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Large diameter Float-Zone crystals for gravitational wave detectors

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The Float-Zone (FZ) method is the only industrially established technique for producing large silicon crystals of ultrahigh purity. The resulting low absorption at 1550 nm makes FZ silicon a strong candidate for cryogenic mirror substrates in next-generation gravitational wave detectors such as the Einstein Telescope (ET). Absorption levels below 10 ppm/cm have been measured in crystals grown by the FZ method.
A major barrier for the application of FZ-Si as mirror substrate is the achievable crystal diameter, currently limited to 200 mm, whereas the ET requires mirror substrates of at least 450 mm in diameter. Although larger FZ-Si crystals also offer cost advantages for the production of electronic power devices, technological limitations and market constraints have so far hindered the introduction of larger-diameter FZ crystals.
This talk provides insight into the FZ-Si wafer production chain, challenges in scaling FZ-Si crystal diameter and semiconductor market dynamics. A research project for the development of 300 mm FZ-Si crystals is outlined. Potential synergies between semiconductor industry requirements and third-generation gravitational wave detectors are considered.

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