FERROMAGNETISM IN DILUTED MAGNETIC SEMICONDUCTORS AT LOW CARRIER DENSITY

V. K. Dugaev[a], V. I. Litvinov[b], J. Barnaś[c], A. H. Slobodskyy[d], W. Dobrowolski[e], M. Vieira[a]

[a]ISEL-DEETC, Rua Cons. Emidio Navarro, 1949-014, Lisbon, Portugal
[b]WaveBand Corporation, 375 Van Ness Ave, Torrance, CA 90501, USA
[c]Dept. of Physics, Adam Mickiewicz University, Umultowska 85, 61-614 Poznań, and Institute of Molecular Physics PAS, Smoluchowskiego 17, 60-179 Poznań, Poland
[d]Physikalisches Institut EP3, Universität Würzburg, 97074 Würzburg, Germany
[e]Institute of Physics PAS, al. Lotników 32/46, 02-668 Warsaw, Poland

9.7 cm

We will present a field-theoretical approach to ferromagnetism in semiconductors. In this approach disorder is modeled by a random field of impurity concentration. The theory accounts for interacting magnetization fluctuations and disorder corrections. In the mean-field approximation we found that both disorder and interaction of magnetization fluctuations result in suppression of ferromagnetism. We also propose a new mechanism of interaction between magnetic impurities in III-V semiconductors at low carrier concentrations. The mechanism is based on spin dependent hybridization of the acceptor state with the valence band, which is controlled by the magnetic moment of the *d*-electrons. The model gives ferromagnetic interaction that does not depend on the carrier concentration. The characteristic length of the interaction is determined by the activation energy of the acceptor level. This mechanism can explain ferromagnetism at low density of carriers. In real GaMnAs ferromagnetic semiconductors, both RKKY interaction *via* free carriers and the proposed mechanism may be equally relevant.

13.4 cm

Subject category :

6. Theory of Magnetism

Presentation mode :
oral

Corresponding author :
V. K. Dugaev

Address for correspondence :
Dr. Vitalii Dugaev
Department of Electronics and Communications
Instituto Superior de Engenharia de Lisboa
Rua Conselheiro Emidio Navarro
1949-014 Lisbon, Portugal

Email address :
vdugaev@deetc.isel.ipl.pt