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THE DEHYBRIDIZATION HAMILTONIAN

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During the last years in scientific literature row reports about atomic-scale perturbation charges in high temperature superconductors (HTSC) have appeared. The question is about the so-called stripes and nanoscale inhomogeneity which appear as a result of electronic states modulation. Occurrence of such anomalies in the distribution of the electronic states causes the special interest because can be related with creation of high-temperature superconductivity state. The charge increasing means existence strong force factor, acting in valence zone of HTSC. Thus, there is a question to these modulations nature origin and their influence on high-temperature superconductivity state.

With the purpose of physical nature of the highpointed anomalies X-ray and photoemission studies of some ternary compounds of the R-Cu-Si(Al) system (R-rare-earth metal) and high-temperature superconductor $YBa_2Cu_3O_{6.9}$ had been performed. Such objects selection is caused such fact that all named compounds are cuprates, in which the dehybridization phenomenon had been found.

In this connection it is expedient to notice that all HTSC are cuprates. Consequently, it is possible to assume that in HTSC the exceptional role in the origin of superconductivity plays atoms of copper just due to dehybridization influence on the structure of the electronic states.

In connection with the expressed circumstances it is necessary to understand dehybridization phenomenon nature. An essence of the phenomenon is conditioned, first of all, by the Cu's 3d-shell electronic structure features. This shell is power stable due to electronic configuration $3d^{10}$ and compact, able to divide the valence zone electronic states of compound and to activate them to Fermi level, creating mentioned stripes and nanoscale inhomogeneity.

The dehybridization of electronic states especially evidently shows up in X-ray emissions spectrums, consideration of which the spared peculiar attention in this study.

It is important to note that in the case of HTSC the role of dehybridization factor is don't caused by copper 3d-shell, but hybrid orbitals $Cu3d(x^2-y^2)-O2p$ type, which form plattigu. Oxygen, which is a strong oxidizer, destroys 3d-shell and forms power strong pointed up orbitals. Thus, power stableness of $Cu3d^{10}$ shells is caused that of $Cu3d(x^2-y^2)-O2p$ hybrid orbitals. Exactly the Cu-O planes are basic objects (in the sense of transition to superconducting state) in the structure of HTSC, which are accountable for superconducting state origin.

Thus, in the case of R-Cu-Si and R-Cu-Al systems Cu atoms, which strongly excite the compounds valence electronic states of the pointed systems, act as specific electronic defects. In the case of high temperature superconductors a similar role carry out $Cu-O$ orbitals.

The experimental facts and theoretical calculations are showed that as peculiar defects come forward hybrid $Cu3d(x^2-y^2)-O2p$ orbitals, which give start to occurrence of HTSC electronic states modulation. This orbitals don't form chemical bonds with any valence zone electrons of HTSC. That is why we speak about dehybridization phenomenon. At such scenario experimental facts are became clear. At first, electronic modulations are directed along $Cu-O$ bonds. Secondly, as was marked, electronic modulations are well-organized in geometrical and power space. Thirdly, electronic modulations possess the characteristic

features of the 2D systems – such geometry is characteristic for crystalline structure layers of $Cu-O$.

With the goal to describe variation of electronic states in superconducting ones we propose next dehybridization Hamiltonian:

$$H_{DG} = \sum_{\vec{k}\sigma} (E_{\vec{k}} - \mu_{DG}) c^{+}_{\vec{k}\sigma} c_{\vec{k}\sigma} - \sum_{\vec{k},ij} \Delta_{\vec{k},ij} (c^{+}_{\vec{k}\uparrow,i} c^{+}_{-\vec{k}\downarrow,j} + c_{-\vec{k}\downarrow,j} c_{\vec{k}\uparrow,i}) + U \sum_{ij} (a^{+}_{i\uparrow} c_{j\uparrow} a^{+}_{i\downarrow} c_{i\downarrow}),$$

where μ_{DG} – chemical dehybridization renormalization potential;

$E_{\vec{k}}$ – dispersion law;

U – Coulomb interaction between $Cu3d(x^2 - y^2) - O2p$ quasiatomic states and conduction electrons;

$\Delta_{\vec{k},ij}$ – the nearest-neigbor d-wave order parameter;

$\sum_{\vec{k},ij}$ – denotes summation over neighboring lattice sites *i* and *j*;

The third item is playing fundamental role in our discussion.

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ПРИКЛАДНОЕ ПРИМЕНЕНИЕ МОДУЛЯ БЕСПРОВОДНОЙ СВЯЗИ ESP8266

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На сегодняшний день тема интернета вещей стала мировым трендом. День за днём выпускаются и совершенствуются всё новые продукты в данной сфере, производители электроники, предлагающие всё более дешёвые и эффективные решения. Одним из таких продуктов является модуль беспроводной связи ESP8266, разработки Espressif, линейка которого насчитывает свыше 13 модификаций. Также на рынке имеются готовые решения для прототипирования на базе данного модуля. На данный момент это самое доступное решение для создания «умного дома» и прочих «умных» вещей. Перспективным направлением для развития данного тренда являются C/X технологии. Использование беспроводных сетей для контроля и управления аграрными комплексами позволит оптимизировать производственный процесс.

Для данной работы были использован модуль NodeMCU v1.0 разработанный проектом NodeMicroControllerUnit. Данное устройство имеет прошивку, содержащую виртуальную машину с поддержкой языка LUA. В данной работе использован язык Arduino, для улучшения совместимости кода между микроконтроллером Arduino Nano и NodeMCU. Проект NodeMCU, потому что существенно упрощает работу с модулем беспроводной свящи и имеет поддержку большого количества различных библиотек для доступа к шинам связи и управления периферийными устройствами. Все входы/выходы разведены на печатной плате и подпаяны к штыревым контактам для монтажа на беспаечную плату.

NodeMCU также является ядром тестового стенда по измерению температуры и передаче измеренных значений на веб-сервер. Стенд состоит из вышеуказанного модуля беспроводной связи, микроконтроллера Arduino Nano, преобразователя логических