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The future of Hugely coherent sensors for HEP

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I will discuss some of the most successful precision probes of fundamental physics to date, which make use of coherent systems of $\mathcal{O}(10^{23})$ particles to study extremely feeble beyond-the-standard-model interactions, such as fifth-forces, low mass dark matter and new sources of CP-violation. I will cover the systems which are currently the most sensitive to new scalar (gravitational) and pseudoscalar (spin) interactions, both as 5th force and I will suggest how they may improve in the near future. Several of the limiting factors at this juncture are most suitable to community-level R&D efforts: low-vibration facilities, improved material noise/properties and lower-noise read-out systems. Improvements in these technical areas are essential to any experimental system pushing the precision limits of new couplings to fermions. The impact that stretches across research groups and the long time-scales and “institutional” knowledge required for progress point to the need for joint rather than isolated R&D, and university/national lab partnerships.

Primary author: Dr TERRANO, William (Princeton University)

Presenter: Dr TERRANO, William (Princeton University)

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