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%\begin{abstract}

In this chapter a model for high $T_c$ super-conductivity as quantum
critical phenomenon is developed. The  relies on the notions of
quantum
criticality, dynamical quantized Planck constant requiring a
generalization
of the 8-D imbedding space to a book like structure, and many-
sheeted
space-time. In particular, the notion of magnetic flux tube as a
carrier of
supra current of central concept.

With a sufficient amount of twisting and weaving these  basic  ideas
one
ends up  to  concrete model for high $T_c$ superconductors as
quantum
critical superconductors consistent with the qualitative facts that
I am
personally aware.  The following minimal model looks the most
realistic
option found hitherto.


\begin{enumerate}

\item The general idea is that magnetic flux tubes are carriers of
supra
currents. In anti-ferromagnetic phases these flux tube structures
form
small closed loops so that the system behaves as an insulator. Some
mechanism  leading to a formation of long flux tubes must exist.
Doping
creates holes located around stripes, which become positively
charged and
attract electrons to the flux tubes.

\item The basic mechanism for the formation of Cooper pairs is
simple.
Magnetic flux tubes would be carriers of dark particles and magnetic
fields
would be crucial for super-conductivity. Two parallel flux tubes
carrying
magnetic fluxes in opposite directions is the simplest candidate for
super-conducting system. This conforms with the observation that
antiferromagnetism is somehow crucial for high temperature
super-conductivity. The spin interaction energy is proportional to
Planck
constant and can be above thermal energy: if the hypothesis that
dark
cyclotron energy spectrum is universal is accepted, then the
energies would
be in bio-photon range and high temperature super-conductivity is
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obtained.
If fluxes are parallel spin $S=1$ Cooper pairs are stable. $L=2$ states are in question since the members of the pair are at different flux tubes.

\item The higher critical temperature T_{c1} corresponds to a formation local configurations of parallel spins assigned to the holes of stripes giving rise to a local dipole fields with size scale of the order of the length of the stripe. Conducting electrons form Cooper pairs at the magnetic flux tube structures associated with these dipole fields. The elongated structure of the dipoles favors angular momentum $L=2$ for the pairs. The presence of magnetic field favors Cooper pairs with spin $S=1$.

\item Stripes can be seen as 1-D metals with delocalized electrons. The interaction responsible for the energy gap corresponds to the transversal oscillations of the magnetic flux tubes inducing oscillations of the nuclei of the stripe. These transverse phonons have spin and their exchange is a good candidate for the interaction giving rise to a mass gap. This could explain the BCS type aspects of high T_c super-conductivity.

\item Above T_c supra currents are possible only in the length scale of the flux tubes of the dipoles which is of the order of stripe length. The reconnections between neighboring flux tube structures induced by the transverse fluctuations give rise to longer flux tubes structures making possible finite conductivity. These occur with certain temperature dependent probability $p(T,L)$ depending on temperature and distance L between the stripes. By criticality $p(T,L)$ depends on the dimensionless variable $x=TL/\hbar$ only: $p=p(x)$. At critical temperature T_c transverse fluctuations have large amplitude and makes $p(x_c)$ so large that very long flux tubes are created and supra currents can run. The phenomenon is completely analogous to percolation.

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\item  The critical temperature $T_c= x_c\hbar/L$ is  predicted to
be
proportional to $\hbar$ and inversely proportional to $L$ (, which
is
indeed to be the case). If flux tubes correspond to a large value of
$\hbar$, one can  understand the high value of $T_c$. Both Cooper
pairs and
magnetic flux tube structures represent dark matter in TGD sense.


\item The  model allows  to interpret the characteristic spectral
lines in
terms of the excitation energy of the transversal fluctuations and
gap
energy of the Cooper pair. The observed 50 meV  threshold for the
onset of
photon absorption suggests that below $T_c$ also $S=0$ Cooper pairs
are
possible and have gap energy about 9 meV whereas $S=1$ Cooper pairs
would
have gap energy about 27 meV. The flux tube model indeed predicts
that
$S=0$ Cooper pairs become stable below $T_c$ since they cannot
anymore
transform to $S=1$ pairs. Their presence could explain the BCS type
aspects
of high $T_c$ super-conductivity. The estimate for $\hbar/\hbar_0=
r$ from
critical temperature $T_{c1}$ is about $r=3$ contrary to the
original
expectations inspired by the model of of living system as a super-
conductor
suggesting much higher value.  An unexpected  prediction is that
coherence
length is actually $r$ times longer than the coherence length
predicted by
conventional theory so that type I super-conductor could be in
question
with stripes serving as duals for  the defects of type I super-
conductor in
nearly critical magnetic field replaced now by ferromagnetic phase.

\end{enumerate}


At qualitative level the model explains various strange features of
high
$T_c$ superconductors. One can understand the high value of $T_c$
and
ambivalent character of high $T_c$ super conductors, the existence
of
pseudogap and scalings laws for observables above $T_c$, the role of
stripes and doping and the existence of a critical doping, etc...
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%\end{abstract}
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