. Georges, "The fully frustrated Ising model in infinite dimensions," *Journal of Physics A: Mathematical and General*, vol. 23, pp. 2165–2171, jun 1990.

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[1] As of 2022, I am the author of 240+ publications cited over 36400 times (H=83) (see my Google Scholar page for a complete list.

[4] A. Georges, M. Mézard, and J. S. Yedidia, "Low-temperature phase of the Ising spin glass on a hypercubic lattice," *Phys. Rev. Lett.*, vol. 64, pp. 2937–2940, Jun 1990.

[5] A. Georges and G. Kotliar, "Hubbard model in infinite dimensions," *Phys. Rev. B*, vol. 45, pp. 6479–6483, Mar 1992.

[6] A. Georges, G. Kotliar, W. Krauth, and M. J. Rozenberg, "Dynamical mean-field theory of strongly correlated fermion systems and the limit of infinite dimensions," *Reviews of Modern Physics*, vol. 68, pp. 13–125, Jan. 1996.

[7] A. Georges and W. Krauth, "Numerical solution of the d=∞ Hubbard model: Evidence for a Mott transition," *Phys. Rev. Lett.*, vol. 69, pp. 1240–1243, Aug 1992.

[8] A. Georges and W. Krauth, "Physical properties of the half-filled Hubbard model in infinite dimensions," *Phys. Rev. B*, vol. 48, pp. 7167–7182, Sep 1993.

[9] P. Limelette, A. Georges, D. Jérome, P. Wzietek, P. Metcalf, and J. M. Honig, "Universality and Critical Behavior at the Mott Transition," *Science*, vol. 302, pp. 89–92, Oct 2003.

[10] P. Limelette, P. Wzietek, S. Florens, A. Georges, T. A. Costi, C. Pasquier, D. Jérome, C. Mézière, and P. Batail, "Mott Transition and Transport Crossovers in the Organic Compound κ-(BEDT-TTF)$_2$Cu[N(CN)$_2$]Cl," *Phys. Rev. Lett.*, vol. 91, p. 016401, Jul 2003.

[11] X. Deng, J. Mravlje, R. Žitko, M. Ferrero, G. Kotliar, and A. Georges, "How Bad Metals Turn Good: Spectroscopic Signatures of Resilient Quasiparticles," *Phys. Rev. Lett.*, vol. 110, p. 086401, Feb 2013.

[12] A. Georges and A. M. Sengupta, "Solution of the Two-Impurity, Two-Channel Kondo Model," *Phys. Rev. Lett.*, vol. 74, pp. 2808–2811, Apr 1995.

[13] A. Georges and A. Sengupta, "Kondo quartet," *Nuclear Physics B - Proceedings Supplements*, vol. 58, pp. 105–122, 1997. Proceedings of the European Research Conference in the Memory of Claude Itzykson.

[14] O. Parcollet, A. Georges, G. Kotliar, and A. Sengupta, "Overscreened multichannel SU(N) Kondo model: Large-N solution and conformal field theory," *Phys. Rev. B*, vol. 58, pp. 3794–3813, Aug 1998.

[15] O. Parcollet and A. Georges, “Transition from Overscreening to Underscreening in the Multichannel Kondo Model: Exact Solution at Large N,” *Phys. Rev. Lett.*, vol. 79, pp. 4665–4668, Dec 1997.

[16] A. Georges and Y. Meir, “Electronic Correlations in Transport through Coupled Quantum Dots,” *Phys. Rev. Lett.*, vol. 82, pp. 3508–3511, Apr 1999.

[17] S. Florens and A. Georges, “Slave-rotor mean-field theories of strongly correlated systems and the Mott transition in finite dimensions,” *Phys. Rev. B*, vol. 70, p. 035114, Jul 2004.

[18] L. de’ Medici, A. Georges, and S. Biermann, “Orbital-selective Mott transition in multiband systems: Slave-spin representation and dynamical mean-field theory,” *Phys. Rev. B*, vol. 72, p. 205124, Nov 2005.

[19] F. Lechermann, A. Georges, G. Kotliar, and O. Parcollet, “Rotationally invariant slave-boson formalism and momentum dependence of the quasiparticle weight,”

[20] S. Burdin, A. Georges, and D. R. Grempel, “Coherence Scale of the Kondo Lattice,” *Phys. Rev. Lett.*, vol. 85, pp. 1048–1051, Jul 2000.

[21] J. R. Moreno, G. Carleo, A. Georges, and J. Stokes, “Fermionic Wave Functions from Neural-Network Constrained Hidden States,” arXiv:2111.10420, accepted for publication at PNAS.

[22] O. Parcollet and A. Georges, “Non-Fermi-liquid regime of a doped Mott insulator,” *Phys. Rev. B*, vol. 59, pp. 5341–5360, Feb 1999.

[23] S. Burdin, D. R. Grempel, and A. Georges, “Heavy-fermion and spin-liquid behavior in a Kondo lattice with magnetic frustration,” *Phys. Rev. B*, vol. 66, p. 045111, Jul 2002.

[24] A. Georges, O. Parcollet, and S. Sachdev, “Mean Field Theory of a Quantum Heisenberg Spin Glass,” *Phys. Rev. Lett.*, vol. 85, pp. 840–843, Jul 2000.

[25] A. Georges, O. Parcollet, and S. Sachdev, “Quantum fluctuations of a nearly critical Heisenberg spin glass,” *Phys. Rev. B*, vol. 63, p. 134406, Mar 2001.

[26] P. T. Dumitrescu, N. Wentzell, A. Georges, and O. Parcollet, “Planckian metal at a doping-induced quantum critical point,” *Phys. Rev. B*, vol. 105, p. L180404, May 2022.

[27] M. Ferrero, P. S. Cornaglia, L. De Leo, O. Parcollet, G. Kotliar, and A. Georges, "Pseudogap opening and formation of Fermi arcs as an orbital-selective Mott transition in momentum space," *Phys. Rev. B*, vol. 80, p. 064501, Aug 2009.

[28] E. Gull, M. Ferrero, O. Parcollet, A. Georges, and A. J. Millis, "Momentum-space anisotropy and pseudogaps: A comparative cluster dynamical mean-field analysis of the doping-driven metal-insulator transition in the two-dimensional Hubbard model," *Phys. Rev. B*, vol. 82, p. 155101, Oct 2010.

[29] W. Wu, M. S. Scheurer, S. Chatterjee, S. Sachdev, A. Georges, and M. Ferrero, "Pseudogap and Fermi-Surface Topology in the Two-Dimensional Hubbard Model," *Phys. Rev. X*, vol. 8, p. 021048, 2018.

[30] W. Wu, M. Ferrero, A. Georges, and E. Kozik, "Controlling Feynman diagrammatic expansions: Physical nature of the pseudogap in the two-dimensional Hubbard model," *Phys. Rev. B*, vol. 96, p. 041105, Jul 2017.

[31] A. Wietek, Y.-Y. He, S. R. White, A. Georges, and E. M. Stoudenmire, "Stripes, Antiferromagnetism, and the Pseudogap in the Doped Hubbard Model at Finite Temperature," *Phys. Rev. X*, vol. 11, p. 031007, Jul 2021.

[32] T. Schäfer, N. Wentzell, F. Šimkovic, Y.-Y. He, C. Hille, M. Klett, C. J. Eckhardt, B. Arzhang, V. Harkov, F. m. c.-M. Le Régent, A. Kirsch, Y. Wang, A. J. Kim, E. Kozik, E. A. Stepanov, A. Kauch, S. Andergassen, P. Hansmann, D. Rohe, Y. M. Vilk, J. P. F. LeBlanc, S. Zhang, A.-M. S. Tremblay, M. Ferrero, O. Parcollet, and A. Georges, "Tracking the Footprints of Spin Fluctuations: A MultiMethod, MultiMessenger Study of the Two-Dimensional Hubbard Model," *Phys. Rev. X*, vol. 11, p. 011058, Mar 2021.

[33] M. Le Tacon, A. Sacuto, A. Georges, G. Kotliar, Y. Gallais, D. Colson, and A. Forget, "Two Energy Scales and two Quasiparticle Dynamics in the Superconducting State of Underdoped Cuprates," *Nature Physics*, vol. 2, p. 537, Aug. 2006.

[34] "First-Principles Approach to the Electronic Structure of Strongly Correlated Systems: Combining the *GW* Approximation and Dynamical Mean-Field Theory, author = Biermann, S. and Aryasetiawan, F. and Georges, A.," *Phys. Rev. Lett.*, vol. 90, p. 086402, Feb 2003.

[35] F. Aryasetiawan, M. Imada, A. Georges, G. Kotliar, S. Biermann, and A. I. Lichtenstein, "Frequency-dependent local interactions and low-energy effective models from electronic structure calculations," *Phys. Rev. B*, vol. 70, p. 195104, Nov 2004.

[36] M. Aichhorn, L. Pourovskii, V. Vildosola, M. Ferrero, O. Parcollet, T. Miyake, A. Georges, and S. Biermann, "Dynamical mean-field theory within an augmented plane-wave framework: Assessing electronic correlations in the iron pnictide LaFeAsO," *Phys. Rev. B*, vol. 80, p. 085101, Aug 2009.

[37] S. Biermann, A. Poteryaev, A. I. Lichtenstein, and A. Georges, "Dynamical Singlets and Correlation-Assisted Peierls Transition in VO_2," *Phys. Rev. Lett.*, vol. 94, p. 026404, Jan 2005.

[38] E. Pavarini, S. Biermann, A. Poteryaev, A. I. Lichtenstein, A. Georges, and O. K. Andersen, "Mott Transition and Suppression of Orbital Fluctuations in Orthorhombic $3d^1$ Perovskites," *Phys. Rev. Lett.*, vol. 92, p. 176403, Apr 2004.

[39] A. Subedi, O. E. Peil, and A. Georges, "Low-energy description of the metal-insulator transition in the rare-earth nickelates," *Phys. Rev. B*, vol. 91, p. 075128, Feb 2015.

[40] B. Amadon, S. Biermann, A. Georges, and F. Aryasetiawan, "The $\alpha-\gamma$ Transition of Cerium Is Entropy Driven," *Phys. Rev. Lett.*, vol. 96, p. 066402, Feb 2006.

[41] M. Aichhorn, S. Biermann, T. Miyake, A. Georges, and M. Imada, "Theoretical evidence for strong correlations and incoherent metallic state in FeSe," *Phys. Rev. B*, vol. 82, p. 064504, Aug 2010.

[42] L. de' Medici, J. Mravlje, and A. Georges, "Janus-Faced Influence of Hund's Rule Coupling in Strongly Correlated Materials," *Phys. Rev. Lett.*, vol. 107, p. 256401, Dec 2011.

[43] A. Georges, L. de' Medici, and J. Mravlje, "Strong electronic correlations from Hund's coupling," *Annual Reviews of Condensed Matter Physics*, vol. 4, p. 137, Feb 2013.

[44] J. Mravlje, M. Aichhorn, T. Miyake, K. Haule, G. Kotliar, and A. Georges, "Coherence-Incoherence Crossover and the Mass-Renormalization Puzzles in Sr_2RuO_4," *Phys. Rev. Lett.*, vol. 106, p. 096401, Mar 2011.

[45] D. Stricker, J. Mravlje, C. Berthod, R. Fittipaldi, A. Vecchione, A. Georges, and D. van der Marel, "Optical Response of Sr_2RuO_4 Reveals Universal Fermi-Liquid Scaling and Quasiparticles Beyond Landau Theory," *Phys. Rev. Lett.*, vol. 113, p. 087404, Aug 2014.

[46] J. Mravlje and A. Georges, "Thermopower and Entropy: Lessons from Sr_2RuO_4," *Phys. Rev. Lett.*, vol. 117, p. 036401, Jul 2016.

[47] M. Zingl, J. Mravlje, M. Aichhorn, O. Parcollet, and A. Georges, "Hall coefficient signals orbital differentiation in the Hund's metal Sr_2RuO_4," *npj quantum materials*, vol. 4, JUL 12 2019.

[48] M. Kim, J. Mravlje, M. Ferrero, O. Parcollet, and A. Georges, "Spin-Orbit Coupling and Electronic Correlations in Sr_2RuO_4," *Phys. Rev. Lett.*, vol. 120, p. 126401, 2018.

[49] A. Tamai, M. Zingl, E. Rozbicki, E. Cappelli, S. Riccò, A. de la Torre, S. McKeown Walker, F. Y. Bruno, P. D. C. King, W. Meevasana, M. Shi, M. Radović, N. C. Plumb, A. S. Gibbs, A. P. Mackenzie, C. Berthod, H. U. R. Strand, M. Kim, A. Georges, and F. Baumberger, "High-Resolution Photoemission on Sr_2RuO_4 Reveals Correlation-Enhanced Effective Spin-Orbit Coupling and Dominantly Local Self-Energies," *Phys. Rev. X*, vol. 9, p. 021048, Jun 2019.

[50] H. U. R. Strand, M. Zingl, N. Wentzell, O. Parcollet, and A. Georges, "Magnetic response of Sr_2RuO_4: Quasi-local spin fluctuations due to Hund's coupling," *Phys. Rev. B*, vol. 100, p. 125120, Sep 2019.

[51] A. Subedi, A. Cavalleri, and A. Georges, "Theory of nonlinear phononics for coherent light control of solids," *Phys. Rev. B*, vol. 89, p. 220301, Jun 2014.

[52] L. Perfetti, P. A. Loukakos, M. Lisowski, U. Bovensiepen, H. Berger, S. Biermann, P. S. Cornaglia, A. Georges, and M. Wolf, "Time Evolution of the Electronic Structure of 1T-TaS_2 through the Insulator-Metal Transition," *Phys. Rev. Lett.*, vol. 97, p. 067402, Aug 2006.

[53] F. Werner, O. Parcollet, A. Georges, and S. R. Hassan, "Interaction-Induced Adiabatic Cooling and Antiferromagnetism of Cold Fermions in Optical Lattices," *Phys. Rev. Lett.*, vol. 95, p. 056401, Jul 2005.

[54] J.-S. Bernier, C. Kollath, A. Georges, L. De Leo, F. Gerbier, C. Salomon, and M. Köhl, "Cooling fermionic atoms in optical lattices by shaping the confinement," *Phys. Rev. A*, vol. 79, p. 061601, Jun 2009.

[55] T.-L. Dao, A. Georges, J. Dalibard, C. Salomon, and I. Carusotto, “Measuring the One-Particle Excitations of Ultracold Fermionic Atoms by Stimulated Raman Spectroscopy,” *Phys. Rev. Lett.*, vol. 98, p. 240402, Jun 2007.

[56] J.-P. Brantut, C. Grenier, J. Meineke, D. Stadler, S. Krinner, C. Kollath, T. Esslinger, and A. Georges, “A Thermoelectric Heat Engine with Ultracold Atoms,” *Science*, vol. 342, no. 6159, pp. 713–715, 2013.

[57] D. Poletti, J.-S. Bernier, A. Georges, and C. Kollath, “Interaction-Induced Impeding of Decoherence and Anomalous Diffusion,” *Phys. Rev. Lett.*, vol. 109, p. 045302, Jul 2012.

[58] D. Poletti, P. Barmettler, A. Georges, and C. Kollath, “Emergence of Glasslike Dynamics for Dissipative and Strongly Interacting Bosons,” *Phys. Rev. Lett.*, vol. 111, p. 195301, Nov 2013.