INSTRUMENTATION

Dynamic duo

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Imagine measuring micrometre-scale distance changes between two satellites flying hundreds of kilometres apart. The Gravity Recovery and Climate Experiment (GRACE) and its successor the GRACE Follow-On mission can do just that; such sensitivity is needed to map the Earth's gravitational field. And now Jing-Yi Zhang and co-authors aim to further miniaturize and reduce the acquisition time achieved by a laser link for the proposed Space Advanced Gravity Measurements mission.

When the lead satellite flies over a region of stronger gravity (from a mountain, say) it will accelerate towards the mass, thereby increasing the inter-satellite distance. But when the trailing satellite approaches the same area, it too accelerates and the gap reduces. To measure these distance changes, Zhang et al. use a dual-way scanning method in which the master and slave lasers can scan simultaneously and independently; the standard way is for one to scan while the other stares. By modulating the powers of the two lasers at different frequencies, their respective signals remain distinguishable. In both ground-based experiments and numerical simulations, the authors achieved a 10 s spatial acquisition time for a 1 mrad cone of uncertainty. This technology may be useful for other missions involving satellite formation flying, such as the Laser Interferometer Space Antenna (LISA).

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