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Towards high-purity, large-diameter silicon mirror substrates: A self-crucible growth concept

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Third-generation gravitational wave detectors operating at cryogenic temperatures, such as the Einstein Telescope, require silicon mirror substrates with both exceptional purity and large diameter (>450 mm). The float-zone (FZ) method enables the growth of ultra-high purity silicon crystals but is limited in diameter beyond 200 mm. The Czochralski (Cz) method allows larger diameters but introduces impurities, e.g., from the quartz crucible. In this talk, a self-crucible growth concept is presented that aims to combine the advantages of both methods while avoiding their drawbacks. Experimental results from the growth of crystals with diameters up to 4 inches in the developed setup are presented. The method's potential for the production of mirror substrates for next-generation detectors is discussed.

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