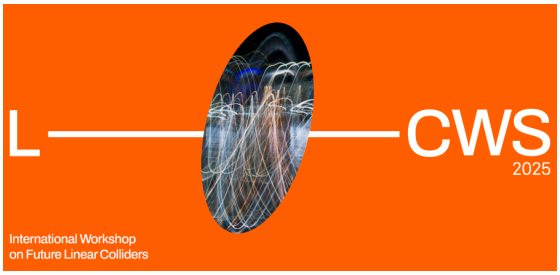

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Concept for an Energy-Frontier Collider based on Structure Wakefield Acceleration

Tuesday 21 October 2025 10:00 (20 minutes)

Structure-wakefield acceleration (SWFA) presents a promising route to a multi-TeV linear collider by combining GV/m-class gradients with high wall-plug efficiency and components suitable for industrial-scale production. In SWFA, a high-charge drive beam excites wakefields in engineered solid-state structures to accelerate a low-emittance “main”beam. Prospective collider configurations are evaluated using experimentally grounded parameters for accelerating fields (0.3–1 GV/m), staging, beam loading, and drive-to-main power transfer. Key technical challenges—emittance preservation across thousands of stages, wakefield phase stability, and positron acceleration—are mapped to an R&D program emphasizing high-efficiency two-beam RF power generation and distribution, novel structure development, precision synchronization, advanced jitter control, and optics strategies for single-bunch stability. SWFA offers competitive wall-plug power requirements for center-of-mass energies in the 1–10 TeV range, while providing a modular upgrade path toward other wakefield-based collider technologies, including collinear concepts based on structures or plasmas

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