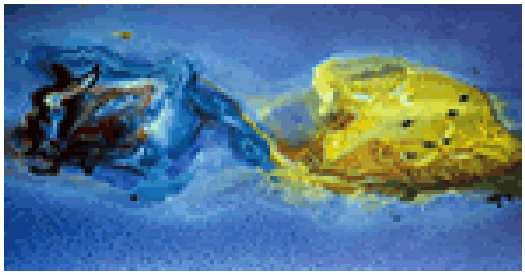

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Composite operator and condensate in SU(N) Yang-Mills theory with U(N-1) stability group

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To establish the widely accepted dual superconductivity picture for explaining quark confinement, a reformulated version of $SU(N)$ Yang-Mills theory, which is based on the Cho-Faddeev-Niemi decomposition, has been recently developed. However, from a novel viewpoint, this decomposition is merely considered to be a nonlinear change of variables.

Within this framework, we consider a certain dimension-2 composite operator whose condensate would give raise to mass term for the coset degrees of freedom through gluon self-interactions. This would not only indicate the analogue to the "Abelian dominance" within our reformulation, but in the past it has also been shown that such a gluon mass leads to many interesting consequences, e.g., removal of the Nielsen-Olesen instability in the Savvidy vacuum or direct implication of quark confinement at low temperatures.

Our discussion is based on the one-loop analysis of the reformulated Yang-Mills theory, which in particular includes the proof of the multiplicative renormalizability of the composite operator. With these results, the existence of the corresponding condensate is discussed within the so-called Local Composite Operator formalism. The condensate is related to the vacuum expectation value of a scalar auxiliary field via a Hubbard-Stratonovich transformation. From the one-loop effective potential for the auxiliary field it is then shown that the condensate can indeed exist.

Finally, a (preliminary) analysis based on the functional renormalization group will be presented to go beyond the loop calculations, if time permits.

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