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Spectrum and Observables in Yang-Mills-Higgs Theory

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The Higgs sector of the standard model, the Higgs and the W/Z bosons, is a quite peculiar theory. Because of the Higgs effect, in some cases the observable particles, i.e. gauge-invariant bound states, have the same mass as the elementary particles. This is what makes perturbation theory in the electroweak sector possible. Under which condition this holds true is not only important for understanding the Higgs sector itself, but may have severe implications for observable states in generic higgsed theories. The spectrum of observables and elementary particles, and thus the validity of a perturbative picture, is studied in a large area of the phase diagram of Yang-Mills-Higgs theory, starting from the QCD-like domain into the region of a potentially heavy Higgs. The results show that the low-lying spectrum depends on whether the theory is in a QCD-like region or a Higgs-like region, but the spectrum is otherwise rather inert to the microscopic details for a wide range of parameters. The applicability of a simple perturbative description is found to be restricted to only an intermediate range of 'Higgs' masses.

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