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Softening of the dynamical σ meson TETSUO HYODO, Tokyo Institute of Technology, DAISUKE JIDO, Yukawa Institute for Theoretical Physics, TEIJI KUNIHIRO, Kyoto University — We study the structure of the lowest lying scalar meson with $I = J = 0$, the sigma meson, through the softening phenomena associated with partial restoration of chiral symmetry. We formulate two-flavor dynamical chiral models with a finite pion mass to describe the $\pi\pi$ scattering. Several structures of the sigma meson can be realized, such as the chiral partner of pion, or a dynamically generated resonance by $\pi\pi$ attraction. We show that, when the chiral symmetry is partially restored, the dynamically generated sigma meson shows qualitatively different softening pattern from the behavior of the chiral partner, reflecting the nature of an s-wave resonance. Investigating the properties with large symmetry restoration, we find that the mass of the dynamical sigma meson approaches the pion mass and that the coupling to $\pi\pi$ scattering state is proportional to the pion mass. Although the dynamical sigma meson consists of mesonic molecule, the behavior near the restoration limit is similar to that of the chiral partner. This suggests an interesting possibility of the dynamical sigma meson as the chiral partner of the pion.

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