Gabriel Kotliar: Research Narrative.

B. Gabriel Kotliar was born on February 26, 1957, in Cordoba Argentina. He got his undergraduate education at the Hebrew University in Jerusalem. He received the Bachelor in Science degree in Physics and Mathematics, Summa Cum Laude in 1979 and his Masters degree in Physics a year later. The research leading to his Ms.Sc dissertation in the area of quantum field theory, entitled "Non Linear Sigma Model and CP(N-1) in 2+epsilon dimensions," was carried out under the supervision of Professor Daniel Amit. It dealt with the cancellation of infrared divergences induced by Goldstone particles. In 1980, Kotliar moved to the United States to complete his graduate studies at Princeton University. His Ph.D thesis work was carried out under the supervision of Professor Phillip W. Anderson, in Condensed Matter theory. It introduced a new model of spin glasses and was entitled, "Random Models with Long Range Interactions."

From 1983 to 1985 Kotliar continued his career as a postdoctoral associate at the Institute for Theoretical Physics at the University of California in Santa Barbara. He worked in the areas of non equilibrium statistical mechanics and pattern formation. In his postdoctoral work, he established the mechanism that selects the velocity of propagation of dendrites. He also extended his interest to the study of disordered electrons and investigated the effects of Anderson localization on superconductivity and ultrasonic attenuation of metals.

From 1985 to 1988 Kotliar was an Assistant Professor at the Massachusetts Institute of Technology . He continued his work on disordered interacting electrons, and developed a Fermi liquid theory of strongly disordered fermions. During this period, his research interests turned to the area of strongly correlated electron systems. He introduced a new slave boson approach to the study of models of correlated electrons. Using slave boson methods, he predicted the symmetry of the order parameter in the high temperature superconductors, as well as other notable characteristics of these materials, such as the existence of a pseudogap. These findings were confirmed by experiments a few years later.

From 1986 to 1988 Kotliar was the recipient of a research fellowship from the Alfred P Sloan foundation. From 1987 to 2002 Kotliar received a Presidential Young Investigator Award, in recognition for contributing to the future vitality of the scientific and engineering effort of the Nation.

In 1988, as part of a major Rutgers Research initiative, Kotliar moved to NJ to join the Rutgers faculty as an associate professor in the area of strongly correlated systems. During this period he was also a frequent consultant at Bell Laboratories (1988-1997), and at Los Alamos National Laboratories (1991-1998). His research efforts focused on developing auxiliary boson methods and the large N expansion for treating strongly correlated fermions, and applied it to materials ranging from high temperature superconductors to heavy fermions. In recognition for his research achievements Kotliar was promoted to full professor in 1992.

Kotliar began to develop the dynamical mean field approach to study strongly correlated materials. This approach reduces the full quantum many body problem on a lattice or on the continuum to an impurity model in a medium to be determined self consistently. This approach treats both incoherent and coherent excitations on the same footing, and is able to deal with situations when a Fermi liquid fixed point has not been reached resulting in anomalous transport and thermodynamic properties. Using this approach, over several years, Kotliar and his collaborators developed a complete theory of the finite temperature Mott metal to insulator transition, a phenomena that occur in several materials, such as vanadium oxide, and the kappa organics. This problem is highly non perturbative and was not amenable to other techniques. The Dynamical Mean Field Theory results are in good agreement with experiments.

In 1994 he received a Lady Davis Fellowship, to pursue research during a sabbatical year at the Hebrew University in Jerusalem. This time period featured significant research advances, and in 2000 Kotliar was elected Fellow of the American Physical Society for his Development of the Dynamical Mean Field Method and its application to strongly correlated electron systems.

The dynamical mean field theory approach, and various extensions developed in Kotliar's group, allowed the treatment of disordered systems, and long range interactions. Many problems, like the formation of local moments, and the interplay of localization and interactions were successfully studied with this methods.

In the last five years, Kotliar's research interests expanded to encompass computational studies of correlated materials combining dynamical mean field theory with realistic electronic structure methods. Numerous materials were studied with these methods. Kotliar's group successfully predicted the photoemission spectra, the total energy and volume, and the phonon spectra of delta plutonium, a problem that had proved intractable to density functional based approaches. For the development of the dynamical mean field method and its extensions, as well as its applications to electronic structure of correlated materials, in 2004, Kotliar was named Board of Governor's professor, a distinction reserved for the most important research achievements of the faculty at Rutgers University. In 2006 he held the Pascal Chair at Ecole Polytechnique in France and was one of the recipients of the Agilent Technology Prize of the European Physical Society.

Kotliar has been in volved in the organization of many meetings, bringing together experts from the band theory community and the many body community to synthesize new realistic methods to approach the strong correlation problem. This development started at the Max Planck Institute for Complex Systems in Dresden in 1997, and continued in Prague in 1999, in Trieste in the summer of the year 2000 and 2002, at the CECAM in Lyon, and at the Lorentz institute in the year 2001. He coordinated a five month long workshop on this theme at the Institute for Theoretical Physics in Santa Barbara.

Kotliar has also devoted efforts to teaching in the area of strongly correlated electrons and electronic structure methods,keeping in mind the importance of training the next

generation of scientists. He has lectured in various international summer and winter schools such the Les Houches summer school, in Les Houches, in 1991, the Jerusalem Winter School in Theoretical Physics in Jerusalem, Israel, in 1991 and 2002, the Spring College in Condensed Matter at the International center for Theoretical Physics Trieste Italy in 1994, the Summer School on Condensed Matter Physics at the Bilkent International Center for Advanced Studies Ankara, in 1996, the Third Training Course in the Physics of Correlated Electron Systems and High-Tc Superconductors International Institute for Advanced Scientific Studies "E.R. Caianiello" Vietri sul Mare , Salerno, Italy in 2000.

He has trained over ten graduate students, and an equal number of postdoctoral researchers. He introduced innovative uses of computers for teaching physics to graduate students and was recognized in an "Excellence in Graduate Teaching " award, of Rutgers University in 2002. Kotliar also served in the advisory committee of various international conferences and played an active role as the main organizer of a series of workshops on Open Problems in Strongly Correlated electron Systems at the ICTP in Trieste in the years 1998, 1999 and 2000.

Kotliar served as associate editor of the Journal Physical Review Letters from 1998 to 1999. He is serving as member of the International Advisory Board for the Max Planck Institute fur Chemische Physik fester Stoffe in Dresden Germany and he served as a member International Advisory Board for the Research Center of Crete FORTH-IESL in Greece from 1996 to 2000.

G. Kotliar has authored over a hundred eighty publications in refereed journals and has given talks in over seventy international conferences and workshops.