JNCASR Bengaluru builds a terahertz silicon chip carrying data at up to 100 Gbps – a step towards 6G

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News

According to a PIB release of the Ministry of Science & Technology on 4 Nov 2026, researchers at the Jawaharlal Nehru Centre for Advanced Scientific Research (JNCASR), Bengaluru – an autonomous institute of the Department of Science and Technology (DST) – led by Dr Abhishek Kumar, have designed a silicon chip that guides terahertz waves past barriers with only about 1–2% loss, using 'topological photonics'. Its power-splitter device carried data at up to 100 Gbit/s (QAM-32). The work appeared in 'Advanced Materials'; IISER Kolkata, IIT Bombay, Singapore's A*STAR and France's University of Lille–CNRS collaborated.

Key facts

Institute	JNCASR, Jakkur, Bengaluru (DST); lead – Dr Abhishek Kumar (Meta Optics Lab); first authors Samina Mulla, Sangram Kumar Sadhu
Technology	Triangular holes in a silicon slab – a 'photonic crystal' mimicking graphene's honeycomb lattice; waves travel along the boundary of two regions
Speed	Up to 100 Gbit/s (splitter); double barrier – 48; omega-shaped – 60 Gbit/s
Loss	One barrier – about 1–2%; two barriers – 2–3%

Frequency	310–360 GHz (terahertz band); high-resistivity silicon – compatible with standard chip-making
Journal	Advanced Materials; next – tuning barriers electrically, thermally or mechanically

Background

- Terahertz waves lie between microwaves and infrared in the electromagnetic spectrum. Their very wide bandwidth suits future 6G links, but they are easily scattered and lost at bends, defects and barriers – the problem this work eases.
- Science: a 'photonic crystal' is a periodic structure that controls light the way a semiconductor controls electrons. The idea of 'topology' in matter won the 2016 Physics Nobel (Thouless, Haldane, Kosterlitz). Graphene – a one-atom-thick honeycomb sheet of carbon – was isolated in 2004 by Andre Geim and Konstantin Novoselov (Nobel 2010).
- JNCASR: set up by DST in 1989 to mark Jawaharlal Nehru's birth centenary; founding president Bharat Ratna C.N.R. Rao; located at Jakkur, Bengaluru, it is a deemed university.
- India's chip push: India Semiconductor Mission (ISM) – Dec 2021, ₹76,000 crore; 'Semicon 2.0' (₹1.27 lakh crore) – Cabinet approval in July 2026. The 'Bharat 6G Vision' document came out in 2023.

Tamil Nadu link: on 24 Apr 2026 MeitY Secretary S. Krishnan launched an indigenously developed Silicon Photonics Process Design Kit (PDK – over 50 verified components) and a Programmable Photonic IC (PPIC) Test Engine from IIT Madras's Centre of Excellence for Compound Photonics and Photonic Integrated Circuits Systems (CoE-CPPICS), Chennai, which MeitY supports.

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