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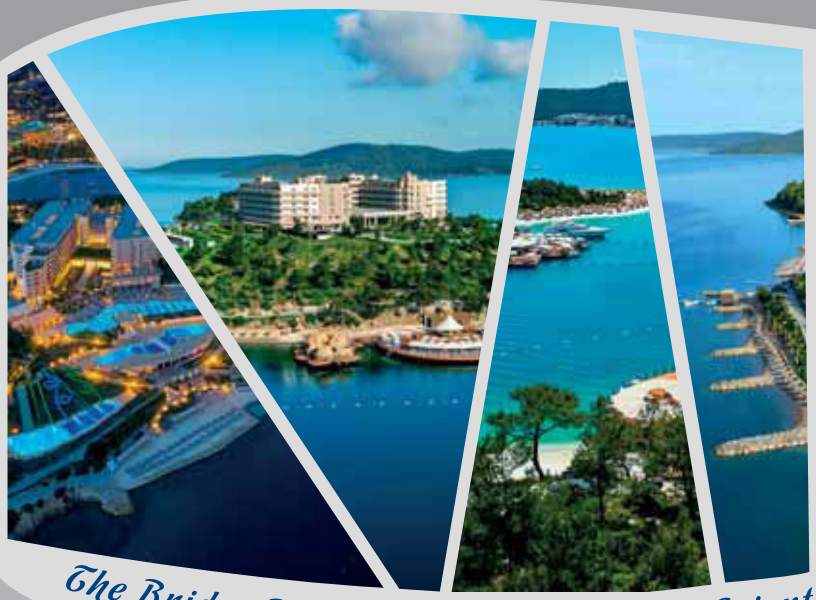

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ON THE ORIGIN OF THE INFLECTION POINT IN THE TEMPERATURE DEPENDENCE OF THE LONDON PENETRATION DEPTH IN CUPRATE SUPERCONDUCTORS

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In some hole-doped cuprate high-temperature superconductors the temperature dependence of the magnetic field penetration depth λ^{-2} reveals an inflection point, i.e. a temperature T_{infl} at which a change in the curvature of the function $\lambda^{-2}(T)$ appears [1,2]. Two possible scenarios of the inflection point origin have been proposed: i) thermal depinning of the Abrikosov vortices [3] and ii) competition of the d- and s–wave superconducting order parameters [2,4]. We suggest alternative explanation for the nature of this inflection point within the spin polaron concept [5] (Fig. 1a). According to this theory the non-monotonic T-dependence of the superfluid density is determined mainly by the states with momenta lying in the vicinity of the intersection points of the Fermi contour and the nodal line in the Brillouin zone. In each quarter of the Brillouin zone, there are two such points, (and, accordingly, two regions, indicated in blue and red in Fig. 1b). The states from these two regions give an opposite in sign contribution to the value of λ^{-2}. It is shown that the inflection point in the T-dependence of λ^{-2} is formed due to both the competition of the contributions from this two regions and specific temperature dependence of the spectral density of spin polaron quasiparticles.

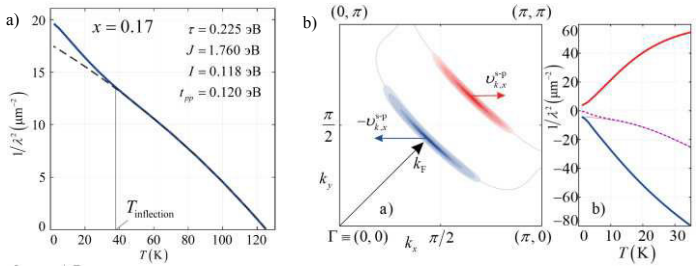

Fig. 1: *a) Inflection point in the temperature dependence of the London penetration depth in cuprate superconductors. b) two regions in the Brillouin zone (blue and red) defining the non-monotonic temperature dependence of the superfluid density.*

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