

THEORIES OF HIGH T_c SUPERCONDUCTORS - TWO VERSUS THREE DIMENSIONS

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Recent Theories for superconductivity in the Cu-O based compounds are reviewed. Theories based on a Hubbard model, or its extension to a t-J model, lead to flux phases and possibly to objects with fractional statistics - "anyons". The anyon model is specific to two dimensions, while more conventional theories (e.g. phonons, excitons) do not necessarily require two-dimensionality.

Relevant experimental data includes resistive fluctuations, nonlinear current-voltage relation and a reversible vortex phase regime with a sharp transition to an irreversible regime. All these phenomena have not been observed in conventional three dimensional superconductors. The data is discussed in terms of a transition from two to three dimensions with implications to the above mentioned theories. Further experiments, which may indicate the proper theoretical approach, are proposed.