

Supersolid and Quantum theatre

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Why in News?

A team of researchers from Italy, recently froze light into a 'supersolid' using 'quantum theatre.'

- **Supersolid** - A super solid is an *exotic phase of matter* in which particles are arranged in a crystalline structure but also move like a non-viscous fluid, exhibiting properties of both a solid and a superfluid.
 - **First created in** - 2017 in a laboratory, but Physicists predicted the idea of a super solid in the 1960s.
 - It combines the friction-free flow of a superfluid with the ordered structure of a crystalline solid.
 - Usually, solids do not move on their own, but super solids ***change direction and density*** depending on their particles' interactions while maintaining an organised internal structure.
 - **Properties of light** - Light always travels at *3 lakh km per second in a vacuum*.
 - It cannot be trapped and solidified because the particles of light, photons, have no rest mass and do not interact strongly with each other.
 - Light exists only as a particle or a wave.
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- **Recent Findings** - It marks the first time scientists have managed to couple light with matter to create a supersolid.
 - It used a quantum mechanical approach that relied on the properties of polaritons.
 - These are hybrid particles that sometimes behave like light and sometimes like matter.
 - They are created by coupling photons with packets of energy inside materials, like phonons (vibrational energy) or excitons (electron-hole pairs).
 - The researchers used an aluminium gallium arsenide semiconductor platform as a waveguide, a channel through which waves can pass, fitted with a source of excitons and a laser.
 - The waveguide had a microscopic structure with a periodic grating.
 - The etched ridges influenced the polaritons' motion, trapping them in a regular pattern.
 - The team used a pulsed laser to maintain a dense polariton condensate at a temperature of about -269°C .
 - **Quantum theatre** - This framework uses concepts from quantum mechanics to analyse theatrical performances, exploring themes like identity, observation, and play.
 - **Potential applications** - Through this experiment photonic supersolids become more

accessible for experimentation.

- Helps in producing lossless optical energy transport and optical computing elements.

Reference

[The Hindu | supersolid | quantum theatre](#)

