Speckle-free lasers could power high-definition imaging

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LIKE stars twinkling in the night sky, laser spots on a screen glitter with a continually changing pattern of bright and dark speckles. The extra glitter is no problem for laser pointers, but it is a serious issue for engineers trying to use laser illumination in cinema-quality projectors, and for lighting scenes to be recorded for medical purposes.

Speckled spectacle *(Image: Bethany Clarke/Getty Images)*

But an end to speckling is in sight, opening the door to a new range of laser-powered video displays and recording techniques. Speckle happens because laser light is coherent - that is, its waves have their peaks and valleys aligned perfectly in phase, like soldiers marching on parade. When those ranks of light waves hit turbulence in the air, they stumble and interfere with each other, producing ever-shifting speckled patterns.

A team of researchers led by Brendan Redding of Yale University has now shown that by reflecting laser light off small particles randomly distributed in a fluid inside the laser - instead of mirrors at either end of the laser, as is typically done to concentrate the beam - they could produce low-coherence "random lasers" that produce images as speckle-free as those made using LEDs or bulbs (*Nature Photonics*, DOI: 10.1038/nphoton.2012.90).

Lasers are an attractive means of powering high-definition projectors in cinemas and for illuminating objects for imaging because their light is very bright. But speckling blurs images. To compensate for this, complex laser-based optical systems have been devised with parts constantly in motion to suppress the mottled light. Breaking down coherence inside the laser itself is a much simpler solution, and team member Hui Cao, also of Yale, says that low-coherence random lasers should light up small objects well enough to produce images that "track real-time motion, like the beating of the heart" in an embryo.

"This is certainly very interesting and hopefully useful," says Chris Dainty of the National University of Ireland in Galway. On the down side, he cautions that reducing the coherence of a laser would make it prone to increased beam spreading, to the possible detriment of imaging and projection over long distances.

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