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Lilienfeld Prize Talk: Persistent Challenges of Quantum Chromodynamics

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Unlike some models whose relevance to Nature is still a big question mark, Quantum Chromodynamics will stay with us forever. Quantum Chromodynamics (QCD), born in 1973, is a very rich theory supposed to describe the widest range of strong interaction phenomena: from nuclear physics to Regge behavior at large E, from color confinement to quark-gluon matter at high densities/temperatures (neutron stars); the vast horizons of the hadronic world: chiral dynamics, glueballs, exotics, light and heavy quarkonia and mixtures thereof, exclusive and inclusive phenomena, interplay between strong forces and weak interactions, etc. Efforts aimed at solving the underlying theory, QCD, continue. In a remarkable entanglement, theoretical constructions of the 1970s and 1990s combine with today's ideas based on holographic description and strong-weak coupling duality, to provide new insights and a deeper understanding.