

Research Interest

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General Aspects:

At general level my research interest since 1978 is connected to condensed matter theory. This almost two decades of research activity covers a relatively broad spectrum, whose characteristics can be summarized as follows (reference numbers are taken from the presented list of published papers).

At the level of techniques used it covers: mean-field theory ([1],[13]), strong-coupling theory ([5]), green-function techniques ([36],[38]), diagrammatic techniques ([60]), perturbation expansions going even up to extremely high orders ([56],[57]), variational descriptions ([58]), group theory ([47]), renormalization group theory ([74]), unitary transformations ([79]), statistical averages ([46]), averages over randomness ([35],[37],[92]), replica trick ([20]), invariant tensor operators ([32],[34]), exact solutions ([94],[99]).

At the level of studied ordered phases, or ordering effects covers: localized magnetism ([1]), itinerant ferromagnetism ([12],[99]), itinerant antiferromagnetism ([10],[62]), spin-density waves ([42],[43]), charge-density waves ([44]), excitonic ferromagnets ([21]), mixed valence effects ([29],[59]), superconductivity ([45],[49],[53]), pairing processes ([50],[55]), impurity effects ([3],[4],[54]), spin-glasses ([15],[16]), topological ordering ([74]), clustering ([61],[76]), non-Fermi liquids ([85],[86]), coexistence phases ([48],[62]), hidden ordering ([66]), correlation transitions ([77]), metal-insulator transitions ([91],[94]), half metals ([99]), insulating and conducting states ([91]), stripes and checkerboards ([96]).

At the level of studied systems covers: Rare-earths compounds ([13],[33],[91]), Cr alloys and compounds ([2],[3],[13]), layered systems and high Tc materials ([45],[55]), heavy-fermion systems ([42],[43],[44]), Ising systems ([67],[68]), random systems ([92]), random quenched systems ([15],[16],[24]), molecular chains ([99]), ladder systems ([95],[97]), transition metal compounds ([13],[31]), metals ([94]), insulators ([70]), mixed valence ([59]), strongly correlated systems ([80-90]).

Recent Research Interest:

Below I am presenting aspects of my main research interest in the last few years.

1) Development of new techniques leading to the description of non-integrable many-body systems in a non-approximated manner ([61],[91],[99]).

2) Search for exotic ordered phases and development of techniques allowing their description ([85],[86],[91],[99]).

3) Search for new techniques allowing a good quality description of disordered, or partially ordered phases ([92],[96]).

4) Study of polymer chains, development of new techniques allowing their description, analyses of possibilities to apply these systems in nano-devices techniques ([99]).

5) Good quality description of rare-earth compounds and their exotic properties ([86],[88],[91],[99]).