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Super Tau Charm Facility

The Super Tau Charm Facility (STCF) is a third-generation high-luminosity electron-positron collider designed to operate at a center-of-mass energy ($\sqrt{s}$) ranging from 2 to 7 GeV, achieving a peak luminosity exceeding 5×10^{34} cm^{-2}s^{-1} at $\sqrt{s} = 4$ GeV. Compared to other experiments, STCF represents a substantial advancement for electron-positron colliders in the Tau-Charm energy region, both in terms of energy coverage and luminosity. A two-order-of-magnitude increase in luminosity and expanded energy range present complex challenges in the accelerator's design and construction. A series new methodologies and cutting-edge technologies in accelerator and particle detector will be implemented.

STCF will offer a unique and comprehensive physics program covering Quantum Chromodynamics (QCD), hadronic physics, flavor physics, Charge-Parity (CP) violation, rare and forbidden decays, and exploration of new physics phenomena, complementing the research carried out at SuperKEKB, LHC, and future high-energy colliders over the next two decades. Key highlights include the potential observation of CP violation in strange-baryon decays, leading-edge tests of CPT symmetry in kaon decay, and ultra-precise measurements of strong-phase parameters in charm meson decays. STCF will provide exceptional opportunities for investigating exotic hadron spectroscopy. Furthermore STCF will offers the opportunities to precisely measure the key physics variables including R-value, τ lepton mass, CKM elements, and strong coupling constant α_s.

The STCF project was first proposed over a decade ago and has since been extensively discussed within China's high-energy physics community. The conceptual design was completed in 2021. A detailed report on physics and detector was released in 2023, and an updated accelerator report is forthcoming. A key technology research and development (R&D) project, jointly supported by Anhui Province and Hefei City with a budget of 364 million RMB, began in 2023. It focuses on designing accelerator and spectrometer systems and overcoming key technological challenges, and is on track for completion by the end of 2025.Efforts to establish STCF as one of China's National Major Science and Technology Infrastructure Projects under the 15th Five-Year Plan are progressing steadily.

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