

# Giorgio Sangiovanni

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<b>Personal data</b>	<ul style="list-style-type: none"><li>• date and place of birth: August 2<sup>nd</sup> 1976, Rome</li><li>• nationality: Italian</li><li>• e-mail address: <a href="mailto:sangiovanni@ifp.tuwien.ac.at">sangiovanni@ifp.tuwien.ac.at</a></li></ul>																																				
<b>Languages</b>	<b>Italian</b> (mother tongue), <b>English</b> and (a bit of) <b>German</b>																																				
<b>Present address</b>	Vienna University of Technology Wiedner Hauptstraße 8 // 138, A-1040 Wien, Österreich Tel. +43 1 58801 13767      Fax +43 1 58801 13899																																				
<b>Employment</b>	<p>September 2008-present <b>University assistant</b>, Institut für Festkörperphysik, TU Wien</p> <ul style="list-style-type: none"><li>• group of Prof. <b>Karsten Held</b></li></ul> <p>December 2004-August 2008 <b>Post-doc grant</b>, Max-Planck Institut für Festkörperforschung Stuttgart</p> <ul style="list-style-type: none"><li>• group of Dr. <b>Olle Gunnarsson</b></li></ul> <p>October 2001-October 2004 <b>PhD student</b>, Physics Department, University of Rome “La Sapienza”</p> <ul style="list-style-type: none"><li>• group of Prof. <b>Claudio Castellani</b></li></ul>																																				
<b>Education</b>	<table><tr><td>2004</td><td>University of Rome “La Sapienza”</td><td>Rome</td></tr><tr><td colspan="3"><b>PhD in Physics</b></td></tr><tr><td colspan="3"><ul style="list-style-type: none"><li>• supervisors: Dr. Massimo Capone and Prof. Claudio Castellani</li><li>• thesis title: <i>The electron-phonon interaction in strongly correlated electron systems</i></li></ul></td></tr><tr><td>2001</td><td>University of Rome “La Sapienza”</td><td>Rome</td></tr><tr><td colspan="3"><ul style="list-style-type: none"><li>• passed national entrance competition for PhD in Physics</li></ul></td></tr><tr><td>2001</td><td>University of Rome “La Sapienza”</td><td>Rome</td></tr><tr><td colspan="3"><b>“Laurea” in Physics</b></td></tr><tr><td colspan="3"><ul style="list-style-type: none"><li>• result: 110/110</li><li>• supervisor: Prof. Claudio Castellani</li><li>• thesis title: <i>Unconventional symmetries of the order parameter in high critical temperature superconductors</i></li></ul></td></tr><tr><td>1995</td><td>Liceo Scientifico “L. Pasteur”</td><td>Rome</td></tr><tr><td colspan="3"><b>“Maturità scientifica” (high-school leaving exam)</b></td></tr><tr><td>1994</td><td>Conservatorio di musica “S. Cecilia”</td><td>Rome</td></tr><tr><td colspan="3"><b>French Horn Diploma</b></td></tr></table>	2004	University of Rome “La Sapienza”	Rome	<b>PhD in Physics</b>			<ul style="list-style-type: none"><li>• supervisors: Dr. Massimo Capone and Prof. Claudio Castellani</li><li>• thesis title: <i>The electron-phonon interaction in strongly correlated electron systems</i></li></ul>			2001	University of Rome “La Sapienza”	Rome	<ul style="list-style-type: none"><li>• passed national entrance competition for PhD in Physics</li></ul>			2001	University of Rome “La Sapienza”	Rome	<b>“Laurea” in Physics</b>			<ul style="list-style-type: none"><li>• result: 110/110</li><li>• supervisor: Prof. Claudio Castellani</li><li>• thesis title: <i>Unconventional symmetries of the order parameter in high critical temperature superconductors</i></li></ul>			1995	Liceo Scientifico “L. Pasteur”	Rome	<b>“Maturità scientifica” (high-school leaving exam)</b>			1994	Conservatorio di musica “S. Cecilia”	Rome	<b>French Horn Diploma</b>		
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## Teaching experience

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| 2003/04  | University of Rome "La Sapienza" | Rome |
| <ul style="list-style-type: none"><li>• teaching assistant to Prof. A. Sutura</li><li>• <b>Fisica generale II</b> (30-hour paid activity) for Geological Science students</li></ul>                        |                                  |      |
| 2002/03  | University of Rome "La Sapienza" | Rome |
| <ul style="list-style-type: none"><li>• teaching assistant to Prof. P. Santini, M. Grilli and A. Tenenbaum</li><li>• <b>Fisica generale</b> (30-hour paid activity) for Natural Science students</li></ul> |                                  |      |

## Research interests

- **Strongly correlated electrons** – I have solid experience with Dynamical Mean Field Theory (DMFT) and with its cluster extensions (I implemented, for instance, a DCA/CDMFT code for one- and two-dimensional Hubbard and Hubbard-Holstein model with a Lanczos solver). I am interested in using and implementing different impurity solvers (e.g. QMC, DMRG) in the context of model calculations as well as of realistic approaches (for example I recently applied LDA+DMFT to study the optical conductivity in  $V_2O_3$ ).
- **Electron-phonon interaction** – I am currently extending beyond the single-site level our previous systematic DMFT investigation of the electron-phonon interaction in strongly correlated systems. I am particularly interested in the effect of Coulomb repulsion on various types of lattice vibrations.
- **High temperature superconductivity** – In the context of cuprates I study the relevance of the interplay between electron-electron repulsion and electron-phonon interaction. In the past I also worked on the gap structure and unconventional pairing symmetries and investigated the pseudogap phenomenon in connection with retarded and non-retarded attractive models.

## Computing skills

- Development and implementation of different many-body techniques: **Quantum Monte Carlo, Exact Diagonalization, Lanczos**.
- Parallel programming (OpenMP and MPI)
- Fortran language and c-shell programming
- Linux cluster administration

## Publications

### *International Journal articles*

1. D. Reznik, G. Sangiovanni, O. Gunnarsson and T. P. Devereaux  
*Photoemission kinks and phonons in cuprates*  
Nature **455**, E6 (2008)
2. E. Koch, G. Sangiovanni and O. Gunnarsson  
*Sum-rules and bath-parametrization for quantum cluster theories*  
Physical Review B **78**, 115102 (2008)
3. L. Baldassarre, A. Perucchi, D. Nicoletti, A. Toschi, G. Sangiovanni, K. Held, M. Capone, M. Ortolani, L. Malavasi, M. Marsi, P. Metcalf, P. Postorino and S. Lupi  
*Quasiparticle evolution and pseudogap formation in  $V_2O_3$ : An infrared spectroscopy study*  
Physical Review B **77**, 113107 (2008)

4. O. Rösch, G. Sangiovanni and O. Gunnarsson  
*Sum rules and vertex corrections for electron-phonon interactions*  
Physical Review B **75**, 035119 (2007)
  
5. G. Sangiovanni, O. Gunnarsson, E. Koch, C. Castellani and M. Capone  
*Electron-phonon interaction and antiferromagnetic correlations*  
Physical Review Letters **97**, 046404 (2006)
  
6. G. Sangiovanni, M. Capone and C. Castellani  
*Relevance of phonon dynamics in strongly correlated systems coupled to phonons: A Dynamical Mean Field Theory analysis*  
Physical Review B **73**, 165123 (2006)
  
7. G. Sangiovanni, A. Toschi, E. Koch, K. Held, M. Capone, C. Castellani, O. Gunnarsson, S.-K. Mo, J. W. Allen, H.-D. Kim, A. Sekiyama, A. Yamasaki, S. Suga and P. Metcalf  
*Static versus dynamical mean field theory of Mott antiferromagnets*  
Physical Review B **73**, 205121 (2006)
  
8. S. Ciuchi, G. Sangiovanni and M. Capone  
*Pairing and polarization in electron-boson systems with retarded interactions via dynamical mean-field theory*  
Physical Review B **73**, 245114 (2006)
  
9. G. Sangiovanni, M. Capone, C. Castellani and M. Grilli  
*Electron-phonon Interaction close to a Mott transition*  
Physical Review Letters **94**, 026401 (2005)
  
10. C. E. Creffield, G. Sangiovanni and M. Capone  
*Phonon softening and dispersion in the 1D Holstein model of spinless fermions*  
European Physical Journal B **44**, 175-181 (2005)
  
11. M. Capone, G. Sangiovanni, C. Castellani, C. Di Castro and M. Grilli  
*Phase Separation close to the density-driven Mott transition in the Hubbard-Holstein model*  
Physical Review Letters **92**, 106401 (2004)
  
12. G. Sangiovanni, M. Capone, S. Caprara, C. Castellani, C. Di Castro and M. Grilli  
*Doping-driven transition to a time-reversal breaking state in the phase diagram of the cuprates*  
Physical Review B **67**, 174507 (2003)

**Conference proceedings (peer reviewed)**

13. O. Gunnarsson, G. Sangiovanni, O. Rösch, E. Koch, C. Castellani and M. Capone  
*Polaron formation in cuprates*  
Physica C, 460-462 (2007) 263-266

14. S. Ciuchi, G.Sangiovanni and M.Capone  
*Detecting pairing and polarization crossovers in systems with retarded interactions*  
 Physica C, 460-462 (2007) 1157-1158
15. M.Capone, G.Sangiovanni, C.Castellani and M.Grilli  
*Electron-phonon Interaction in proximity of a Mott transition*  
 Physica B, 359-361 (2005) 636-638
16. M.Capone, S.Ciuchi and G.Sangiovanni  
*Polaron Crossover and Bipolaronic Metal-Insulator Transition in the half-filled Holstein model*  
 Physica B, 359-361 (2005) 813-815
17. M.Capone and G. Sangiovanni  
*The effects of the electron-phonon interaction on a Mott insulator*  
 Journal of Magnetism and Magnetic Materials Vol.272-276, Supplement 1, Pages E301-E302 (2004)
18. G.Sangiovanni, M. Capone and S.Caprara  
*Time reversal breaking superconducting state in the phase diagram of the cuprates*  
 International Journal of Modern Physics B – Vol.17 n. 4,5 & 6 (2003) 614-620

#### **Other conference proceedings**

19. G.Sangiovanni and O. Gunnarsson  
*Electron-phonon interaction in strongly correlated electron systems: relevance of antiferromagnetic correlations.*  
 Journal of Physics: Conference Series **108**, 012012 (2008)
20. P. Barone, M. Capone, C. Castellani and G.Sangiovanni  
*Electron-Phonon coupling in the presence of strong correlations*  
 Proceedings "Polarons in Bulk Materials and Systems with Reduced Dimensionality" International School of Physics "Enrico Fermi", Varenna, Italy, July 2005
21. S.Ciuchi, M. Capone, E. Cappelluti and G.Sangiovanni  
*Polarons and Bipolarons in Holstein and Holstein t-J models by Dynamical Mean Field Theory*  
 Proceedings "Polarons in Bulk Materials and Systems with Reduced Dimensionality" International School of Physics "Enrico Fermi", Varenna, Italy, July 2005 (cond-mat/0510620)

#### **Talk and seminars**

- 2008                      Max-Planck Institut für Festkörperforschung      Stuttgart
- Vortrag anlässlich der **Arbeitsbesprechung**, Abteilung Andersen, "Quasiparticle evolution and pseudogap formation in  $V_2O_3$ "

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|------|--|----------------|
| 2007 | AIST   | Tsukuba        |
| •    | <b>invited talk</b> at the International Symposium on Lattice Effects in Cuprate High Temperature Superconductors "LEHTSC 2007", organized by H. Oyanagi and H. Eisaki |                |
| 2007 | Tokyo University, Dep. of Applied Physics  | Tokyo          |
| •    | seminar organized by <b>Prof. Imada</b> " <i>Electron-phonon interaction in strongly correlated electron systems</i> "   |                |
| 2007 | Tokyo University, ISSP   | Kashiwa        |
| •    | seminar organized by <b>Prof. Takada</b> " <i>Electron-phonon interaction and antiferromagnetic correlations</i> "   |                |
| 2007 | Tokyo University, Dep. of Physics  | Tokyo          |
| •    | seminar organized by <b>Prof. Aoki</b> " <i>Electron-phonon interaction in strongly correlated electron systems</i> "  |                |
| 2006 | INFM   | Sestri Levante |
| •    | <b>invited talk</b> at the 13th national congress on high-temperature superconductivity "SATT13", organized by C. Ferdeghini, M. Putti and A. Siri                     |                |
| 2004 | Max-Planck-Institut für Festkörperforschung  | Stuttgart      |
| •    | seminar Abteilung <b>Metzner</b> " <i>Electron-phonon interaction in proximity of a Mott transition</i> "  |                |
| 2004 | University of Rome "Roma Tre"  | Rome           |
| •    | seminar organized by <b>Prof. Raimondi</b> " <i>Interazione elettrone-fonone vicino ad una transizione di Mott</i> "   |                |
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|--------------------------------|---|---|--------|
| <b>Conferences and schools</b> | 2008  | European Physical Society                         | Rome   |
|                                | •   | contributed <b>talk</b> at EPS – CMD 22 2008      |        |
|                                | 2008  | Deutsche Physikalische Gesellschaft               | Berlin |
|                                | •   | contributed <b>talk</b> at DPG Tagung Berlin 2008 |        |
|                                | 2008  |   | Bonn   |
| •                              | participation to the International Workshop on Computational Physics and Materials Science: "Progress in Computational Electronic Structure Theory", organized by E.Koch and E.Pavarini   |   |        |
| 2007                           | University of Rome "La Sapienza"  | Rome  |        |
| •                              | participation to "coherence and incoherence in strongly correlated systems", satellite Statphys23, organized by G.Bachelet, M.Capone, S.Caprara, C.Castellani, M.Grilli, G.Jona Lasinio, G.Parisi, L.Pietronero, R.Raimondi and E.Tosatti |   |        |

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|------|---|------------------|
| 2007 | Max-Planck-Institut für Physik Komplexer Systeme  | Dresden          |
| •    | <b>poster</b> contribution to the international workshop “Strong Correlations and Angle-Resolved Photoemission Spectroscopy” (CORPES07), organized by K.Matho, P.Aebi, D.Dessau and M.Potthoff                                |                  |
| 2007 | Deutsche Physikalische Gesellschaft   | Regensburg       |
| •    | contributed <b>talk</b> at DPG Tagung Regensburg 2007   |                  |
| 2007 | American Physical Society   | Denver           |
| •    | contributed <b>talk</b> at APS March Meeting 2007   |                  |
| 2006 |   | Dresden          |
| •    | <b>poster</b> contribution at M2S, organized by J.Fink  |                  |
| 2005 | MPI-FKF and DFG   | Schloss Ringberg |
| •    | <b>talk</b> at “Properties of Cuprate Superconductors”, joint workshop of the MPI-FKF Stuttgart and DFG Research Unit 538   |                  |
| 2005 | MPI-FKF   | Schwäbisch Gmünd |
| •    | <b>talk</b> at the $\Psi_k$ 2005 conference   |                  |
| 2005 | ICTP  | Trieste          |
| •    | <b>poster</b> contribution to Summer School and Miniconference on Dynamical Mean-Field Theory for Correlated Electrons Applications to Real Materials, Extensions and Perspectives, organized by V. Anisimov and D. Vollhardt |                  |
| 2005 | Società Italiana di Fisica  | Varenna          |
| •    | participation to "Polarons in Bulk Materials and Systems with Reduced Dimensionality" International School of Physics "Enrico Fermi", organized by G. Iadonisi and J. Ranninger   |                  |
| 2004 | University of Karlsruhe   | Karlsruhe        |
| •    | <b>poster</b> contribution to the International Conference on strongly correlated electron systems “SCES ’04”   |                  |
| 2004 | University of Rome “La Sapienza”  | Rome             |
| •    | <b>talk</b> at the 12th national congress on high-temperature superconductivity “SATT12”, organized by P.Calvani and R.Cantelli   |                  |
| 2004 | University of Miami   | Miami            |
| •    | <b>poster</b> contribution to the “Workshop on Unconventional Superconductivity”, organized by J. Ashkenazi and M. V. Eremin  |                  |
| 2003 | ICTP  | Trieste          |
| •    | participation to the Workshop “Ab-Initio Many-Body Theory for Correlated Electron Systems”, organized by W. Temmerman and A.Georges   |                  |
| 2003 | CNR   | Rome             |
| •    | <b>poster</b> contribution to the “International Conference on Magnetism” – ICM2003, member of the Publication Committee  |                  |

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|------|---|---------|
| 2003 | University of Rome "La Sapienza"  | Rome    |
| •    | participation to the workshop "Open questions in understanding the superconducting and normal state properties of $MgB_2$ ", organized by O. K. Andersen, J. Kortus, G. B. Bachelet and L. Pietronero |         |
|      |   |         |
| 2003 | Max-Planck-Institut für Physik Komplexer Systeme  | Dresden |
| •    | <b>poster</b> contribution to the international workshop and seminar on "Modern Aspects of Quantum Impurity Systems", organized by R. Bulla, D. Logan and A. Schiller                                 |         |
|      |   |         |
| 2002 | ICTP  | Trieste |
| •    | participation to the "Workshop on correlation effects in electronic structure calculations", organized by V. Anisimov and G. Kotliar  |         |
|      |   |         |
| 2002 | University of Salerno   | Vietri  |
| •    | <b>poster</b> contribution to the 11th national congress on superconductivity "SATT11"  |         |
|      |   |         |
| 2001 | ICTP - Elettra  | Trieste |
| •    | <b>poster</b> contribution to the Workshop "Synchrotron radiation and the Cuprate, Fulleride and new High-Temperature Superconductors"  |         |
|      |   |         |
| 2001 | University of Rome "La Sapienza"  | Rome    |
| •    | <b>poster</b> contribution to the international conference "3 <sup>rd</sup> Paladin Memorial"   |         |
|      |   |         |
| 2001 | INFM  | Rome    |
| •    | participation to the conference "INFMeeting 2001"   |         |
|      |   |         |
| 2000 | University of Rome "La Sapienza"  | Rome    |
| •    | participation to the international conference "Stripes and High- $T_c$ Superconductivity"   |         |