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Quark confinement to be caused by Abelian or non-Abelian dual superconductivity in the $SU(3)$ Yang-Mills theory

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<PRE> The dual superconductivity is a promising mechanism for quark confinement. We have presented a new formulation of the Yang-Mills theory on the lattice, that enables us to change the original non-Abelian gauge field into the new field variables such that one of them called the restricted field gives the dominant contribution to quark confinement in the gauge-independent way. We have pointed out that the $SU(3)$ Yang-Mills theory has a new way of reformulation using new field variables (minimal option), in addition to the conventional option adopted by Cho, Faddeev and Niemi (maximal option). In the preceding lattice conferences, we have accumulated the numerical evidences that support the non-Abelian dual superconductivity using the minimal option for the SU(3) Yang-Mills theory. This should be compared with Abelian dual superconductivity from the maximal option which is a gauge invariant version of the conventional Abelian projection method in the maximal Abelian gauge. In this talk, We focus on discriminating between two reformulations, i.e., maximal and minimal options of $SU(3)$ Yang-Mills theory for quark confinement from the viewpoint of dual superconductivity. We investigate the dual Meissner effect at finite temperature and the phase transition in both options which are compared with the original Yang-Mills theory. For this purpose, we measure the distribution of the chromoelectric flux connecting a quark and an antiquark and the induced magnetic-monopole current around the flux tube in both confinement/deconfinement phase. </pre>

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