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TRL 4 LIFE SCIENCES

Drug delivery and targeting including personalised treatments using molecular recognition

Designer gene therapy; embryonic treatment of hereditary diseases. Use of nucleotide polymorphism to tailor individual requirements to pharmacological treatments.

TRL 3 LIFE SCIENCES

Computational drug design and testing

Modelling and mathematics to develop working models of complex biological processes for the identification of disease and prediction of DNA interactions. Nascent fields such as biosimulation, pharmacogenomics are expected to mature first and will give rise to fully predictive biomedicine for development of tailored treatments, including addiction. “Laptop labs” will allow the simulation of bio-processes in the early design of drugs

TRL 4 LIFE SCIENCES

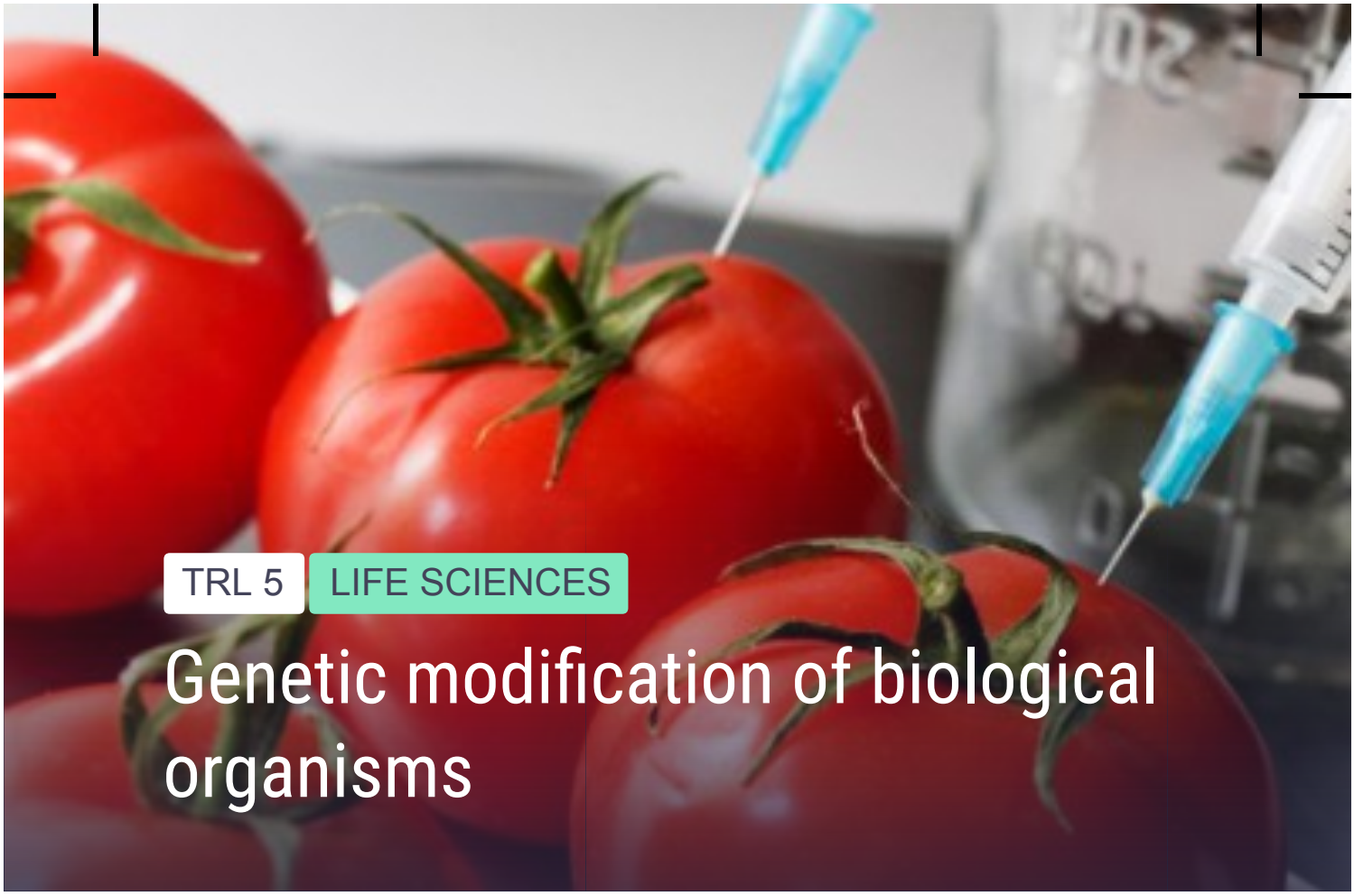
Medical nanostructures for drug delivery

Metal (gold) covered non-conducting nanoshells are injected into cancerous tissue. Nanoshells have been injected with a specific antibody specific to that type of cancer so that the shells bind to cancer only. Once light of specific frequency is shone, nanoshells emit heat and kill the cancer.

TRL 6 LIFE SCIENCES

Nanobiology

Application of nanotech to treat disease and detect changes on nano-level (better drug delivery and vaccine development, advanced nano-sensing of CB threats, sensing of biological signatures)



TRL 5 LIFE SCIENCES

Genetic modification of biological organisms

Control of pests, disease and improvements in food production. Stem-cell therapies to supplant pharmacological approaches.

TRL 3 LIFE SCIENCES

Water purification using nanotechnologies

Use of nanoscale porous membranes to improve the efficiency and reduce the size and energy consumption of desalinisation plants. Nano-ceramic sponges can remove industrial contaminants; biofilters can remove bacteria viruses and prions. Nanoscale purification, disinfection and measurement are expected to standardise wastewater treatment that is more efficient, effective and small.

TRL 2 LIFE SCIENCES

Advanced biometrics

DNA pattern recognition. Behavioural and passive biometrics. Facilitated by detection and characterisation of traces of DNA from as little as a single molecule, complex sensory networks and computational models. Ubiquitous sensing and embedded biometric algorithms. Speech and language recognition. Intelligent information processing based on aural language comprehension, biological characteristics.

TRL 4 LIFE SCIENCES

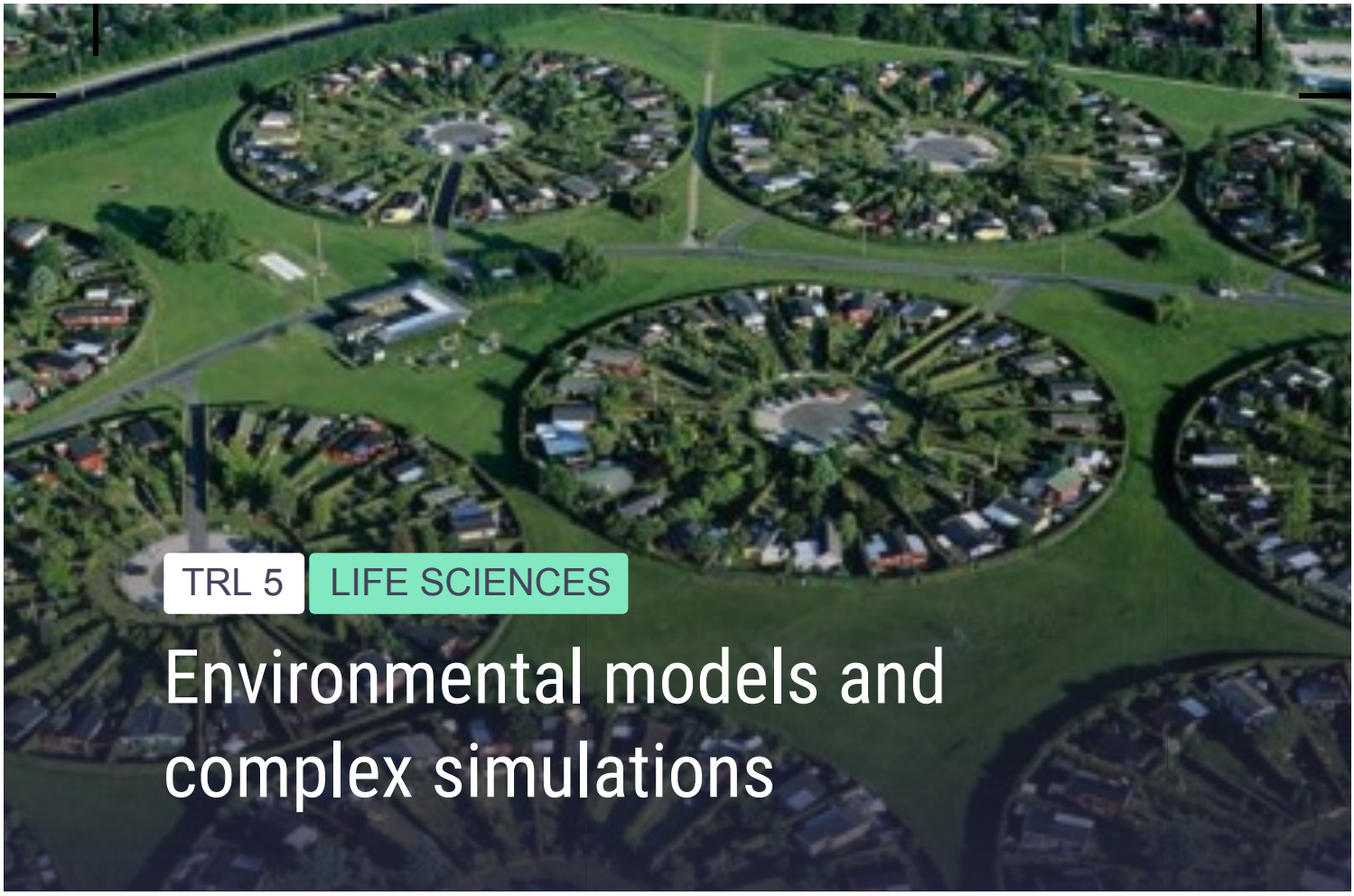
DNA microarrays, rapid bioassays and nanowire sensors

Enable optoelectronic and chemical detection of DNA for testing against viruses, toxins, drug interactions – could replace current microarrays. Correlation of DNA interactions with physical processes

TRL 3 LIFE SCIENCES

Biological process identification and modelling

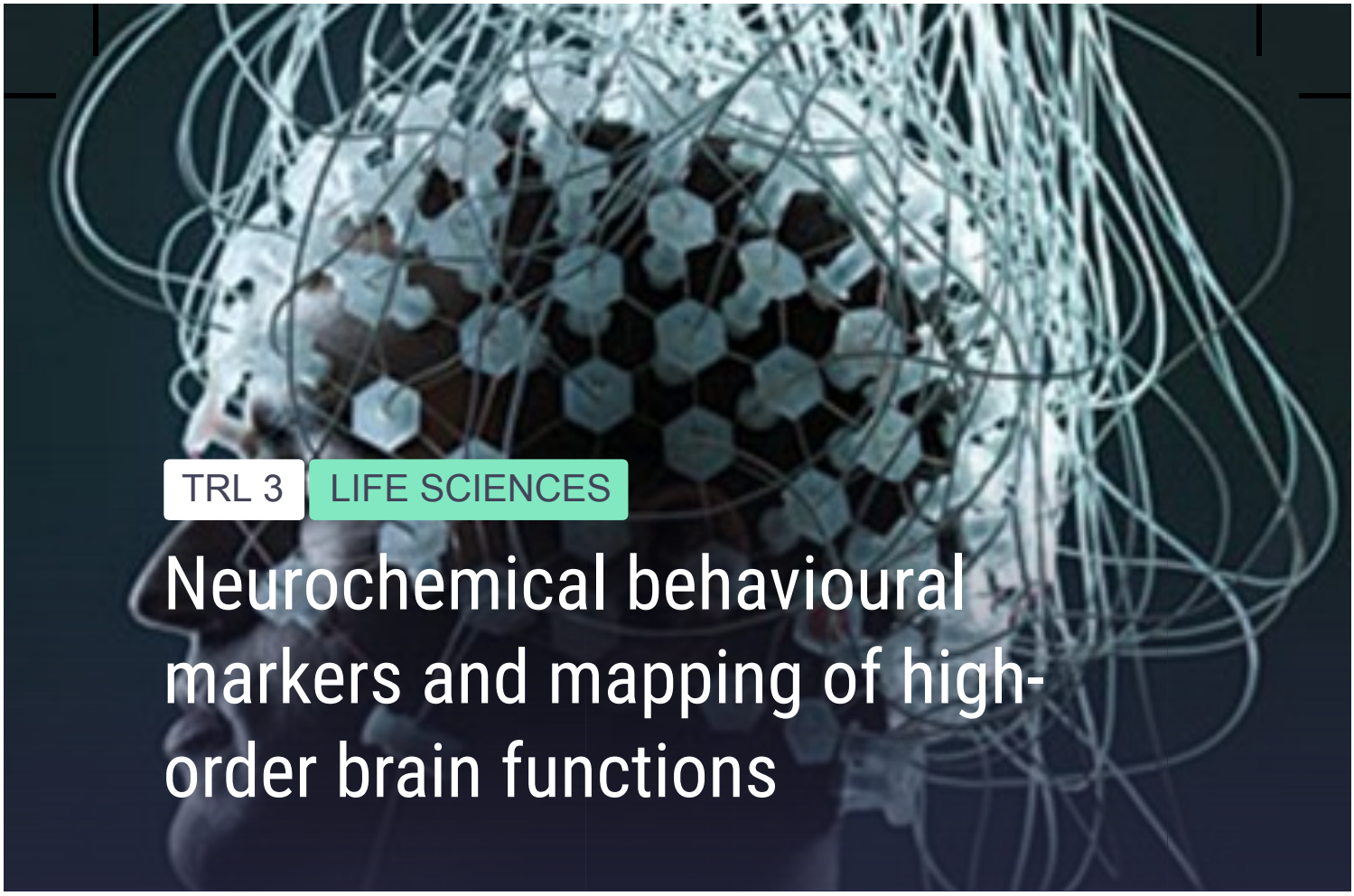
Use of RNA interference techniques to rapidly link DNA functions to biochemical processes (2012-2019). Development of mathematical models of complex biological systems (2050).



TRL 5 LIFE SCIENCES

Environmental models and complex simulations

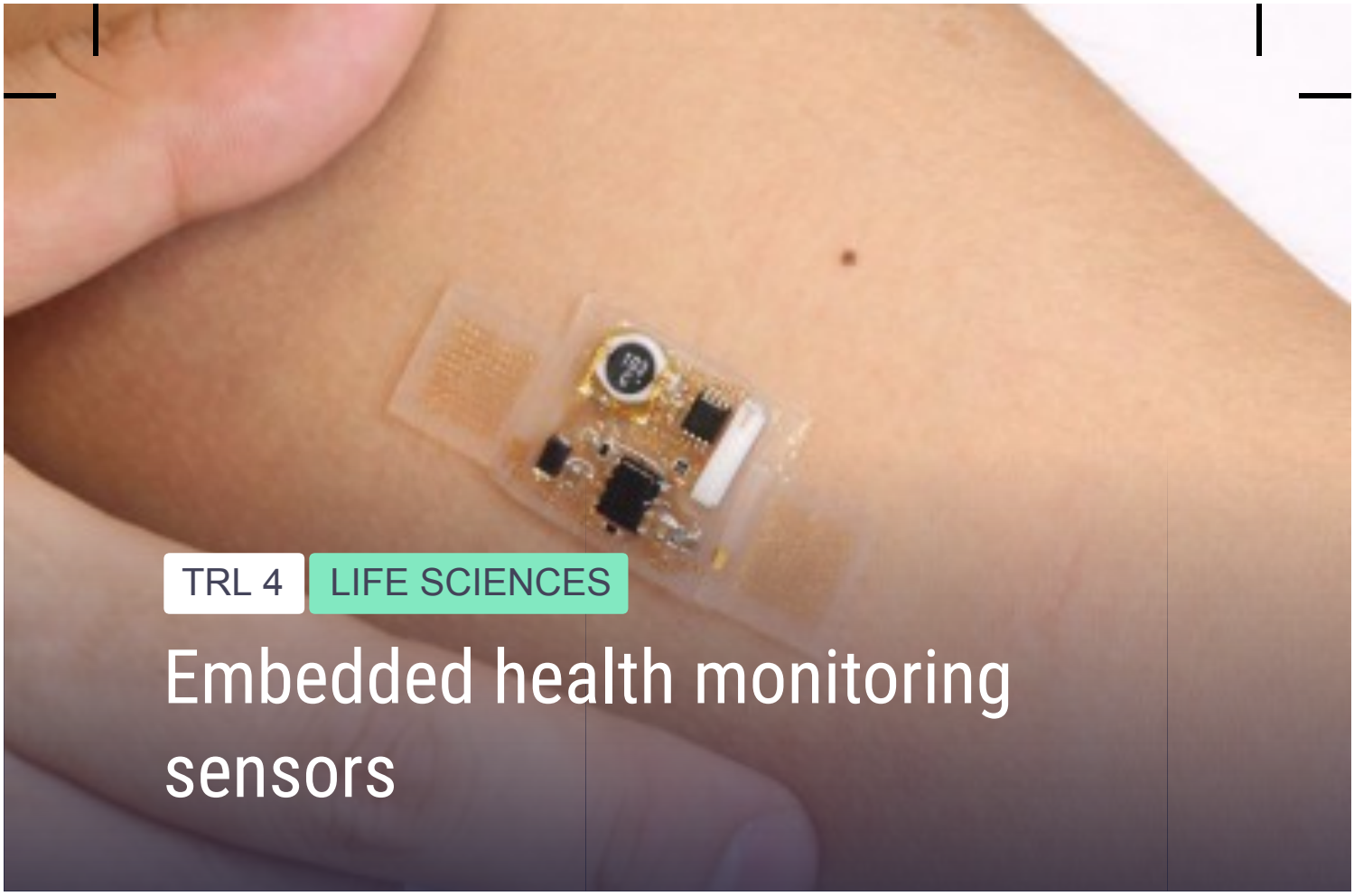
Application of complexity theory to modelling biological systems and environmental processes. Design of efficient operations and urban planning. Accurate climate and weather modelling. Predictive and accurate models of anthropogenic climate effects.



TRL 3 LIFE SCIENCES

Neurochemical behavioural markers and mapping of high-order brain functions

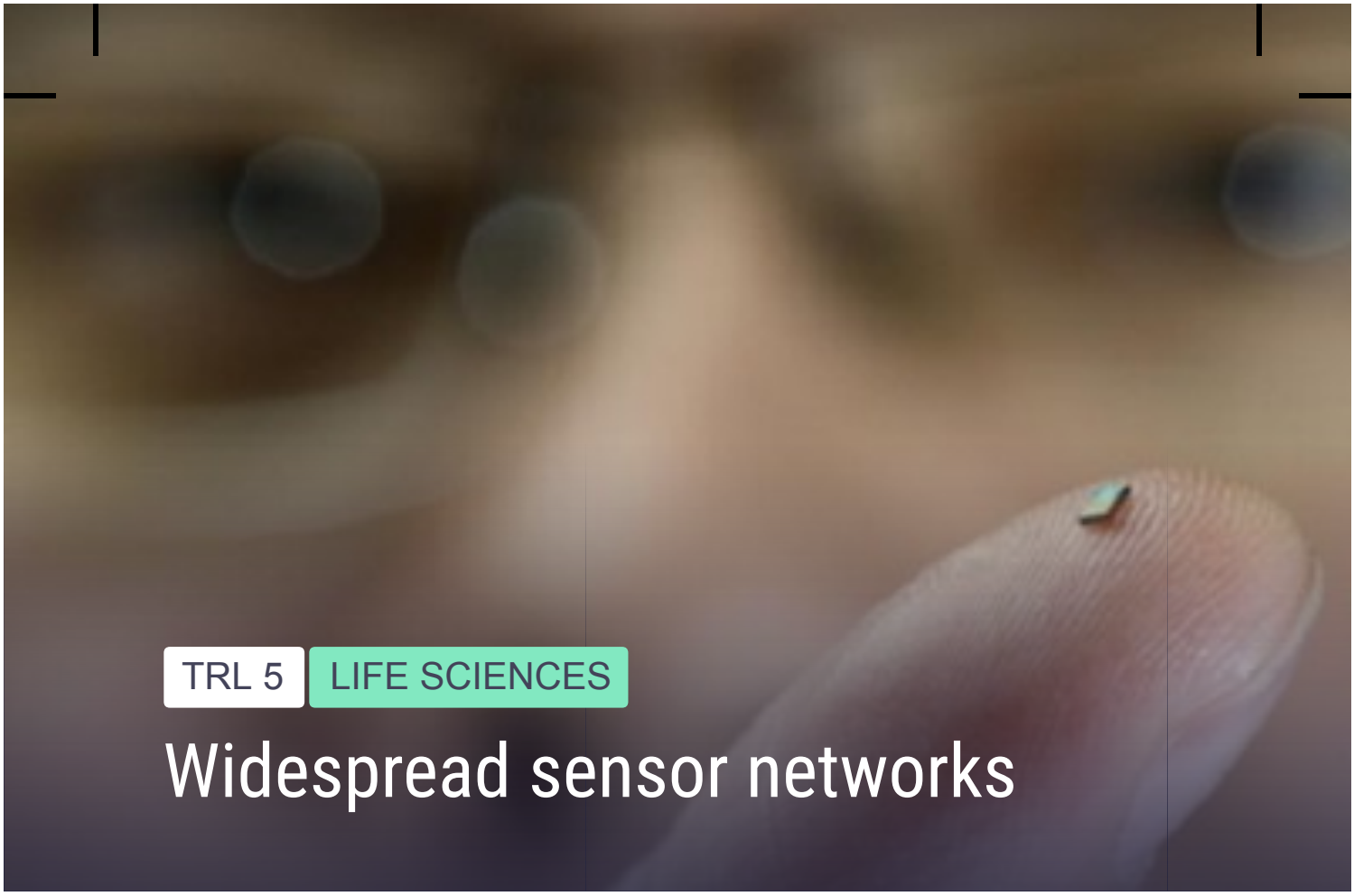
Development of cognitive sensors for brain-machine interfaces and human mental performance augmentation. Integration of massive analytics to understand neural computations, learning and pattern recognition



TRL 4 LIFE SCIENCES

Embedded health monitoring sensors

Remotely accessible, embedded sensors for individual performance and health monitoring. Instantaneous delivery of treatments in emergency situations to combat pathogens and adverse biological symptoms. Highly selective miniaturised sensors for chemical and biological threats.



TRL 5 LIFE SCIENCES

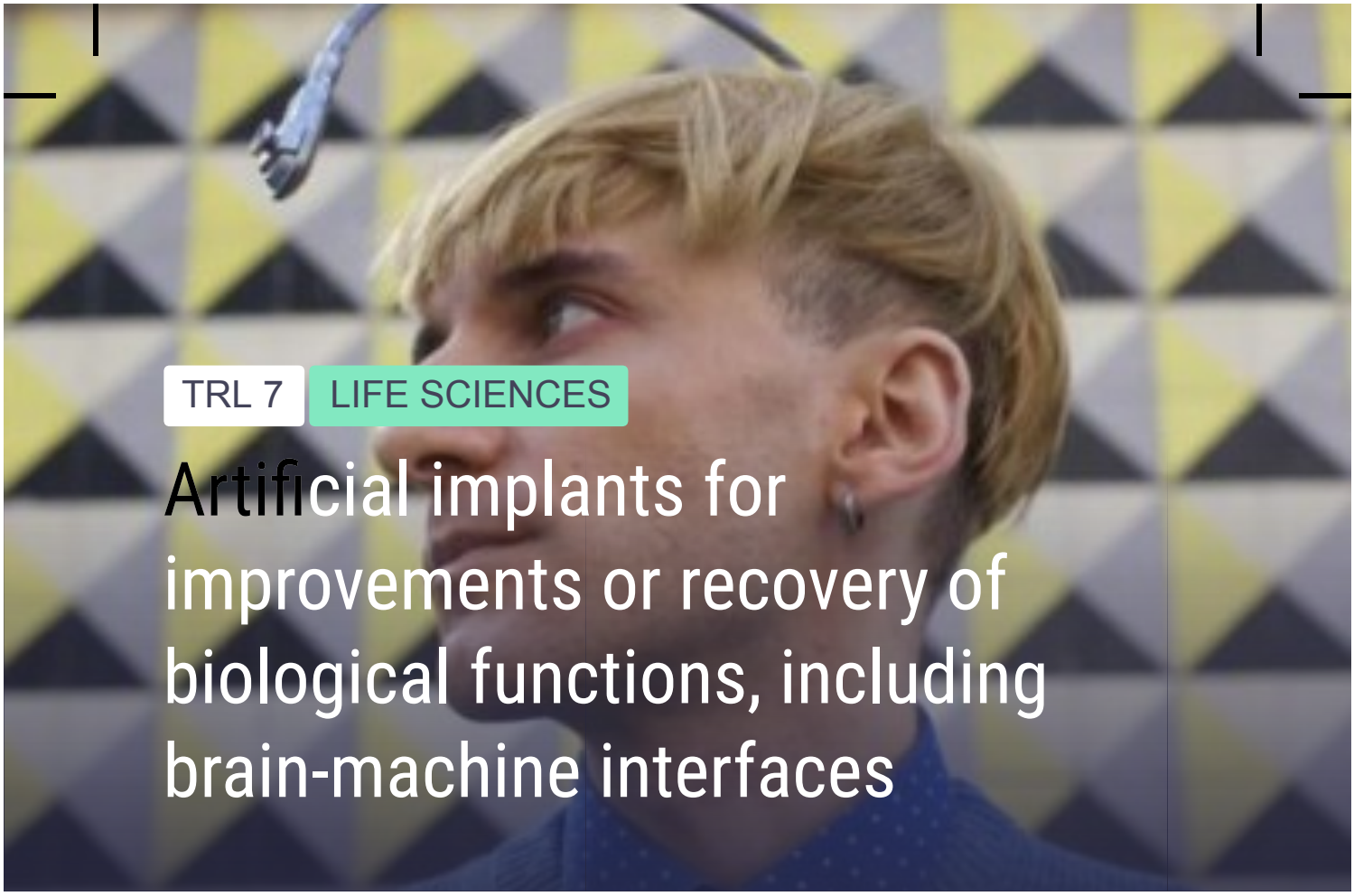
Widespread sensor networks

Miniaturised, self-powered, processing-enabled sensors that are ubiquitous globally. Enabling massive data gathering and analysis about living organisms and infrastructure. Aided by growth in embedded sensors and computational devices in personal goods.

TRL 4 | LIFE SCIENCES

Accurate prediction and modification of human behaviour and intent

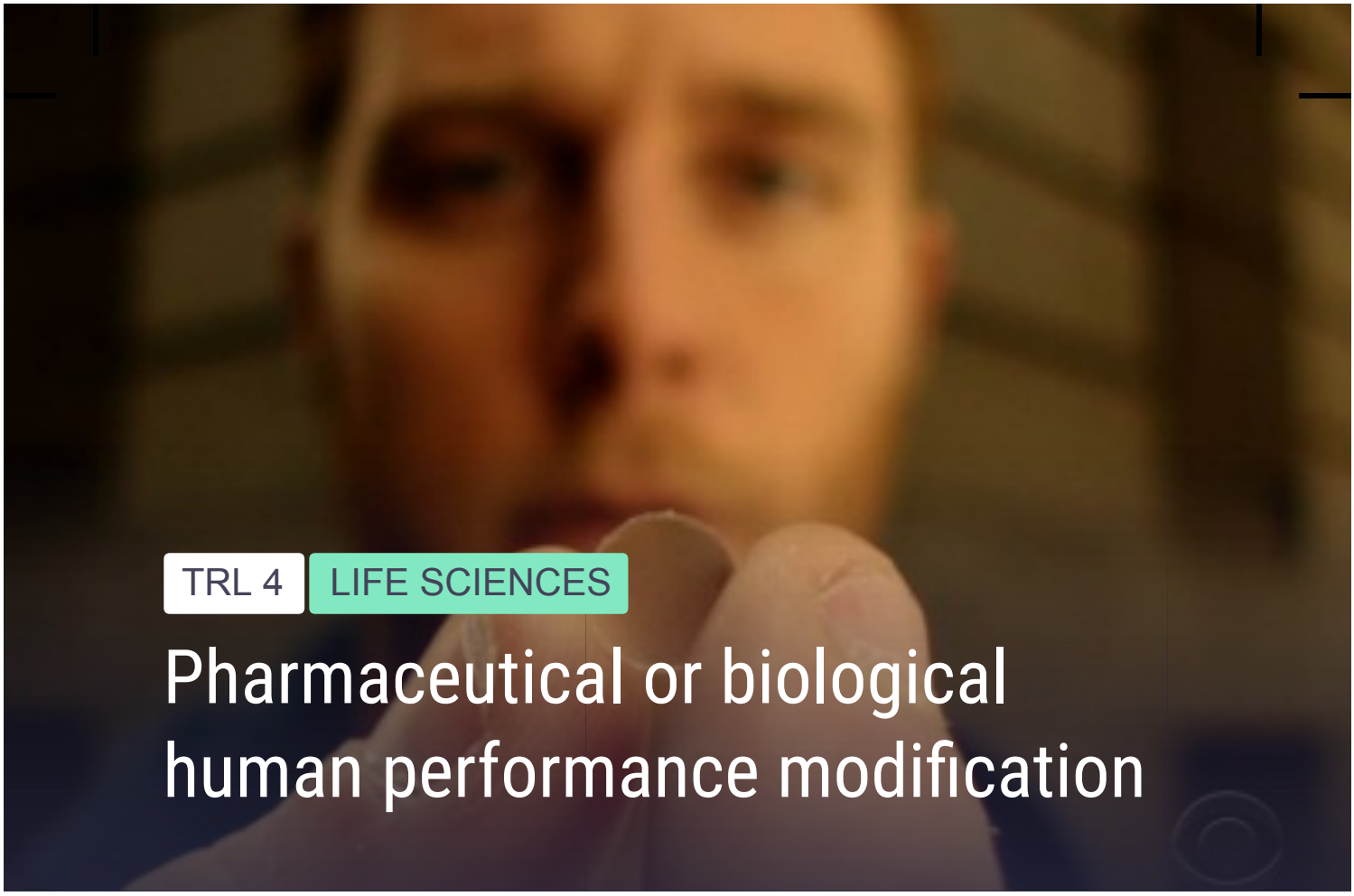
Modelling of human cognition based on biological processing. Application of statistical methods to behaviour modelling and prediction of behaviour. Reasoning under great uncertainty. Use of applied sociology across multiple scientific disciplines. Combination of neuroscience and psychiatry for brain imaging and high-level functional mapping.



TRL 7 LIFE SCIENCES

Artificial implants for improvements or recovery of biological functions, including brain-machine interfaces

Controlling/mimicking high-order biological functions through synthetic means. Artificial extensions of human capabilities, including brain repair (2020-2030). Long lasting, bio-compatible cochlear, optoelectronic implants for better sensing performance. Brain-machine interfaces.



TRL 4 LIFE SCIENCES

Pharmaceutical or biological human performance modification

Use of drugs for increased cognition, performance, reduced sleep. Pharmaceutical improvements to intelligence, memory, endurance (2030-2060). Behaviour modification. DNA modification for offspring selection based on performance characteristics (2030-2060). Understanding and treating brain conditions.

TRL 4 LIFE SCIENCES

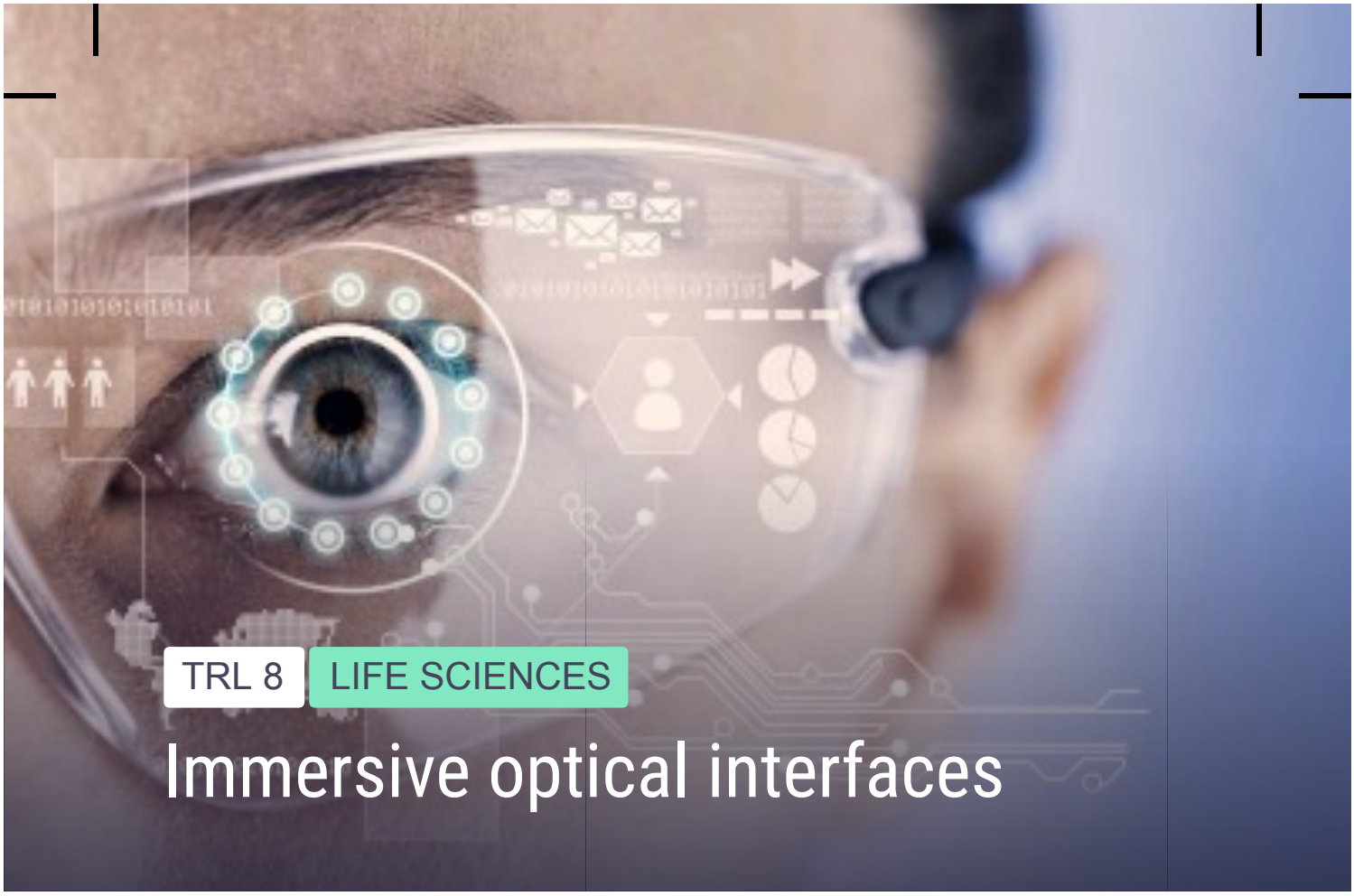
Restoration/regeneration of human body parts

Skin, tissue and organ growth on nanopatterned scaffolds. Bio-engineered tissue and organs grown in-vivo.

TRL 8 LIFE SCIENCES

Integrated machine control

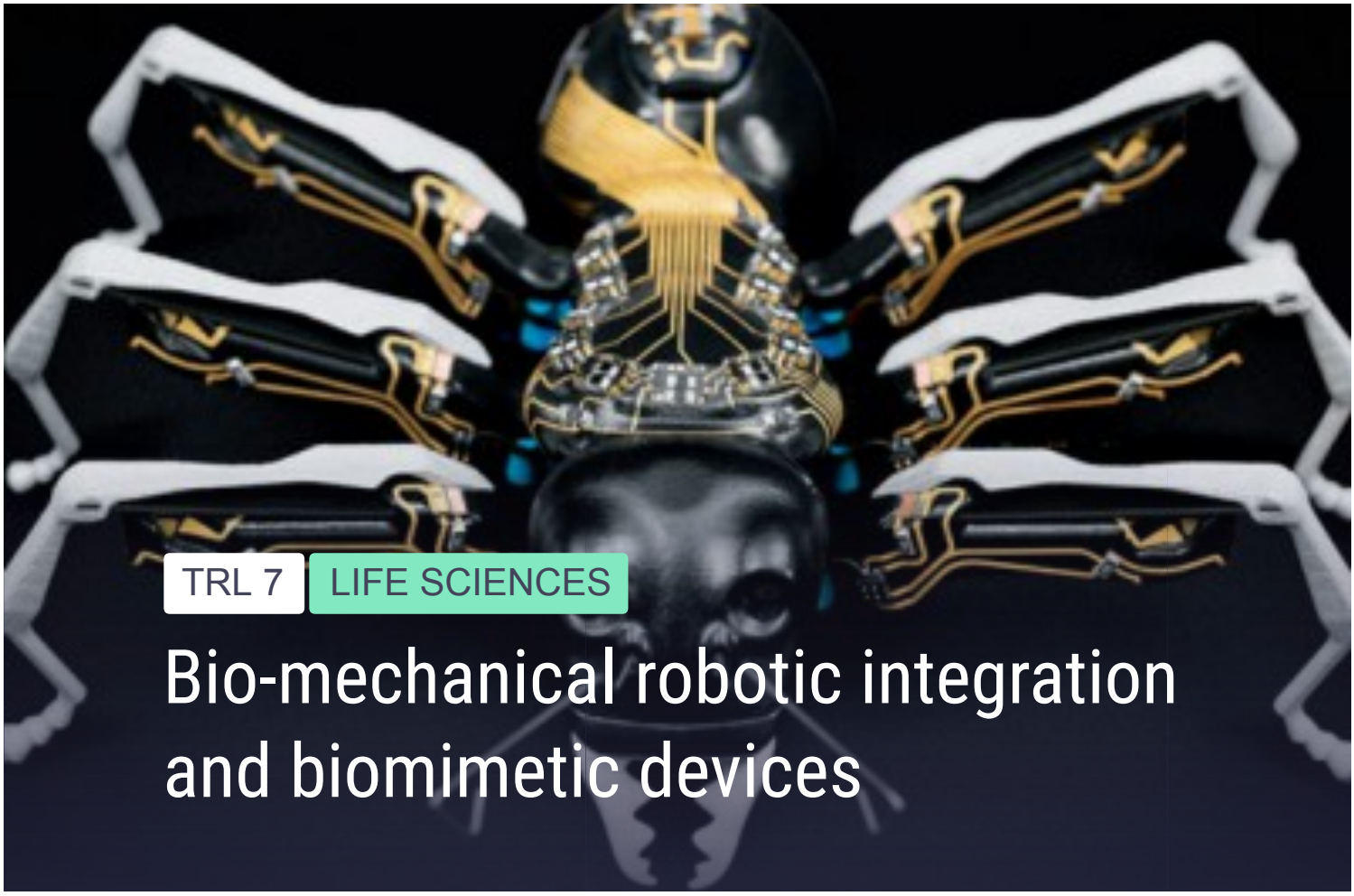
Wearable computers for device control. Hands-free interfaces and input devices (voice recognition, gestures, optical sensing) for rapid communication of intent to autonomous systems.



TRL 8 LIFE SCIENCES

Immersive optical interfaces

Contextual, flexible and interactive displays augmenting human visual perceptions to provide a fully seamless simulation or entertainment experience and extending visual capacity.



TRL 7 LIFE SCIENCES

Bio-mechanical robotic integration and biomimetic devices

Introduction of biomimetic implants and biologically inspired mechanical concepts. Remote control of insects in flight. Development of bioelectronic devices. Application of biomimetic robotics. Autonomous decision making on robotic platforms. Intelligence [sic] service robots.

TRL 6 LIFE SCIENCES

Bio-factories and biological substrates

Large scale manufacturing of synthetic biochemicals. New discoveries of reproducible biological processes and molecules. Mass application of artificial photosynthesis to organic solar cells (artificial leaves). DNA modification of animals and plants to produce new materials (spider silk spinning from goat milk). Use of silk worms to spin spider silk.

TRL 4 LIFE SCIENCES

Synthetic biological engineering

Manufacture and application of synthetic chemicals such as bioactive peptides to target specific cellular receptors and affect human behaviour. Developments in genomics and proteomics to create synthetic organisms engineered to achieve specific tasks.

TRL 6 MATERIALS AND MANUFACTURING

Nanomaterials and structures

Application of nanotechnology to embed multifunctional characteristics into materials.

TRL 4 MATERIALS AND MANUFACTURING

Metal-organic compounds

Structural self-assembly. Safe hydrogen storage. CO2 capture. Mass manufacture of organic electronics.

TRL 5 MATERIALS AND MANUFACTURING

Biomedical materials

In-situ cellular and organ self-repair. Tissue engineering and regenerative medical applications.

TRL 7 MATERIALS AND MANUFACTURING

Specialised, high-performance coatings

Multi-functional coatings that improve existing material strength, endurance, reduce friction, lower RF signatures and increase resistance to environmental hazards.

TRL 5 MATERIALS AND MANUFACTURING

De-icing composites

Composite materials that actively remove ice crystals or impede their growth.

TRL 4 MATERIALS AND MANUFACTURING

Electronic materials

Specifically programmed materials with embedded functional elements. Combined photonic and electronic effects. Large band gap semiconductors that operate at high frequencies.

TRL 7 MATERIALS AND MANUFACTURING

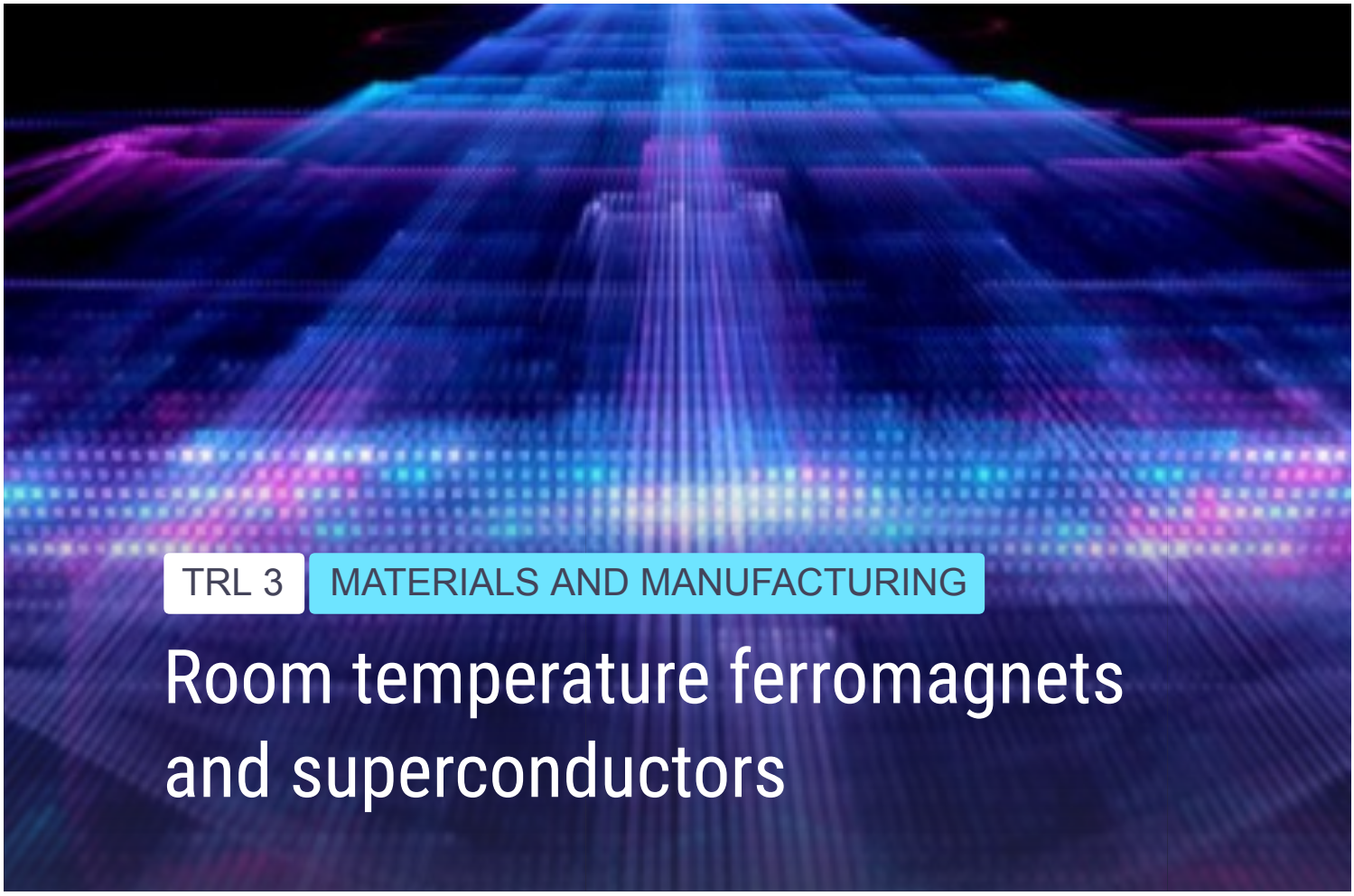
Smart fabrics

Fabrics embedded with electronics, power sources and optoelectronics. Protective clothing, bioactive textiles that remove toxins, electronic textiles capable of remote sensing, adaptive textiles incorporating actuators, reactive textile that respond and change shape to external stimuli such as impacts.

TRL 4 MATERIALS AND MANUFACTURING

Self-healing materials

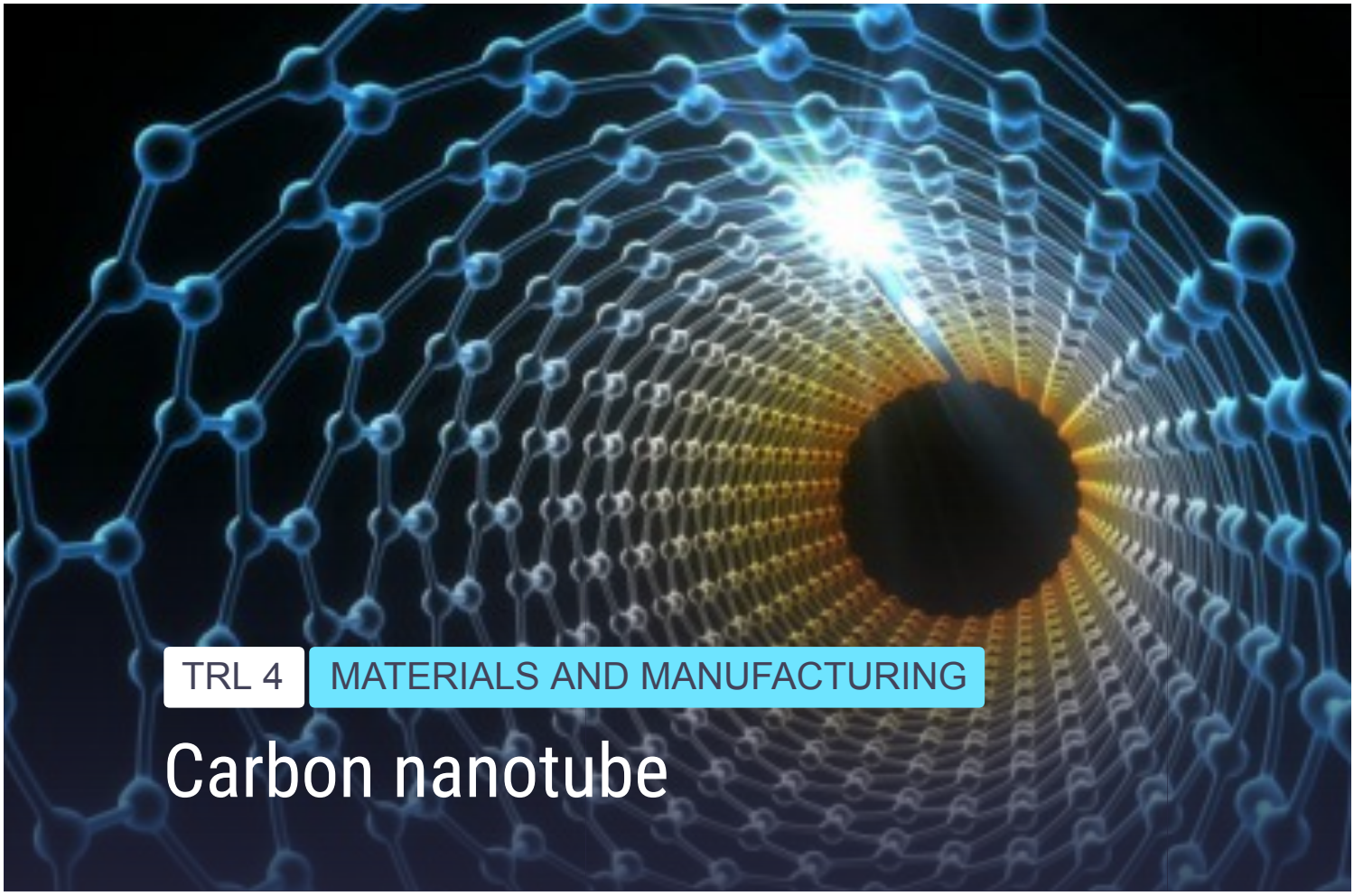
Routine self-repair and maintenance performed automatically and in flight.



TRL 3 MATERIALS AND MANUFACTURING

Room temperature ferromagnets and superconductors

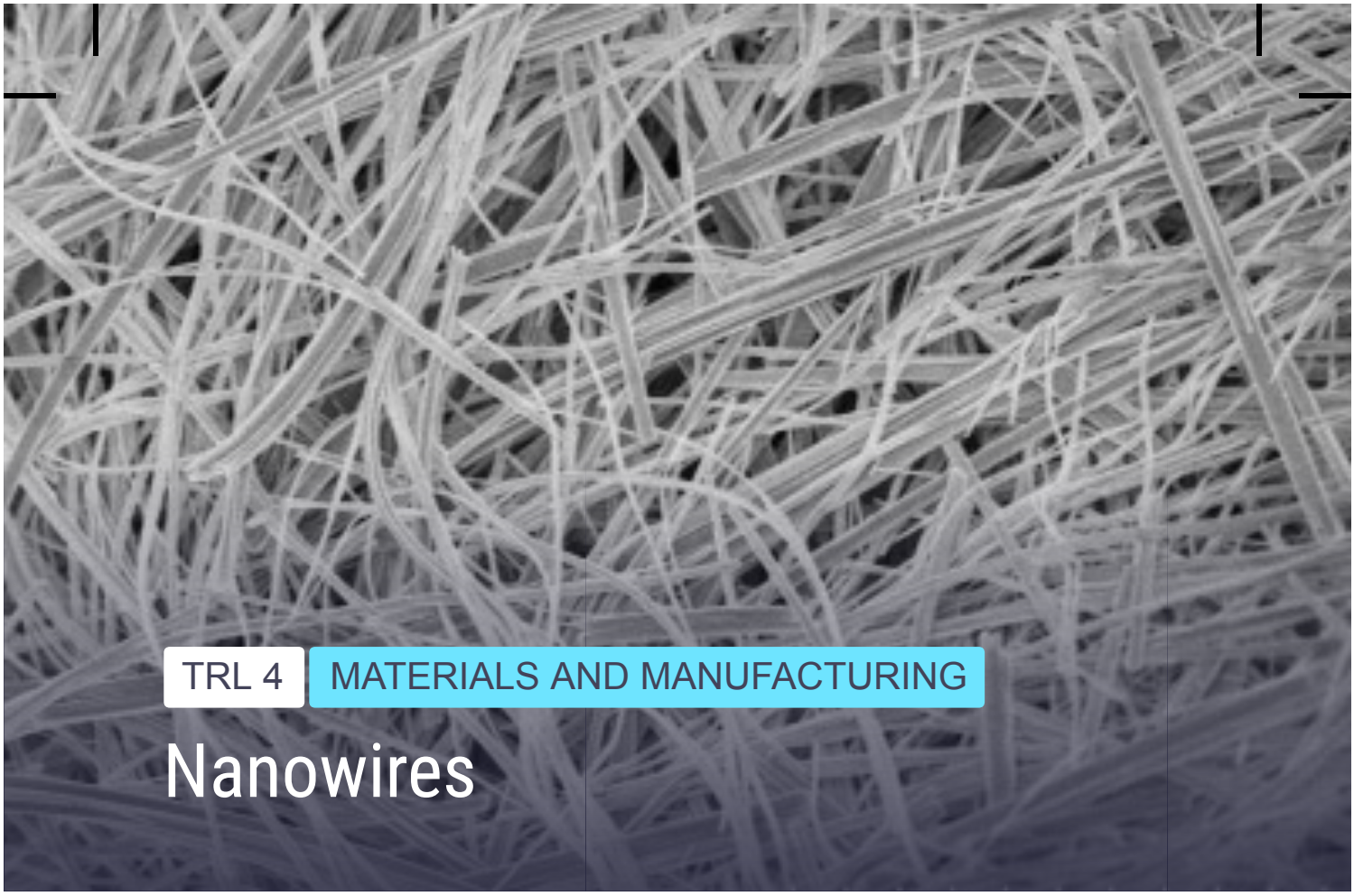
Use of new materials for high density data storage, new computing architectures such as mermistors and quantum computing and high-energy applications



TRL 4 MATERIALS AND MANUFACTURING

Carbon nanotube

Portable and inexpensive water purification using CNT membranes and filters. Use of CNTs to create new composites that are stronger and lighter – CNRPs. These may be used to create efficient morphing wings, radiation resistive space hardware, impact resistance; space elevator. More immediate applications will be to lighten vehicles where performance is secondary to cost. Integrated sensor ability using nanotubes. Nanotubes...



TRL 4 MATERIALS AND MANUFACTURING

Nanowires

Extremely low resistivity and vast increases in electronics' efficiency. Used in the replacement of copper wires and as heat sinks as they have great thermal conductivity. Can be used in miniaturising spacecraft. May exhibit superconductivity near room temperature. Improvements in greater battery energy densities compared with Li-ion devices.

TRL 2 MATERIALS AND MANUFACTURING

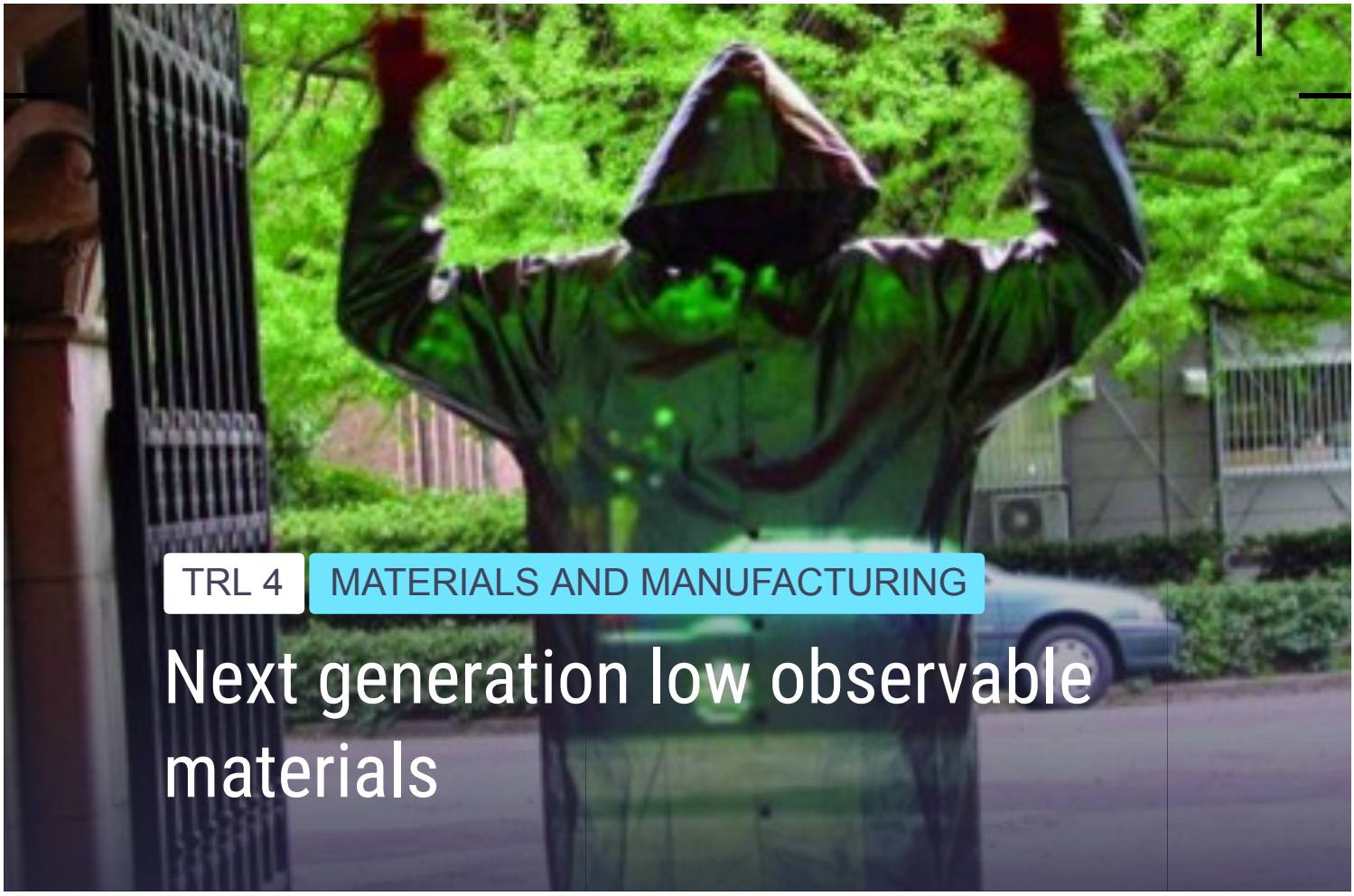
Quantum materials

Materials with tailored quantum effects for use in quantum computers, hightemperature superconductivity or lasers. Macro-quantum effects of photonic material, new principles for quantum manipulation characterising and measuring.

TRL 6 MATERIALS AND MANUFACTURING

Reactive materials and structures

Shape-adaptive materials that react to electric currents, kinetic forces. Shapememory materials that can be programmed to take on certain configurations in specific environmental conditions. Reactive nano-armour composites for battlefield use. Impact resistant rheo-fluidic systems.



TRL 4 MATERIALS AND MANUFACTURING

Next generation low observable materials

Adaptive camouflage in the visible and microwave regions. RF absorbing metamaterials with reduced EO/IR visibility.

TRL 4 MATERIALS AND MANUFACTURING

Silicon photonics

Optical processing on future computing platforms for massive decreases in heat dissipation and increases in processing speed.

TRL 4 MATERIALS AND MANUFACTURING

DNA fabrication techniques and nanomolecular manufacturing

Application of molecular self-assembly and programming using DNA information on a macroscopic scale.

TRL 6 MATERIALS AND MANUFACTURING

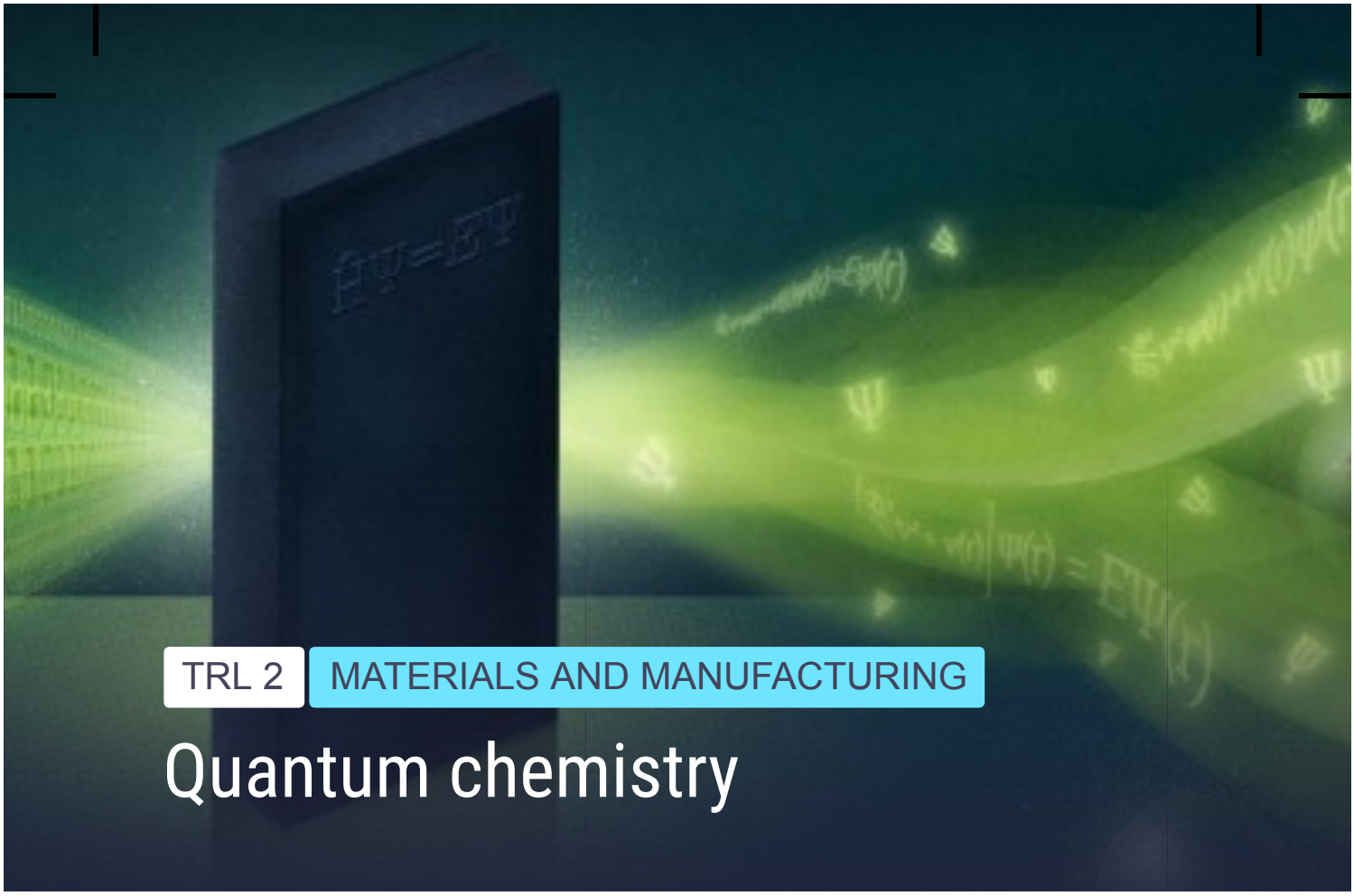
On-demand manufacturing

Development of 3D printers with multifunctional materials to produce complex designs for the end user. Low complexity, low-energy manufacturing. Decreased reliance on mass production and factories.

TRL 3 MATERIALS AND MANUFACTURING

Programmable manufacturing

Nano-brick self-assembly into functional electronic, mechanical, optical or biological structures. Creation of quantum nanostructures for use in brain repair or quantum computing. Manufacturing technology using advanced information technology and service robotics.



TRL 2 MATERIALS AND MANUFACTURING

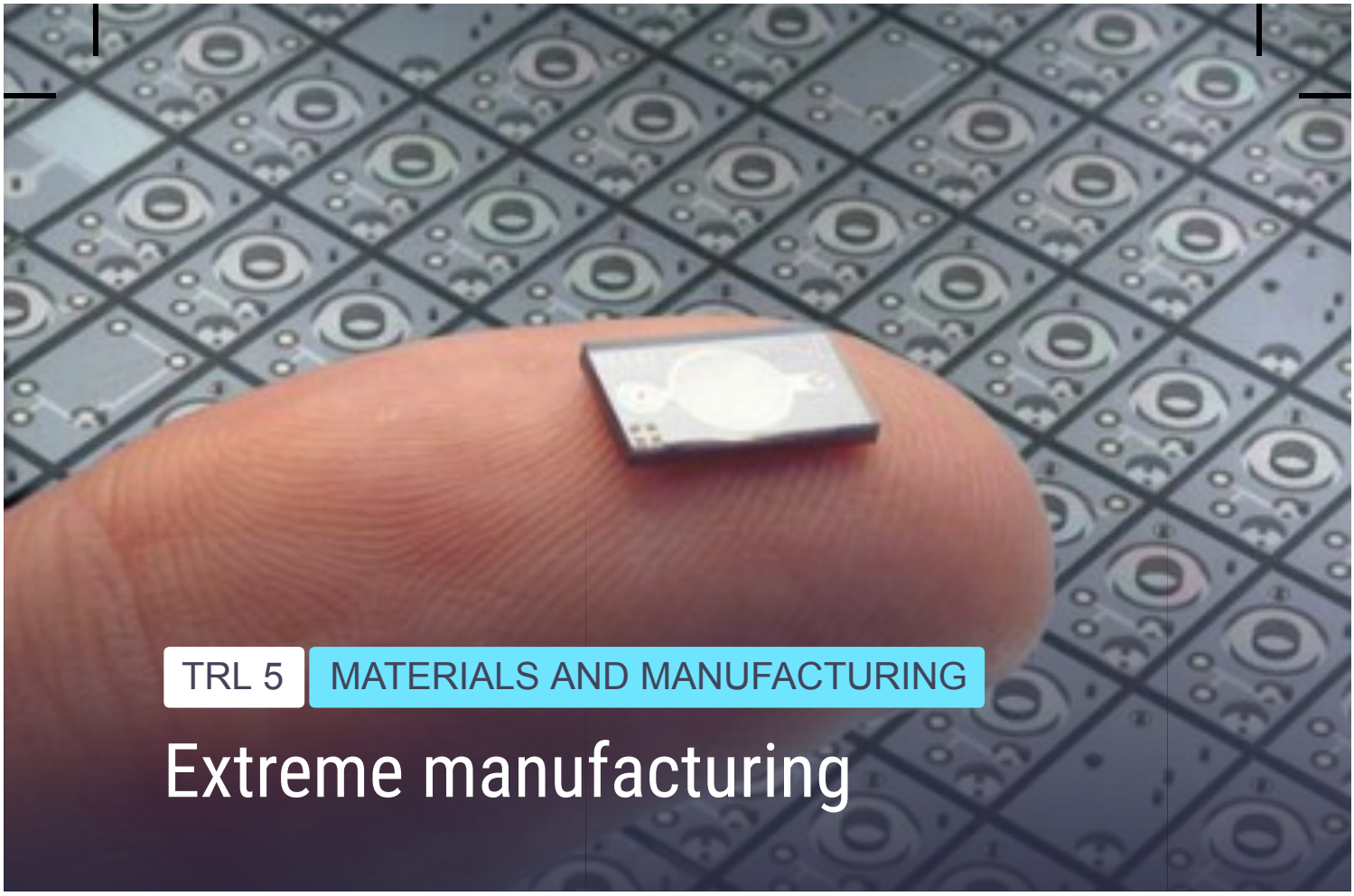
Quantum chemistry

High fidelity chemistry models used in the prediction of reaction rates, energy flows and chemical pathways to maximise reaction efficiencies and reduce waste by products.

TRL 4 MATERIALS AND MANUFACTURING

Green chemistry and manufacturing

Use of biomass and low toxicity chemicals in manufacturing. Development of new chemical reactions and process simulations to support efficient manufacturing.



TRL 5 MATERIALS AND MANUFACTURING

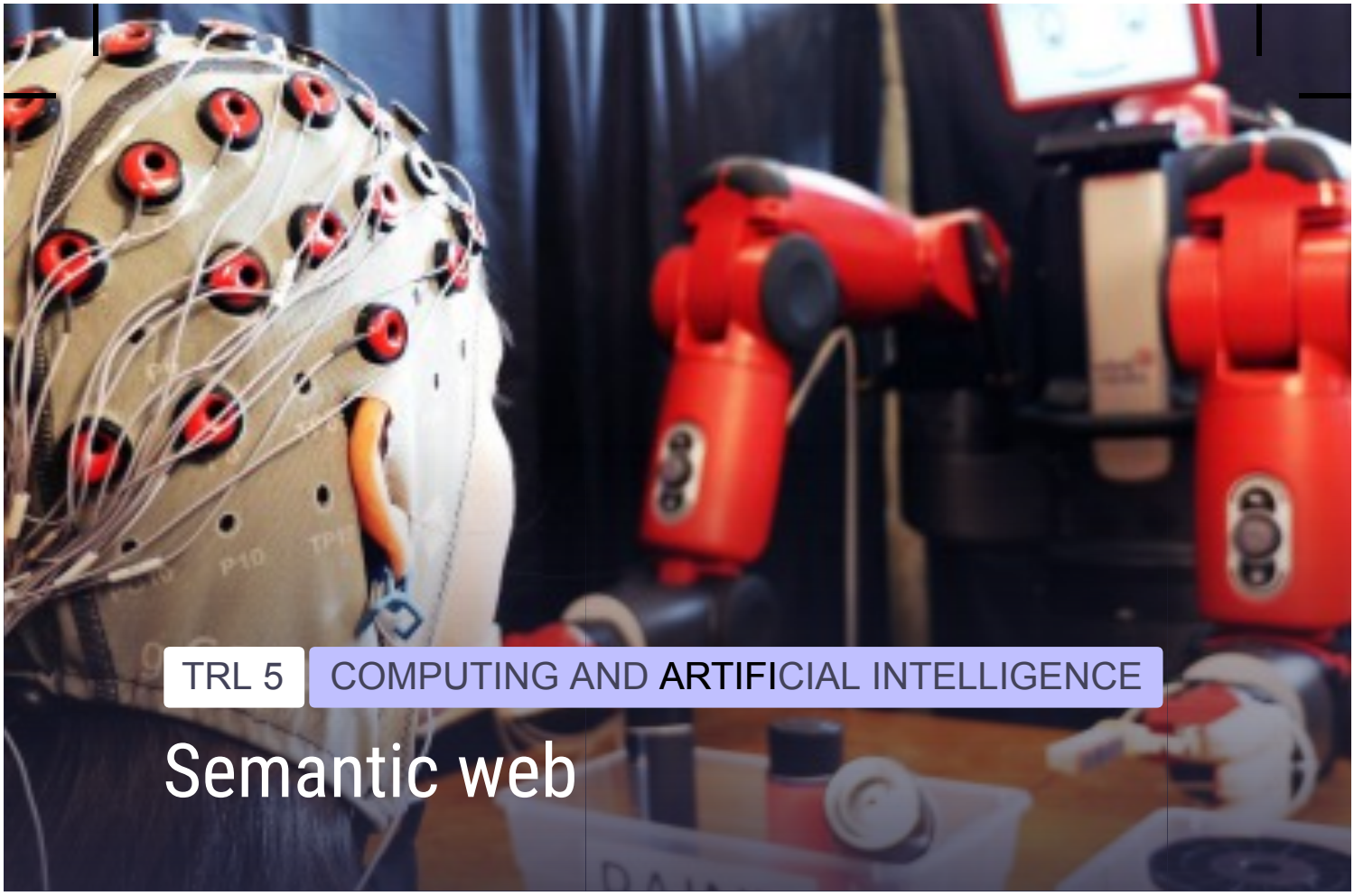
Extreme manufacturing

MEMS, NEMS for precision manufacturing; extremely powerful functions for operations in extreme environments.

TRL 6 COMPUTING AND ARTIFICIAL INTELLIGENCE

Massive analytics

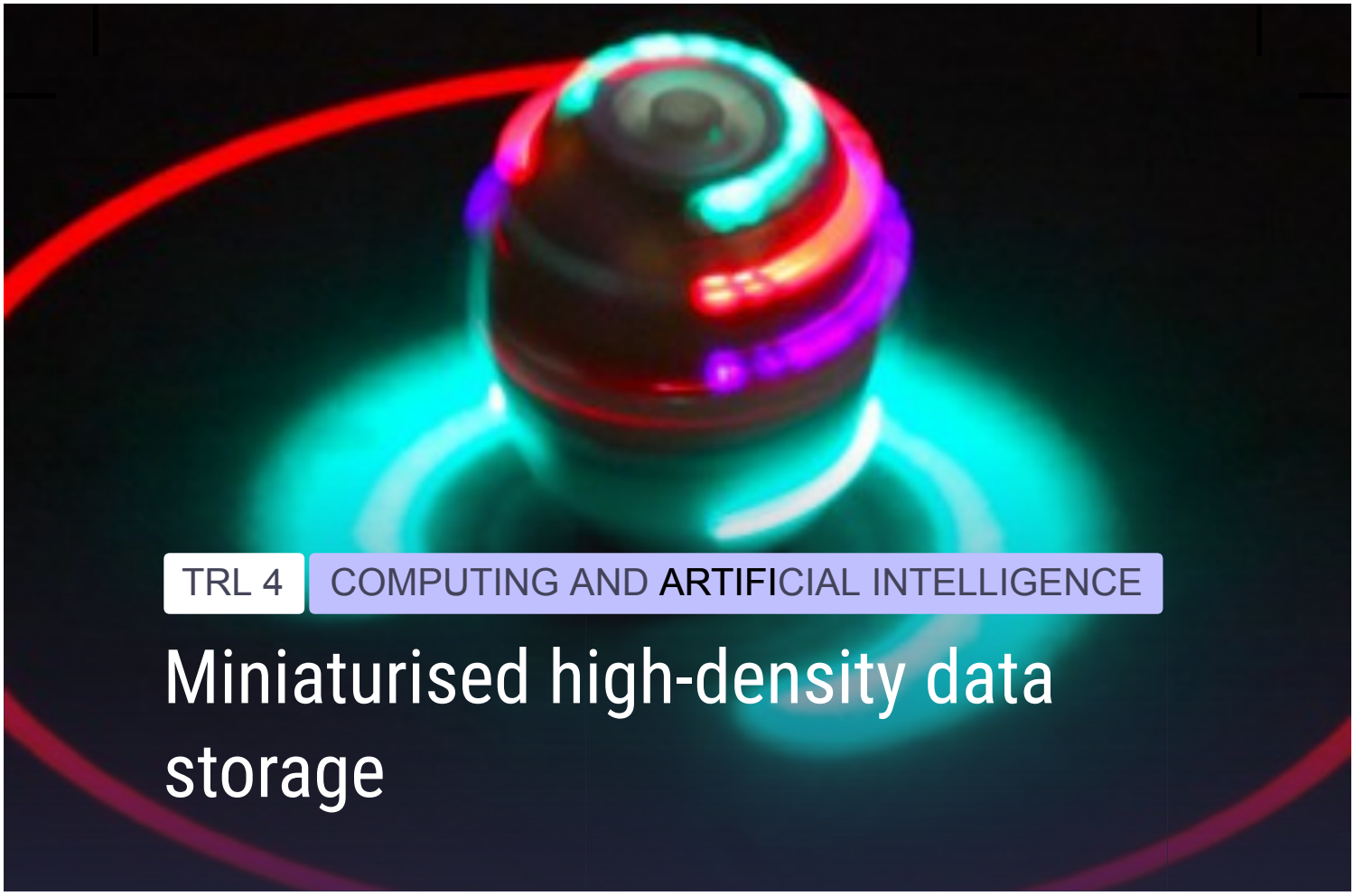
Vast databases that may include personal, genetic and biometric information will require supercomputer-like processing power on demand to complete smart contextual searches. Algorithms and computational models could be developed to complete sophisticated pattern matches, track logistics and engage in market trading. Autonomous systems may be supported by similar massive analytics to make real-time decisions under...



TRL 5 COMPUTING AND ARTIFICIAL INTELLIGENCE

Semantic web

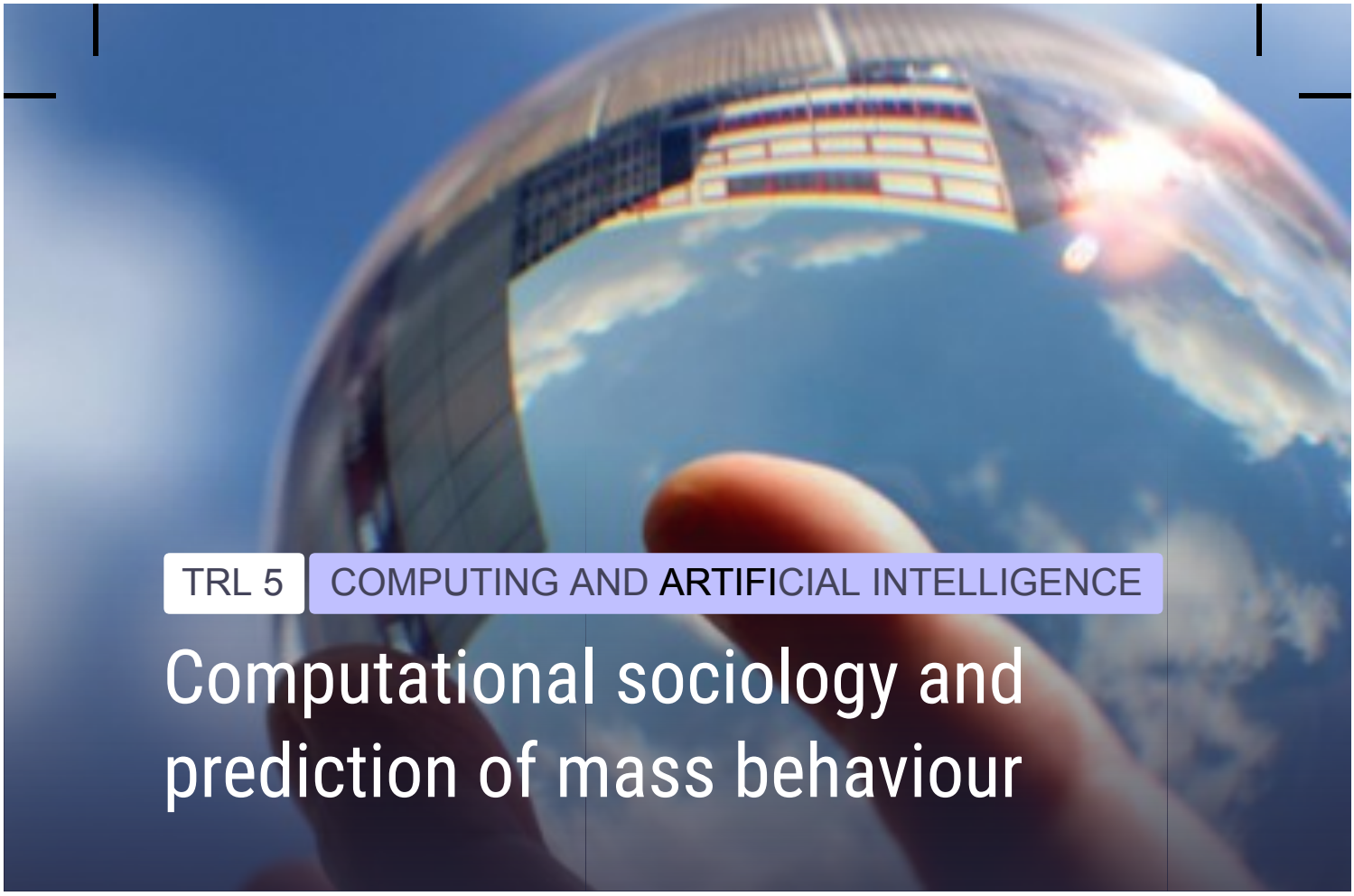
Machine readable context will allow accurate human-machine coupling and data sharing in time-sensitive applications.



TRL 4 COMPUTING AND ARTIFICIAL INTELLIGENCE

Miniaturised high-density data storage

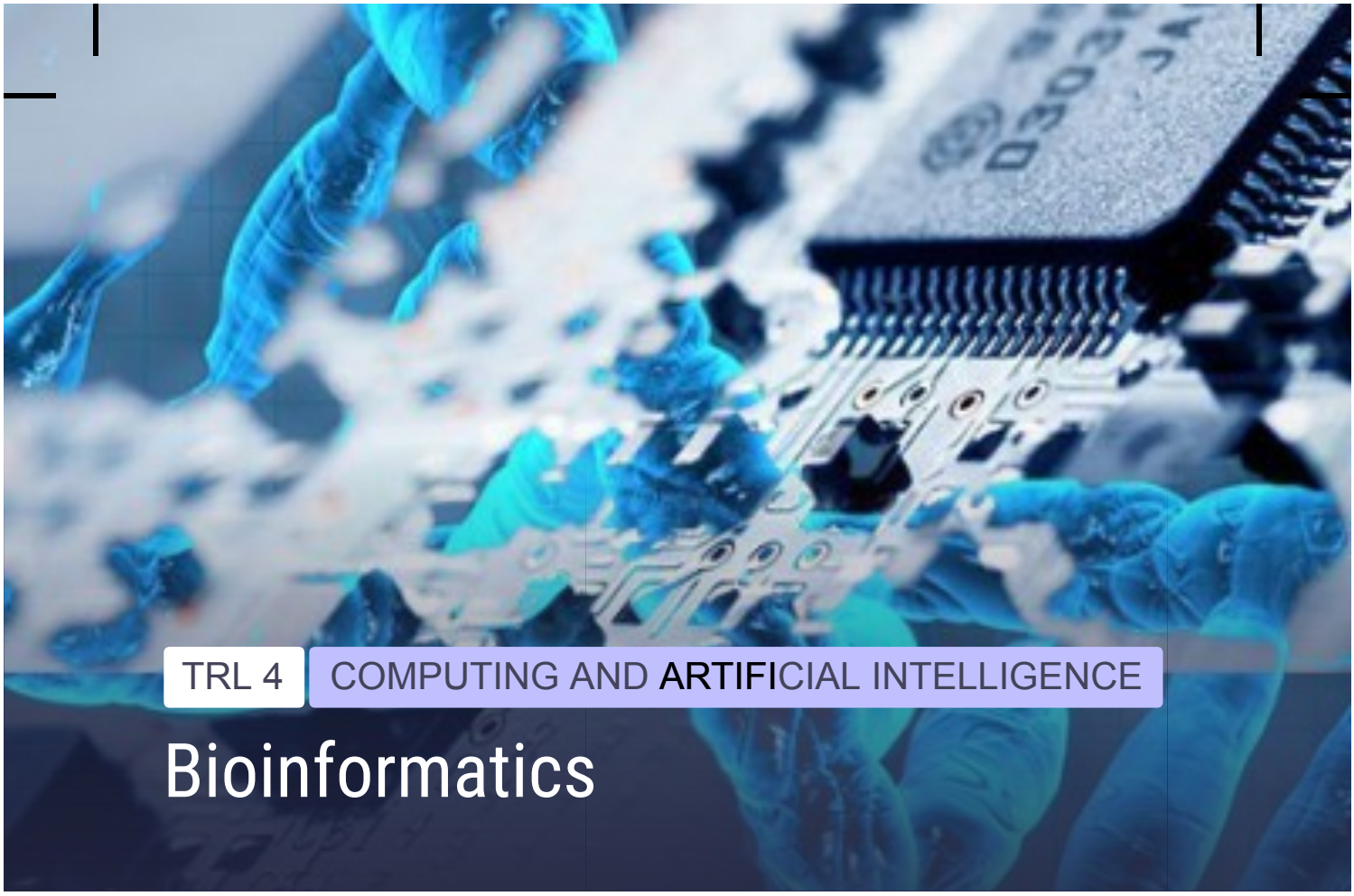
MRAM and spintronic applications to new computing architectures providing high data densities in miniaturised packages. Possible transistor replacements for miniaturised and more powerful computing architectures. Applications to neuromorphic computer systems and pattern recognition.



TRL 5 COMPUTING AND ARTIFICIAL INTELLIGENCE

Computational sociology and prediction of mass behaviour

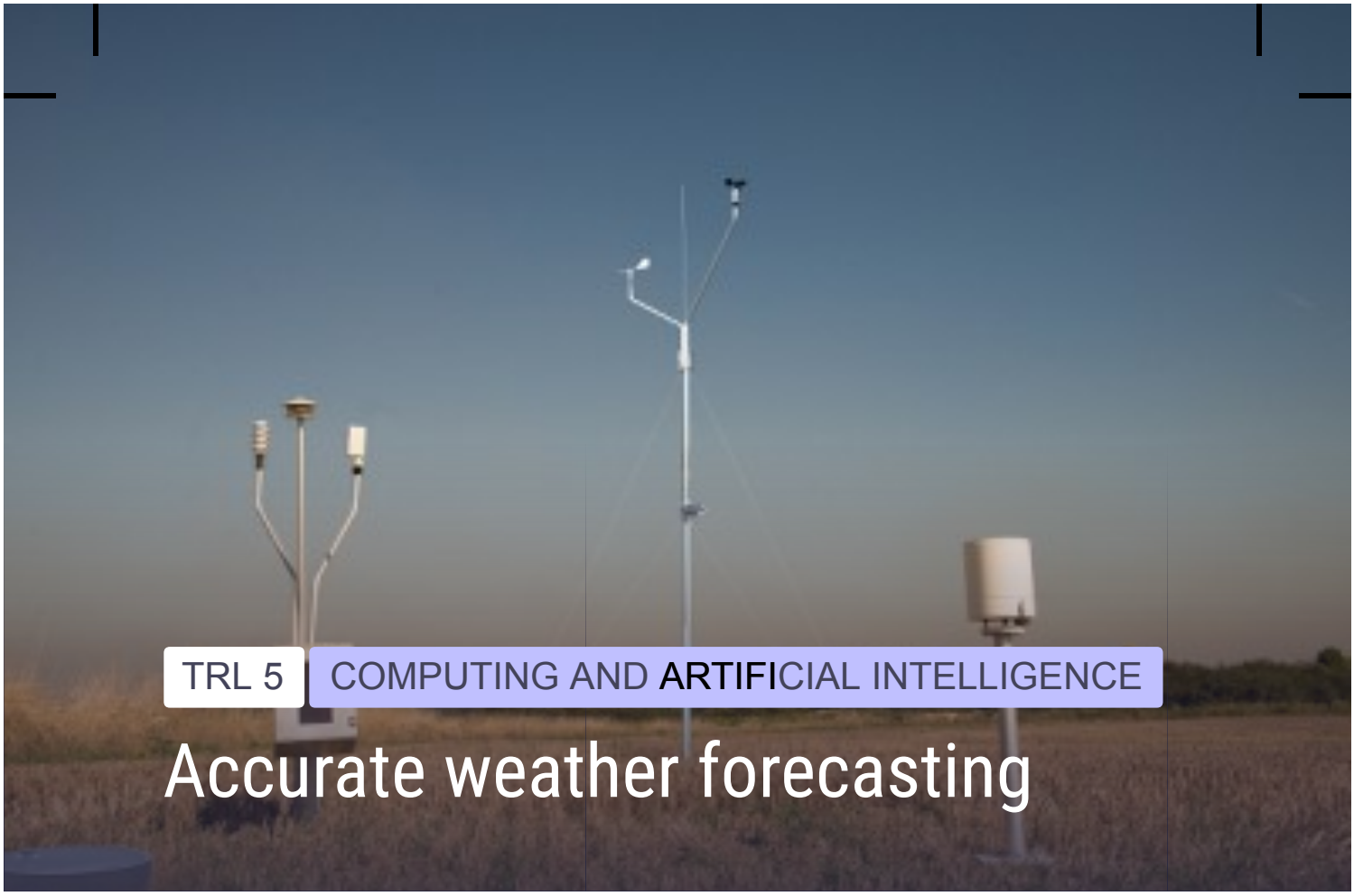
Application of social network modelling and novel cognitive models to estimate human behaviour and intent autonomously



TRL 4 COMPUTING AND ARTIFICIAL INTELLIGENCE

Bioinformatics

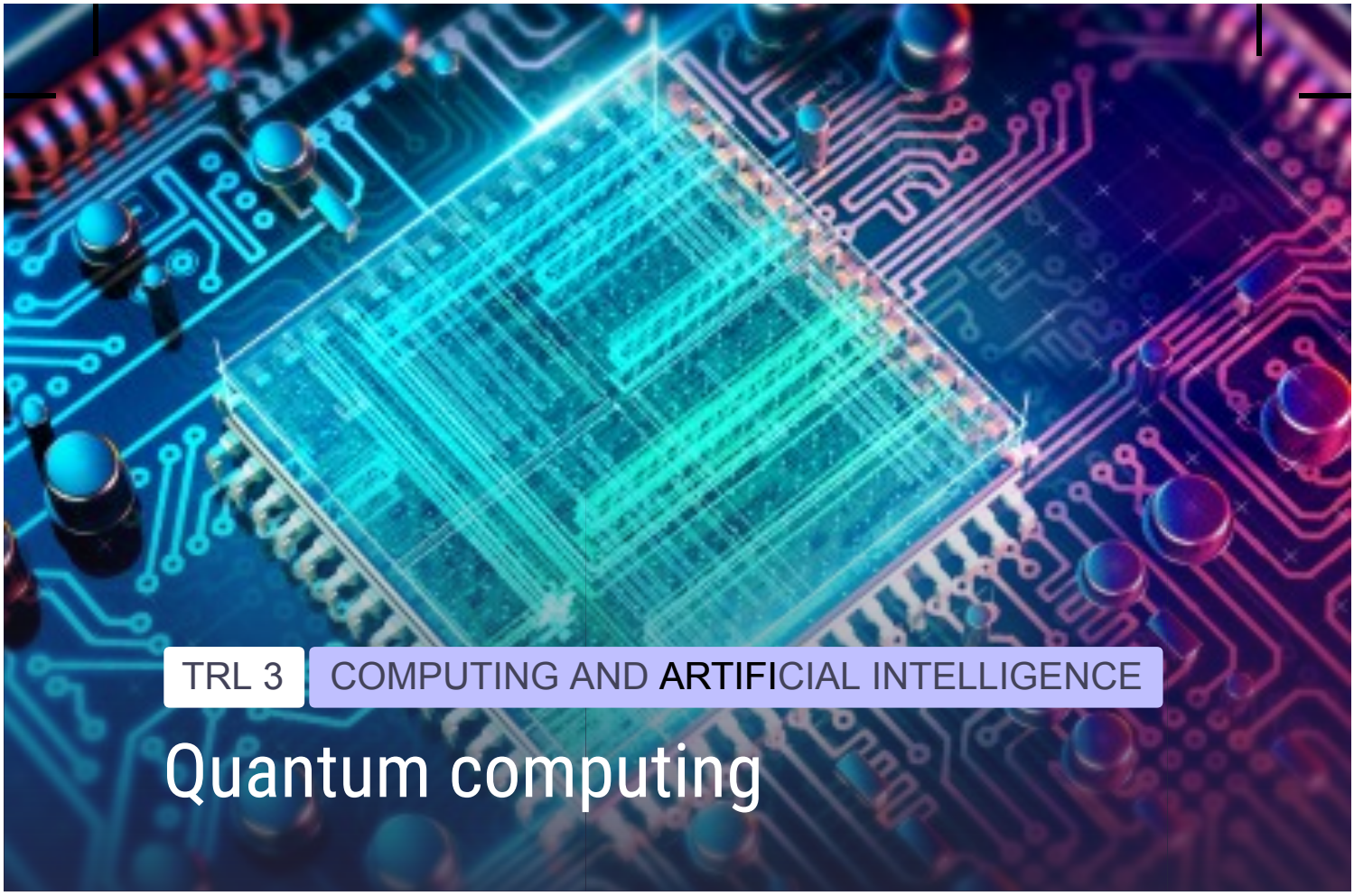
Data gathering and process identification in complex biological environments using a combination of nanosensors, massive analytics and autonomous reasoning.



TRL 5 COMPUTING AND ARTIFICIAL INTELLIGENCE

Accurate weather forecasting

Interdisciplinary interaction between complex atmospheric models, sensor networks and new computing architectures with massive processing power will enable accurate decision-level predictions.



TRL 3 COMPUTING AND ARTIFICIAL INTELLIGENCE

Quantum computing

Will enable massively parallel computations for quantum cryptography, pattern recognition, autonomy and simulations. Quantum informatics, correlated electronics, quantum communication, confined small-scale quantum system and artificial photonic crystal for future IT development.

TRL 4 COMPUTING AND ARTIFICIAL INTELLIGENCE

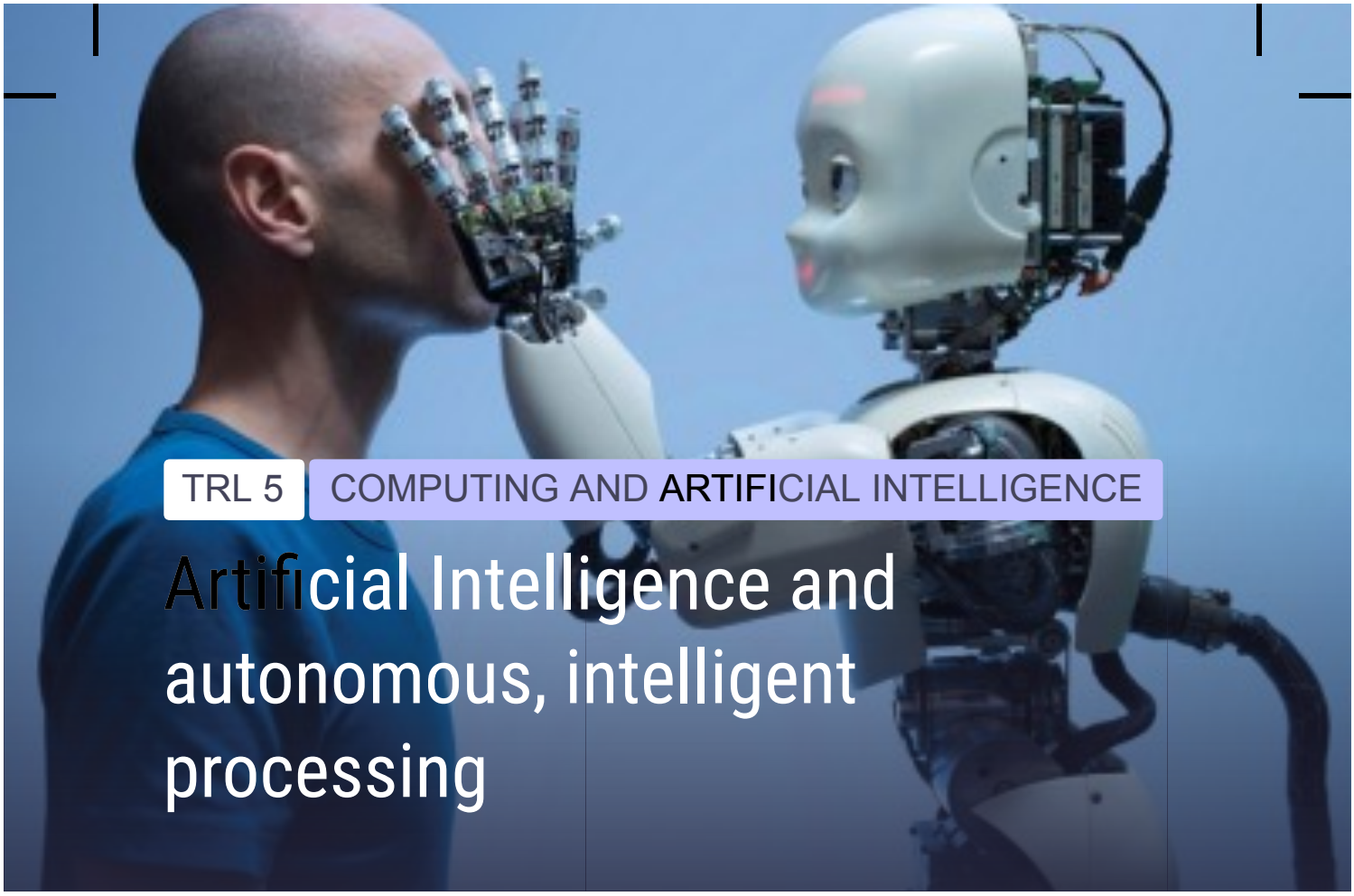
DNA computing

Biochemical nanocomputers based on biochemical interactions of protein chains. Will provide very large improvements in computational power and will be self sustaining and have the potential for self-repair. Could be integrated with biological organisms for direct interactions with cellular chemistry and autonomous biological regulation.

TRL 4 COMPUTING AND ARTIFICIAL INTELLIGENCE

Ad-hoc networks

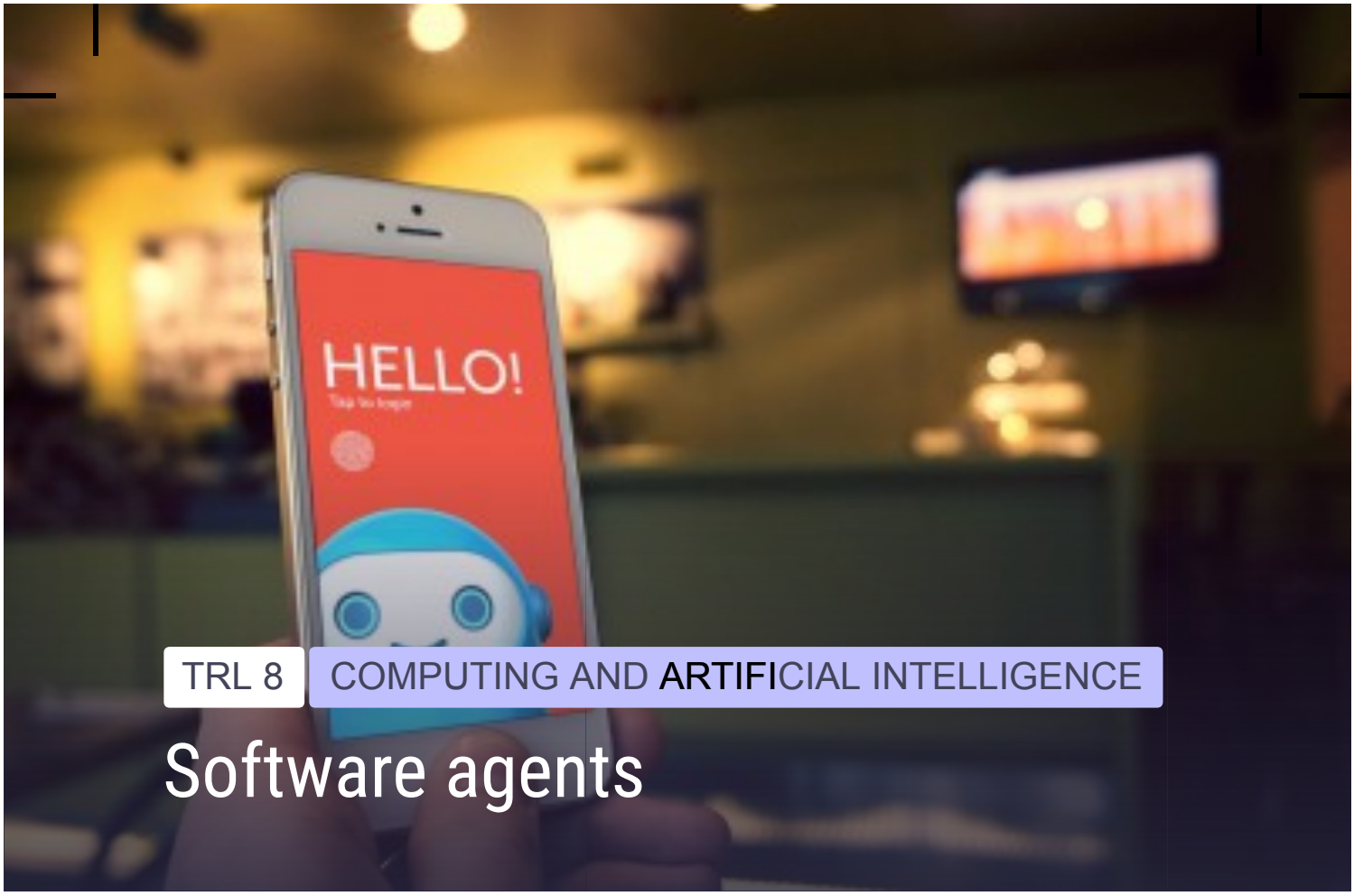
High-flexibility, attack free [sic] data networks and ad hoc intelligent system. Network polymorphism.



TRL 5 COMPUTING AND ARTIFICIAL INTELLIGENCE

Artificial Intelligence and autonomous, intelligent processing

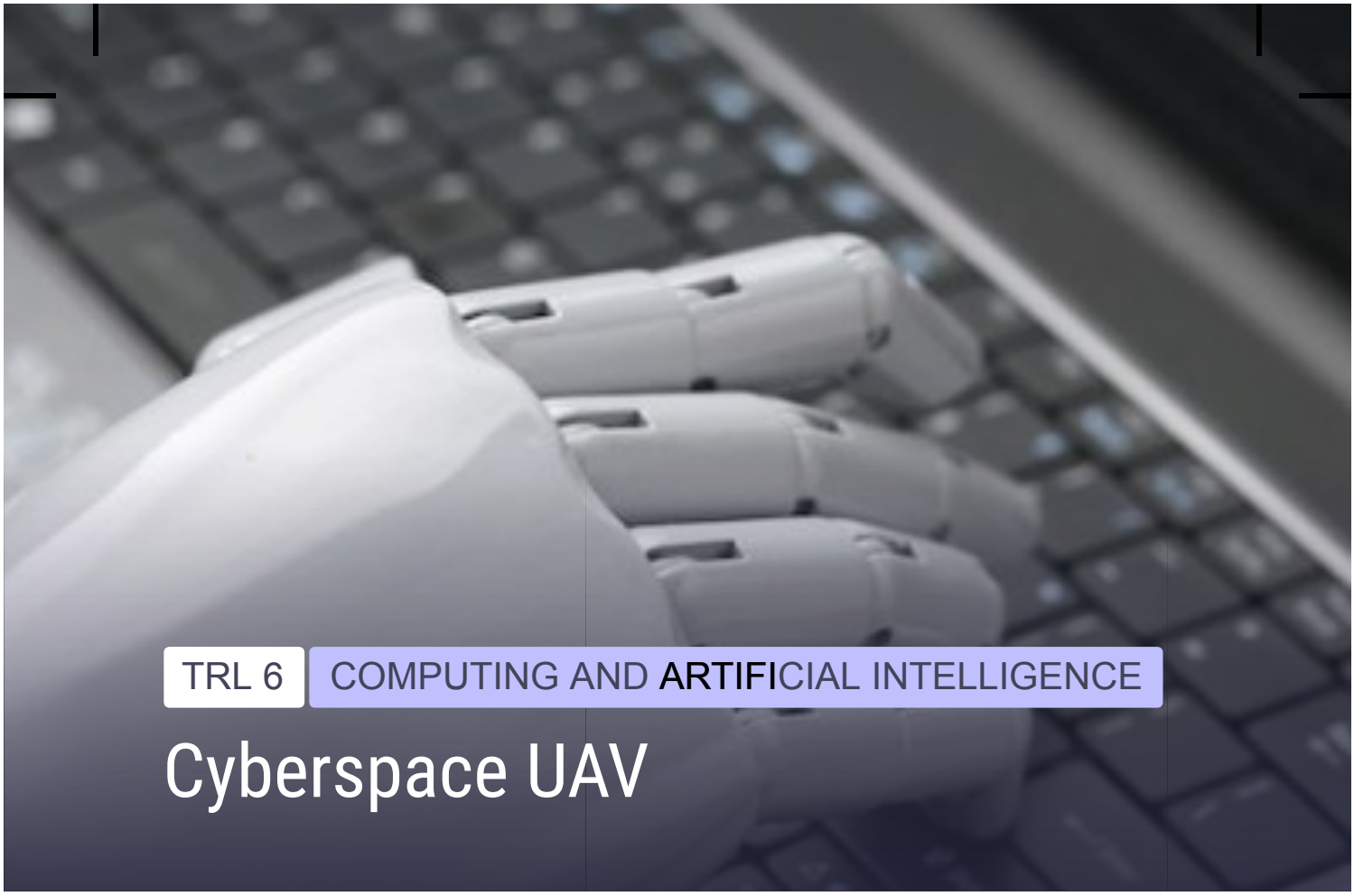
Gearing human intensive functions through processing-enabled devices. Robotic decision making based around autonomous reasoning and learning. Use of distributed sensing to be aware of environments. Trusted autonomy that can be validated.



TRL 8 COMPUTING AND ARTIFICIAL INTELLIGENCE

Software agents

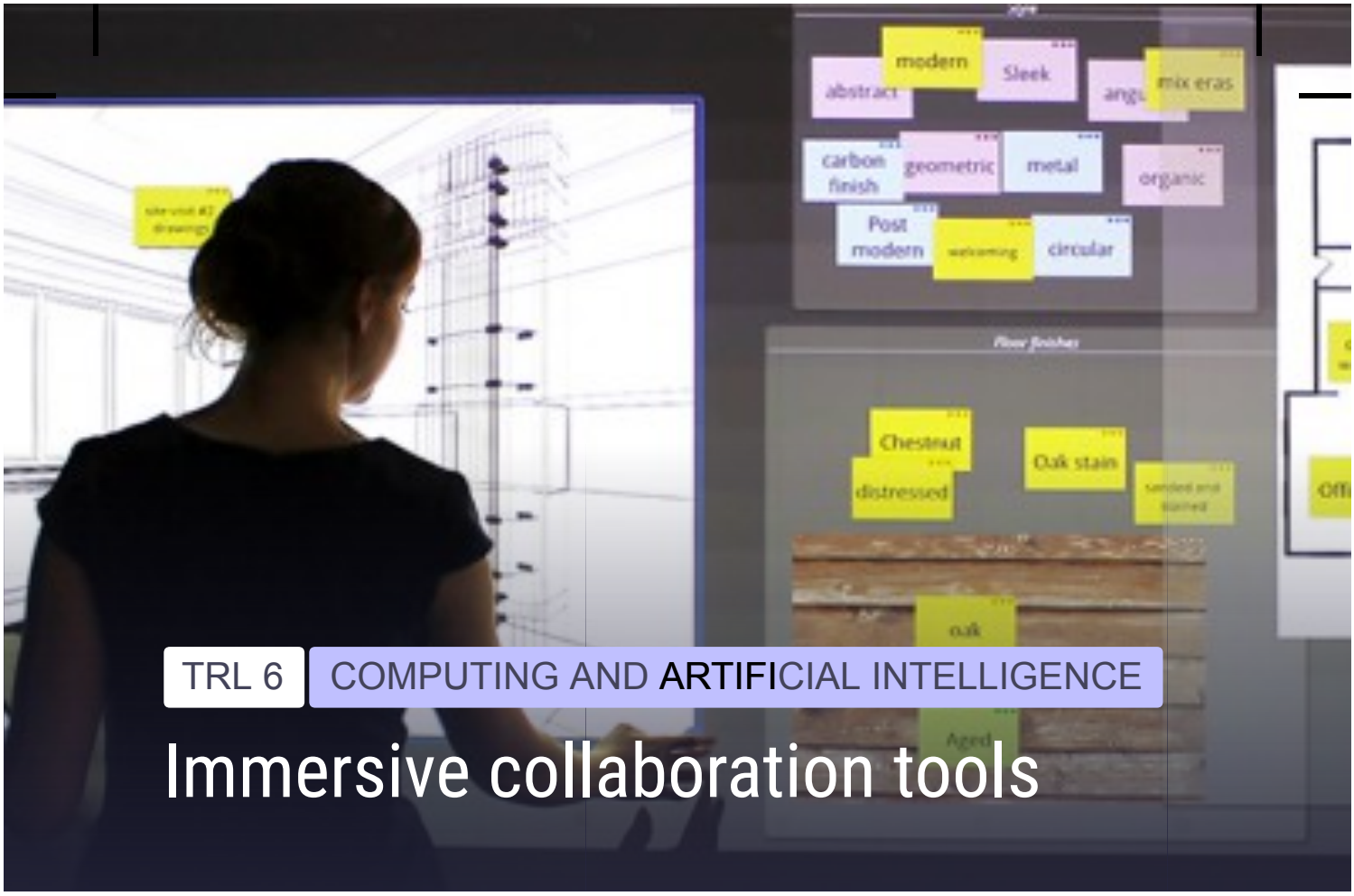
Self organising and evolving software. Intelligent agents and bots. Automated software generation based on signal data recognition and autonomous learning within complex environments.



TRL 6 COMPUTING AND ARTIFICIAL INTELLIGENCE

Cyberspace UAV

Software agent that is adaptive and flexible while under cyber threats. Monitors and conducts ISR on the cyber environment. Repairs friendly nodes affected by malicious cyber operations



TRL 6 COMPUTING AND ARTIFICIAL INTELLIGENCE

Immersive collaboration tools

Self-organising networks for information management and flow. Community computing grids for efficient resource allocation and parallel computing. Peer production networks for rapid problem solving. Social mobile computing that supports collaboration and problem-solving in ad-hoc situations.

TRL 8 COMPUTING AND ARTIFICIAL INTELLIGENCE

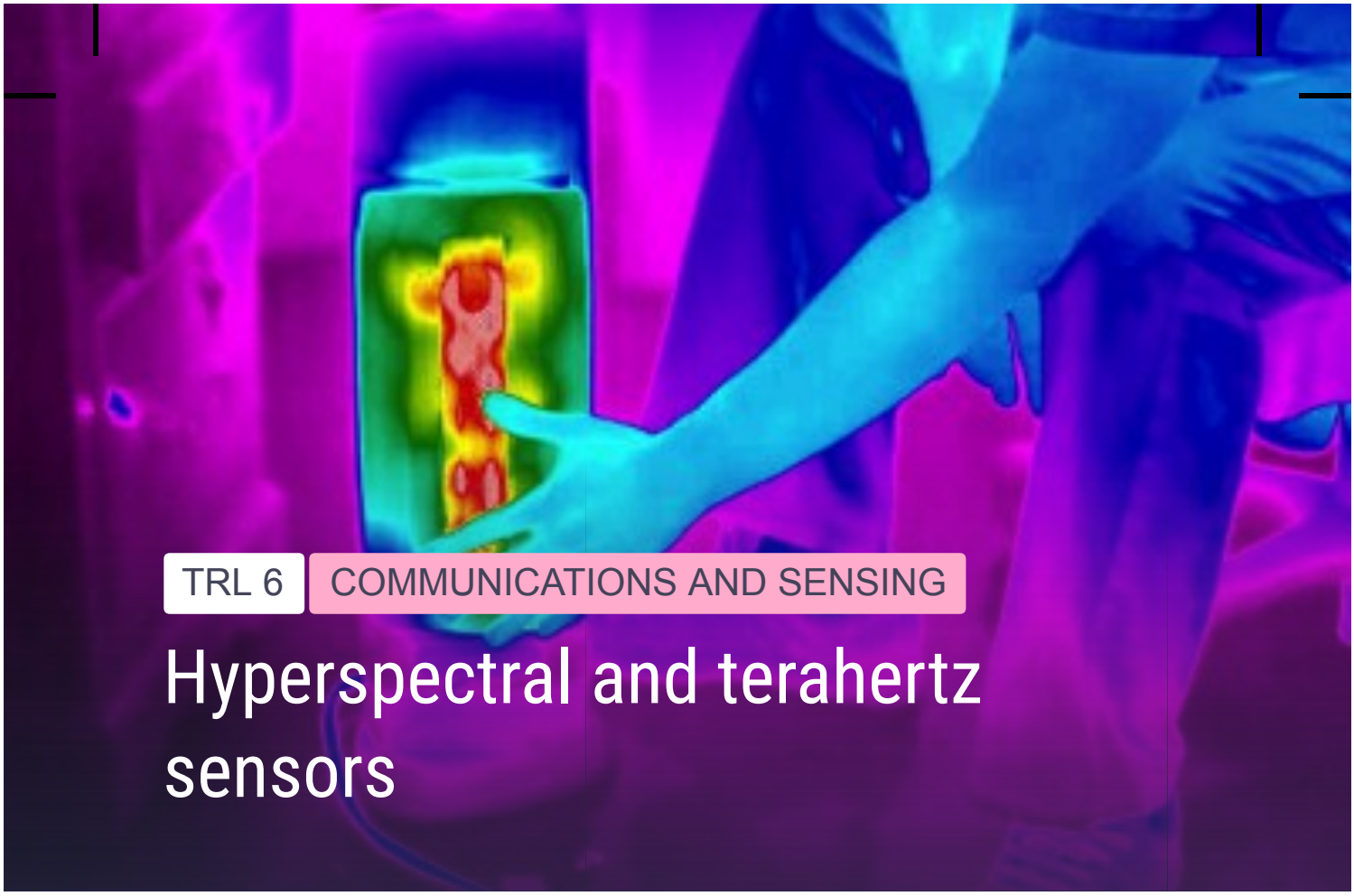
Virtual synthetic environments and adaptive training

Cultural, social and combat training. Virtual surgery. Quantitative simulations of social interactions. Data mining of social interactions such as online social networks or MMOG to quantify relationships and establish predictive models. Continuous, adaptive training.

TRL 5 COMMUNICATIONS AND SENSING

Pervasive, undetectable sensor networks

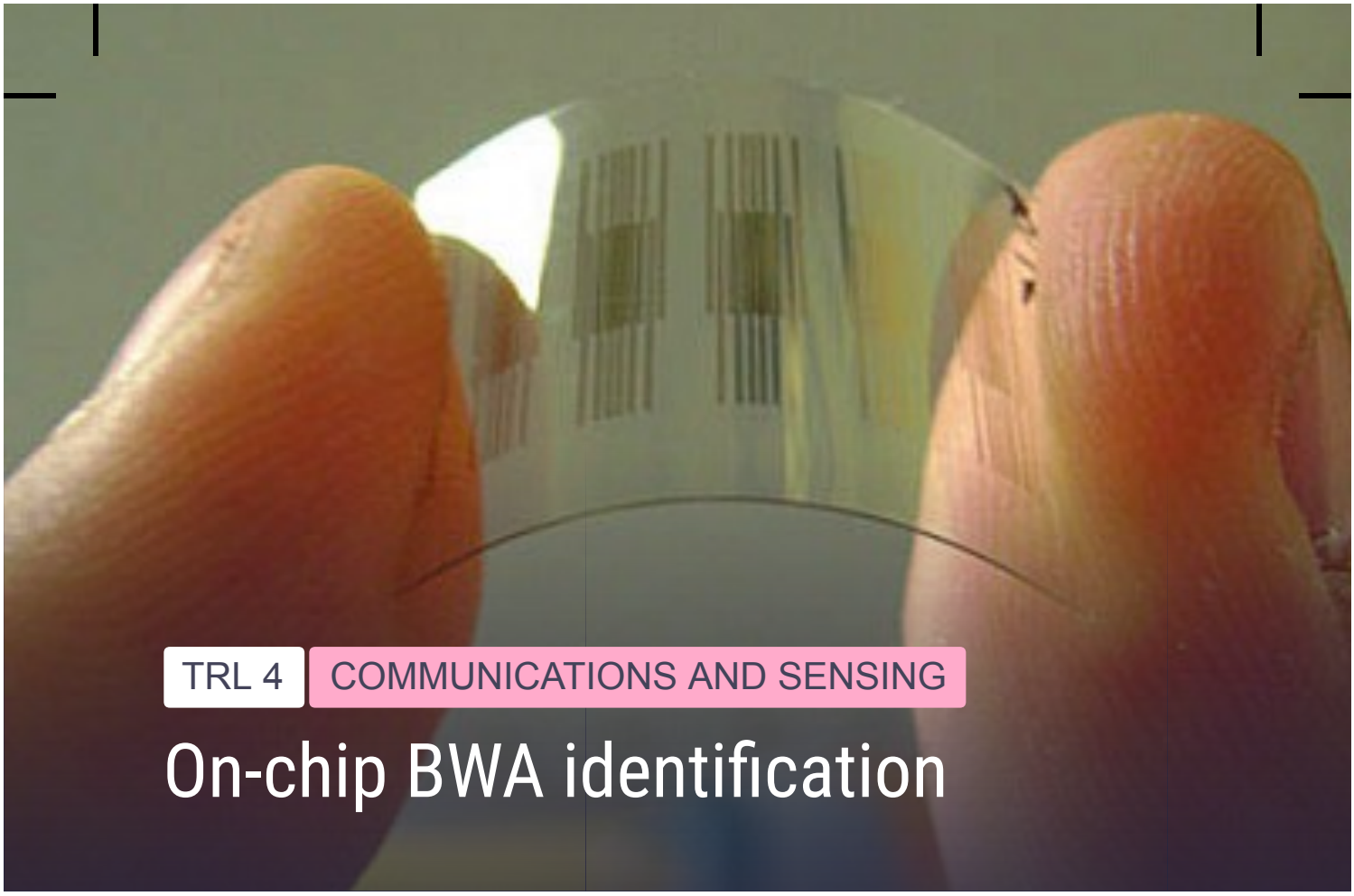
Real-time data mining and health monitoring using NEMS or MEMS based sensors. Embedded combat ID. Smart-dust sensors that are completely undetectable and persistent.



TRL 6 COMMUNICATIONS AND SENSING

Hyperspectral and terahertz sensors

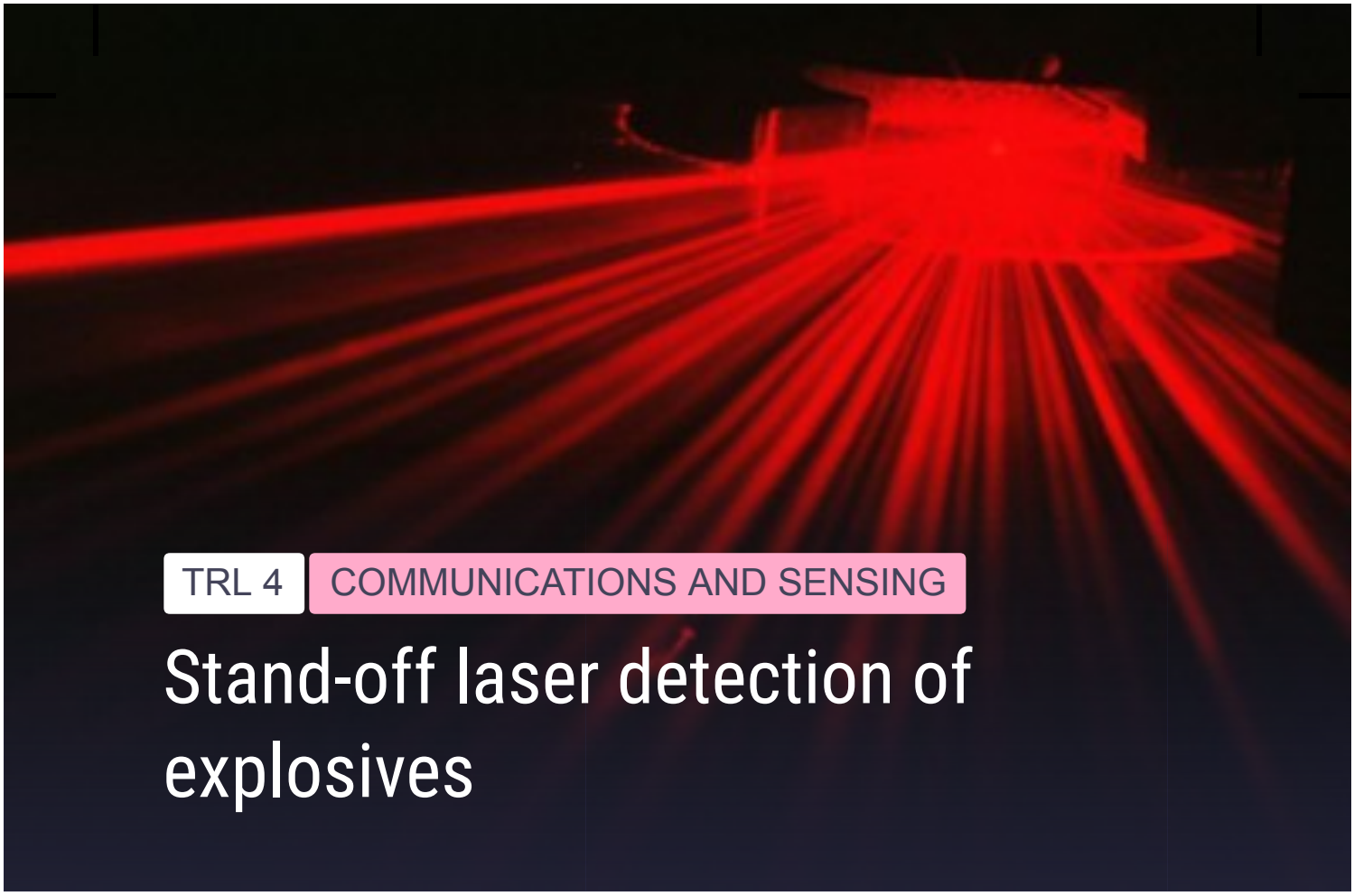
Stand-off detection of substances such as explosives and chemical agents. Improved imaging systems for vision through surfaces such as water, walls and vehicles. Multispectral sensor swarms.



TRL 4 COMMUNICATIONS AND SENSING

On-chip BWA identification

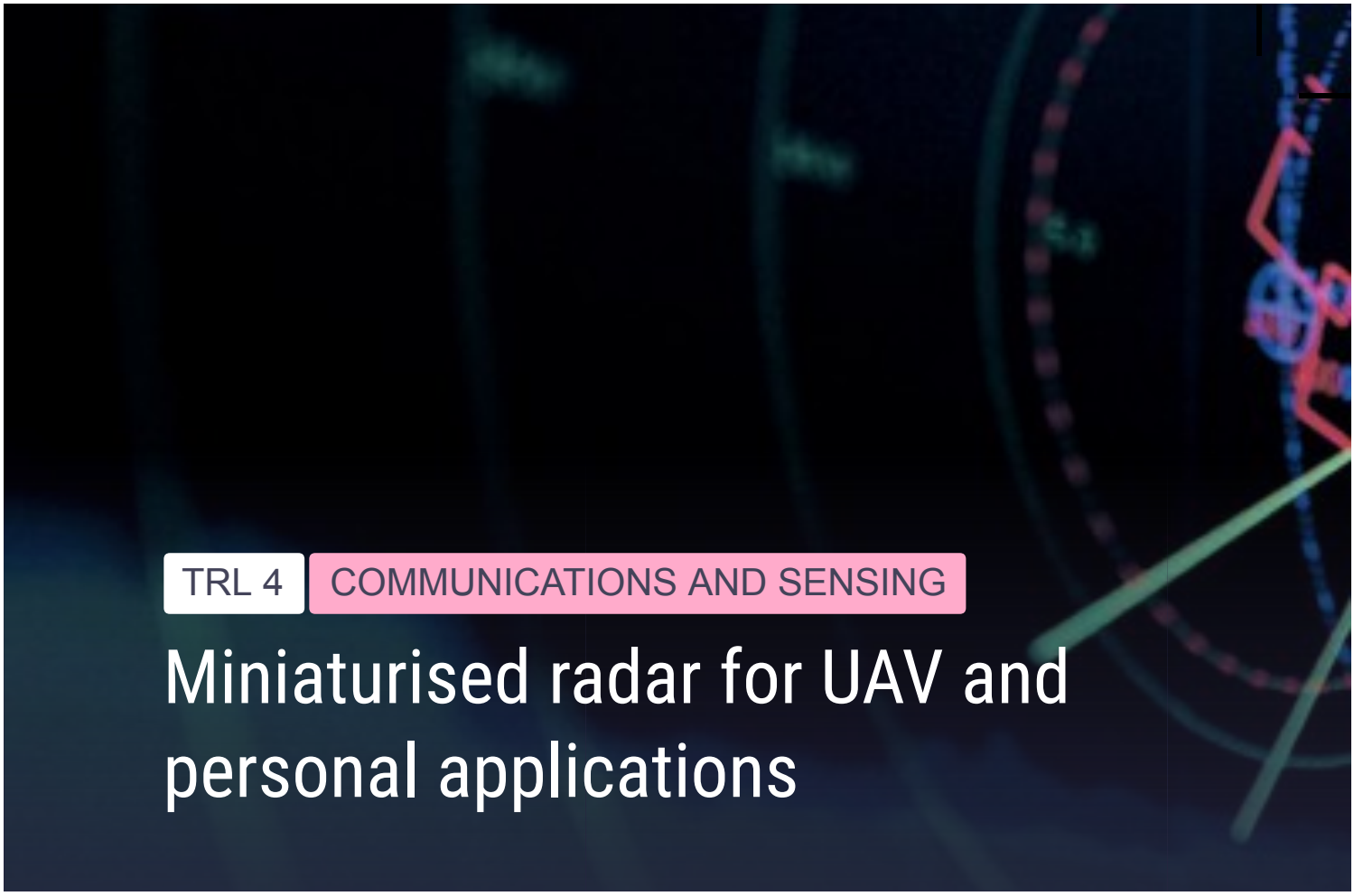
Immediate recognition of toxic biological agents using nanosensors or DNA sensing techniques.



TRL 4 COMMUNICATIONS AND SENSING

Stand-off laser detection of explosives

Ranged detection using a plasma pulse to evaporate small amounts of substance. Line of sight effects only.



TRL 4 COMMUNICATIONS AND SENSING

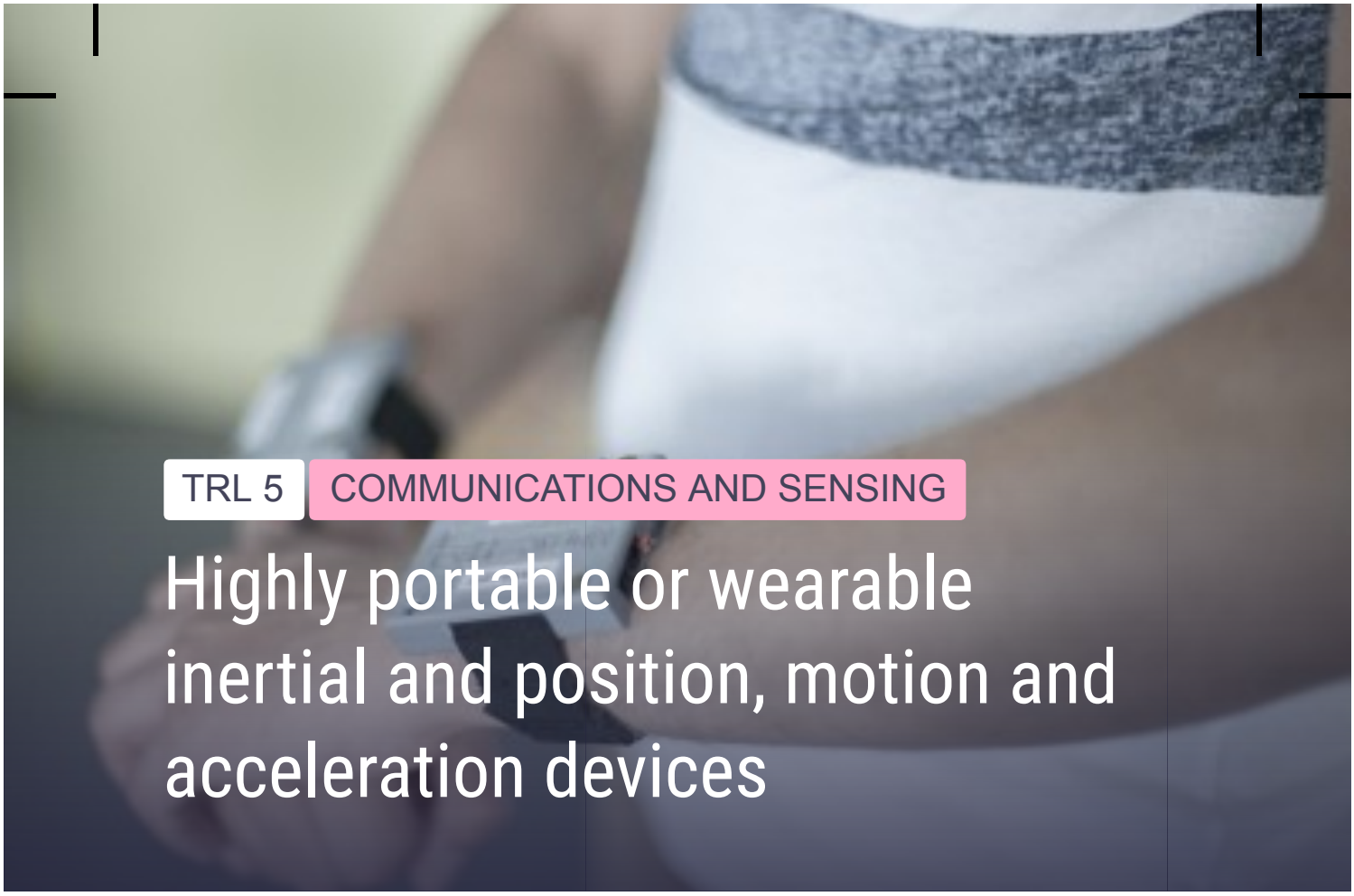
Miniaturised radar for UAV and personal applications

Use of NEMS/MEMS and high density energy storage to create a light-weight, portable radar system.

TRL 5 COMMUNICATIONS AND SENSING

Autonomous and self organising sensor networks

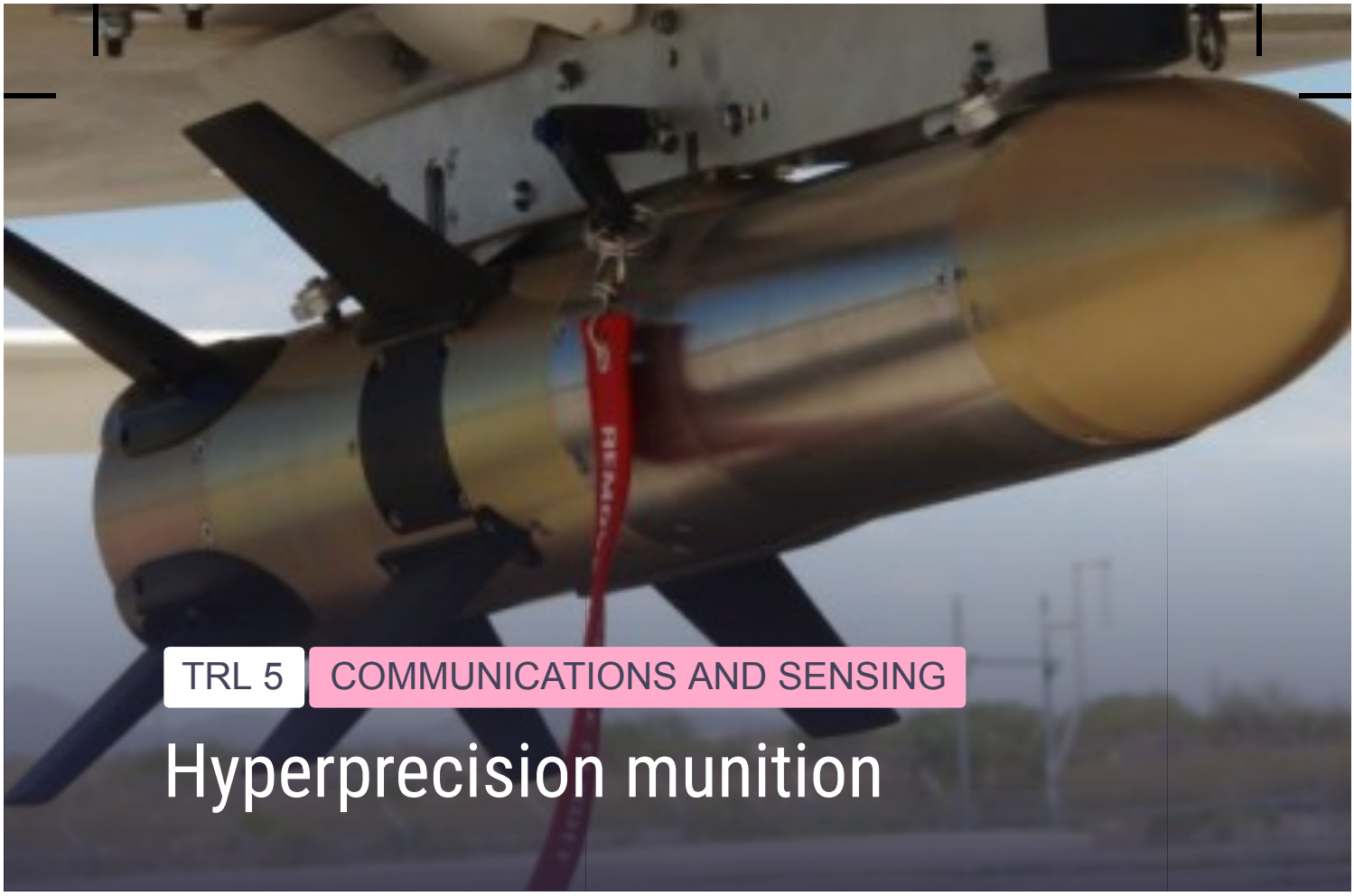
Processing enabled sensors that autonomously track their environment and can optimise placement for maximum data collection and interpretation.



TRL 5 COMMUNICATIONS AND SENSING

Highly portable or wearable inertial and position, motion and acceleration devices

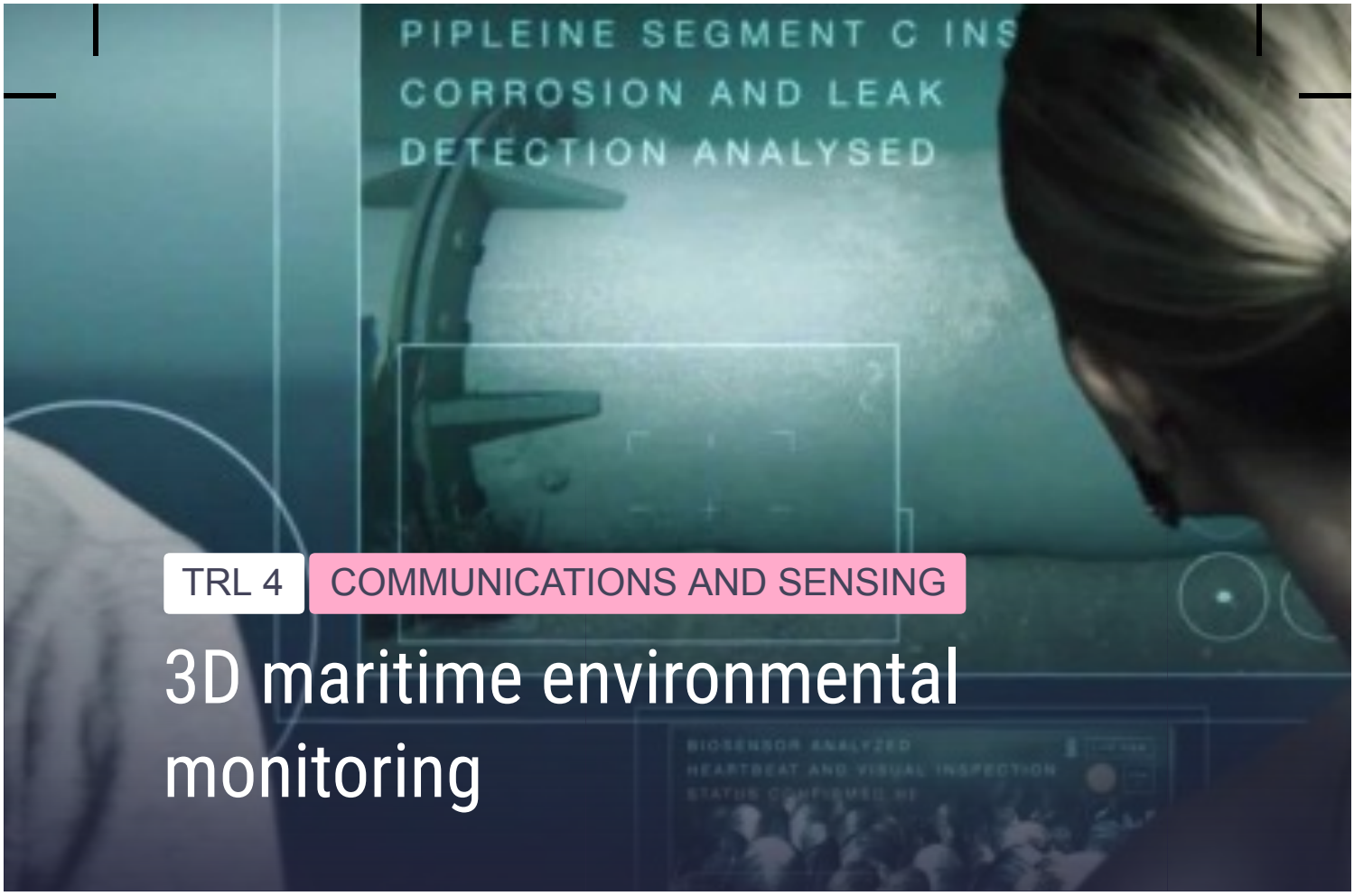
Chip-scale (micro and nano) atomic clocks for accurate timing in GPS-denied environments. Cold atom interferometric devices for acceleration measurements Highly portable or wearable inertial and position, motion and acceleration devices



TRL 5 COMMUNICATIONS AND SENSING

Hyperprecision munition

Use of autonomous munitions and networked sensors to provide real-time accurate ISR.



TRL 4 COMMUNICATIONS AND SENSING

3D maritime environmental monitoring

Synchronised monitoring from space, offshore stations, water surface, and inwater. Research will be focused on remote marine sensing technology, acoustic probe technology, buoy technology, shore-based long-range radar technology, and marine information processing and application technology.

TRL 4 COMMUNICATIONS AND SENSING

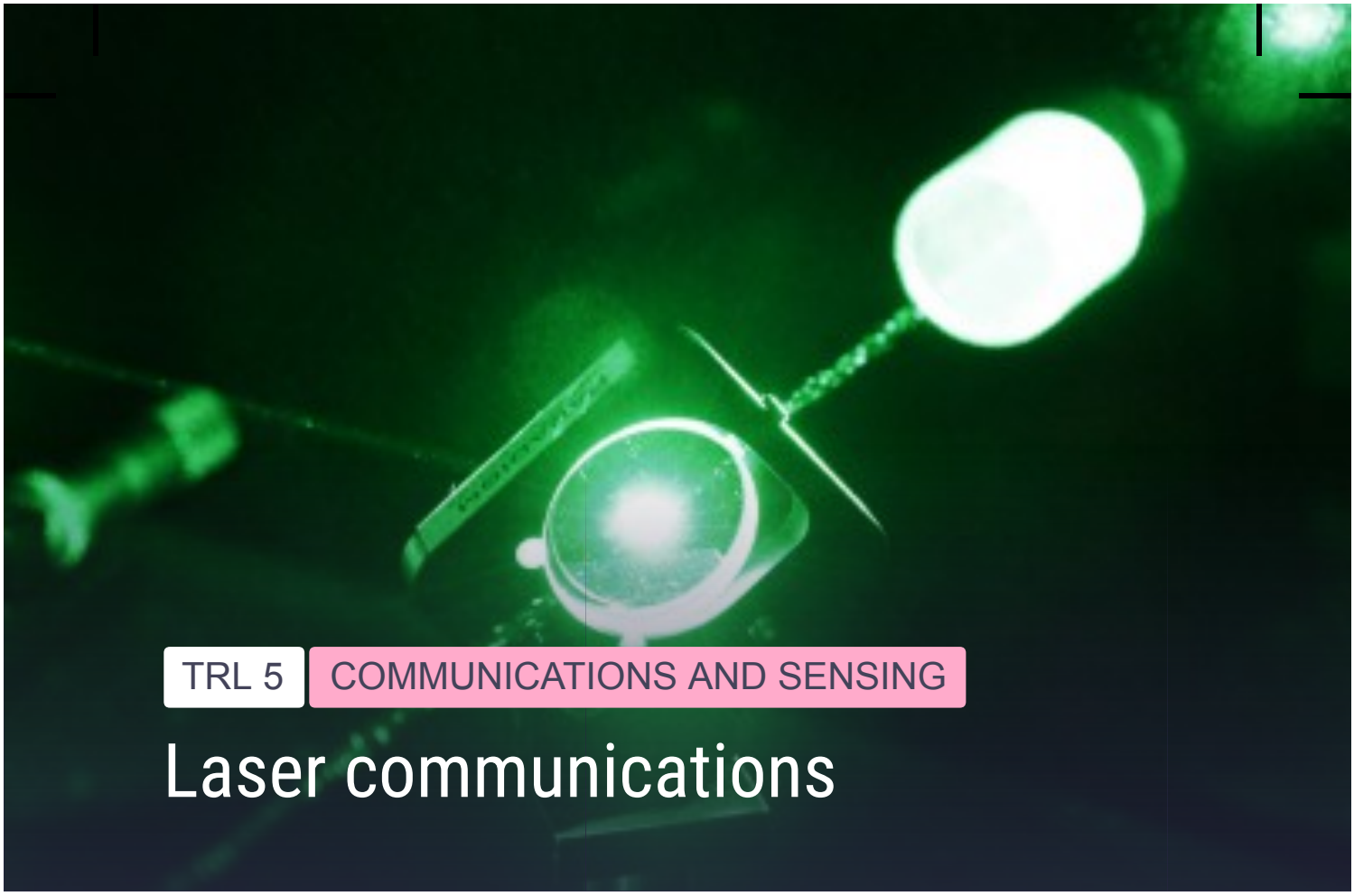
Deep sea sensing

Ocean floor-based multi-parameter fast sounding technology, gas hydrates mining, deep-sea sample collection and communications.

TRL 4 COMMUNICATIONS AND SENSING

Secure wireless links

Development of highly secure wireless, RF data links and encryption protocols for cloud computing applications and ubiquitous equipment-sensor links. Protocols will utilise polymorphic networks and may be highly frequency-agile and adaptive in order to be as resilient to cyber attacks as possible. Automated vulnerability assessments and reactions will allow such systems to maintain operational efficiency under ongoing cyber...



TRL 5 COMMUNICATIONS AND SENSING

Laser communications

Application of quantum key distribution to encrypt high bandwidth laser communications and provide full-spectrum access to communication channels in congested environments.

TRL 6 COMMUNICATIONS AND SENSING

Persistent near-space communication relays

HALE airships with advanced thermal and meta-materials. Self monitoring and autonomy will further ensure survivability.

TRL 4 ENERGY

Short-range laser defence

Destruction of air threats using MW-class, precision laser weapon. It can sense and track multiple targets and instantaneously engage it.

TRL 2 ENERGY

Femtolaser

Self focusing, high power laser

TRL 3 ENERGY

Space-based lasers

Two concepts: ground based laser with mirrored space relays or a space-based solid-state laser.

TRL 4 ENERGY

Future airborne laser

Aircraft mounted nuclear-powered laser on board a manned platform with extremely long endurance (crew-limited).

TRL 4 ENERGY

Tactical airborne laser

Use of solid-state and fibre laser systems to provide 300kW power and autonomous self defence against missile or aircraft threats. Possible tactical strike use.

TRL 6 ENERGY

Microwave and RF DEW

Delivery of electronic attack using directed energy to disrupt electronic components and personnel. Microwave beams will cause painful sensations with no lasting damage. RF attacks will damage electronics.

TRL 4 ENERGY

High-density/high-efficiency energy storage technology

Hydrogen fuel cell development and use of CNT structures to ensure safe hydrogen capture and storage. Synthetic development of specialised high energy materials. Large scale applications of super-capacitors. Efficient rechargeable cell materials and supercapacitors.

TRL 4 ENERGY

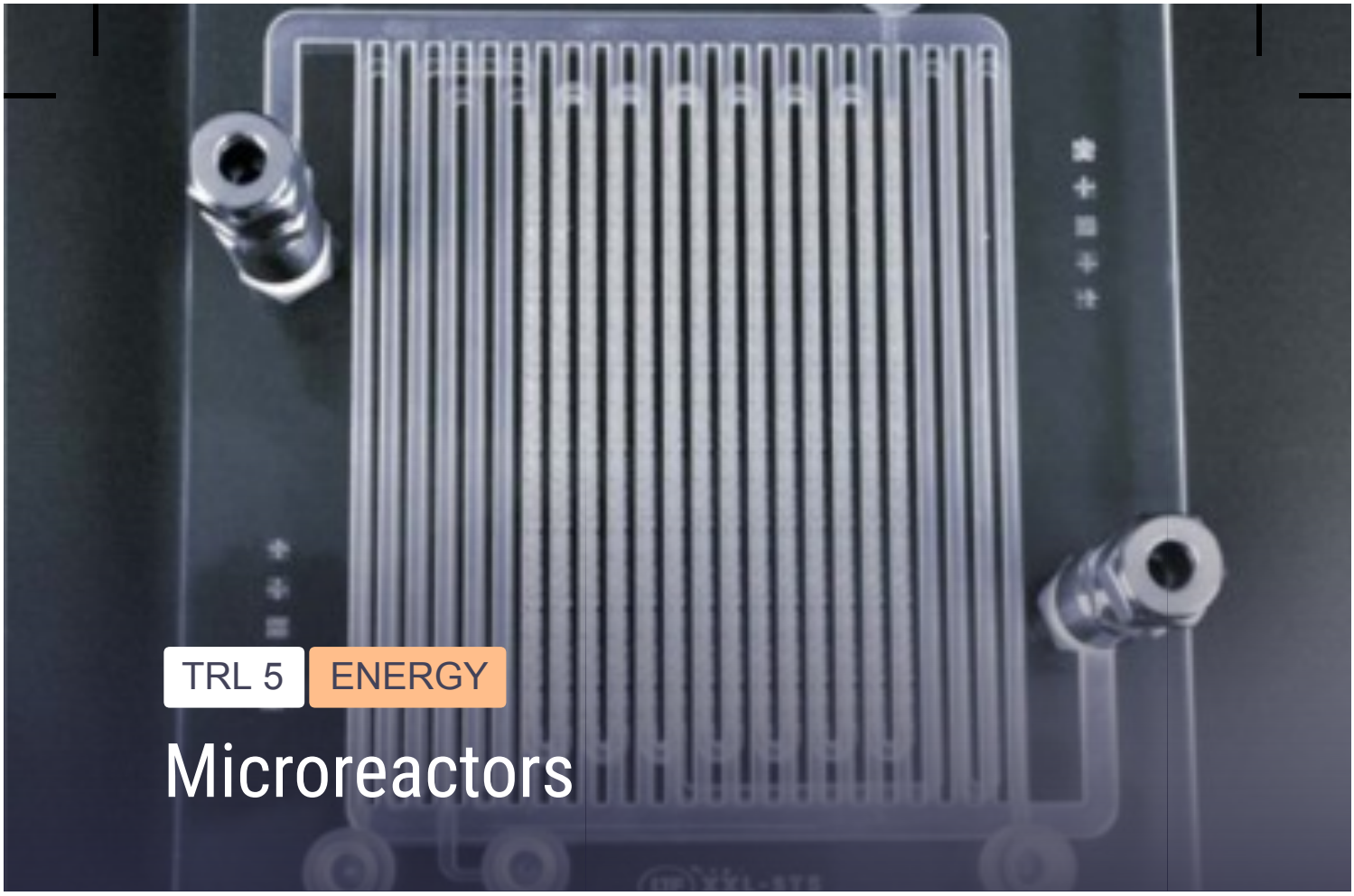
Controlled fusion power

New confinement, simulation and material could produce an operational reactor by 2030 and commercialisation no earlier than 2040. Research into large superconducting magnets, microwave heating, beam injection heating, materials, high-temperature plasma physics and non-Tokamak approaches to fusion

TRL 5 ENERGY

Biofuels and synfuels

Production of fuels from biomass generated in shallow sea/desert conditions. Produces petrochemical feedstock in a closed CO2 cycle (carbon neutral). Replacement of petrochemical sources with synthetic alternatives that are mass produced and not oil-dependant. Use of tactical biorefineries to convert waste and garbage into energy.



TRL 5 ENERGY

Microreactors

Nanoengineered molecular reactors harnessing biochemical reactions inside living organisms or as part of a synthetic bio-machine. Very efficient, invisible and portable.

TRL 3 ENERGY

Next-generation nuclear reactors

Fourth generation nuclear energy systems with increased efficiency. Fast neutron reactor technology (breeder).

TRL 4 VEHICLES

Hypersonic air-breathing engines

Propulsion technology and materials that can withstand the extreme temperatures of hypersonic flight will take another 20 years to develop. Automatic diagnostic and prognostic systems will allow reusable combined rocket/scramjet platforms for low cost orbital insertion. Inward turning inlets and dual flow paths will provide high volumetric efficiencies. Hypersonic transatmospheric aircraft to deal with heat issue as above Mach 10.

TRL 4 VEHICLES

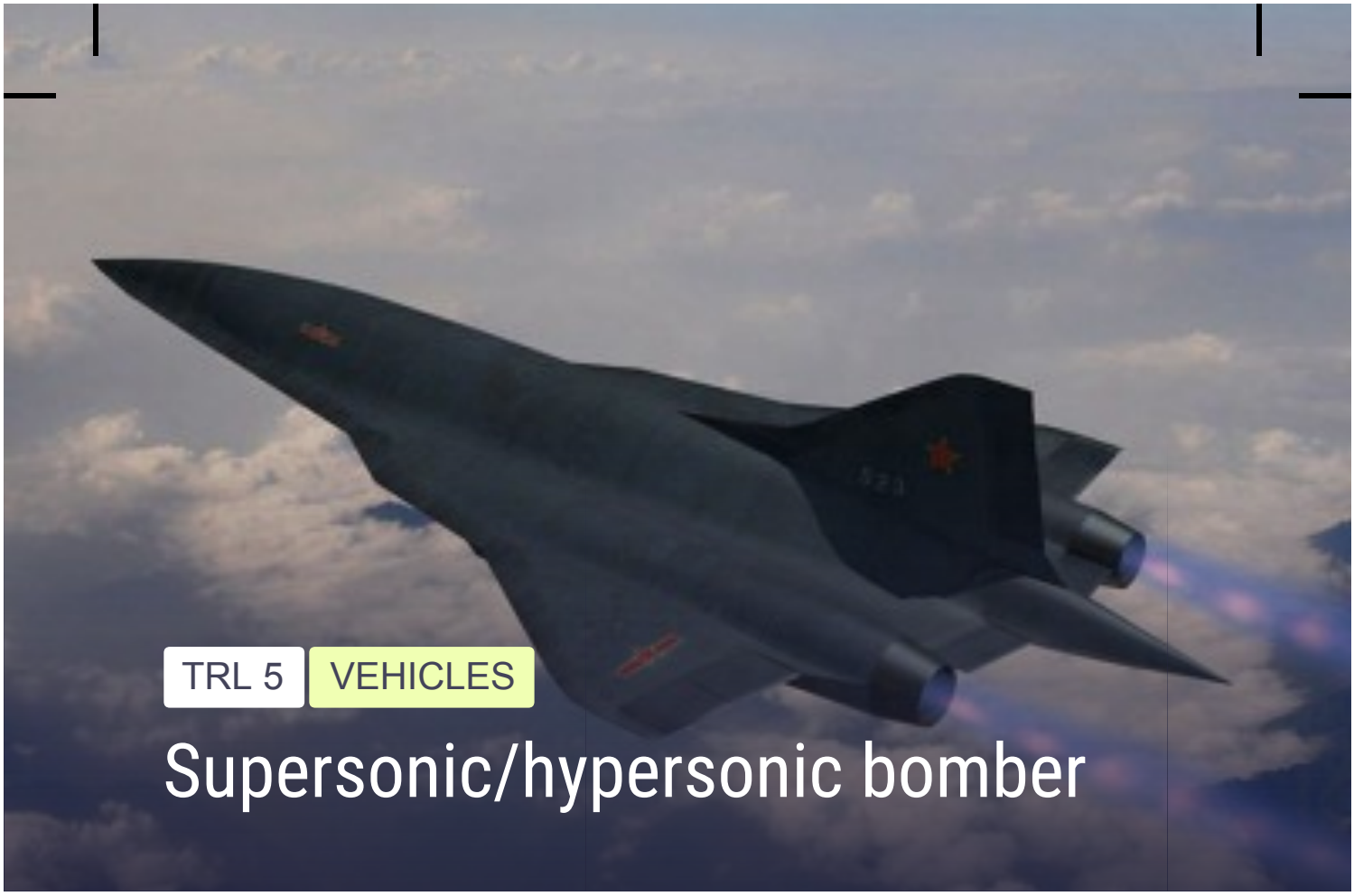
Next generation high-efficiency turbine engines

Alternate fuels, serpentine nozzles, health monitoring, MEMS flow control and nanomaterials will be used to deliver efficient embedded turbine engines for future aircraft configurations

TRL 4 VEHICLES

Dual mode propulsion (supersonic/hypersonic)

Dual mode propulsion (supersonic/hypersonic) stand-off missile with optical terrain following, advanced EW and jam-resistant PNT systems.



TRL 5 VEHICLES

Supersonic/hypersonic bomber

Operational readiness of a new bomber platform is not likely until 2037 or beyond. Low observables in a supersonic configuration are the likely future requirements.

TRL 3 VEHICLES

Hypersonic aircraft

Trans-atmospheric vehicle with global radius. Allows rapid, reusable access to space and orbital payload insertion. May have combined-cycle propulsion (rocket/scramjet) with vertical takeoff

TRL 3 VEHICLES

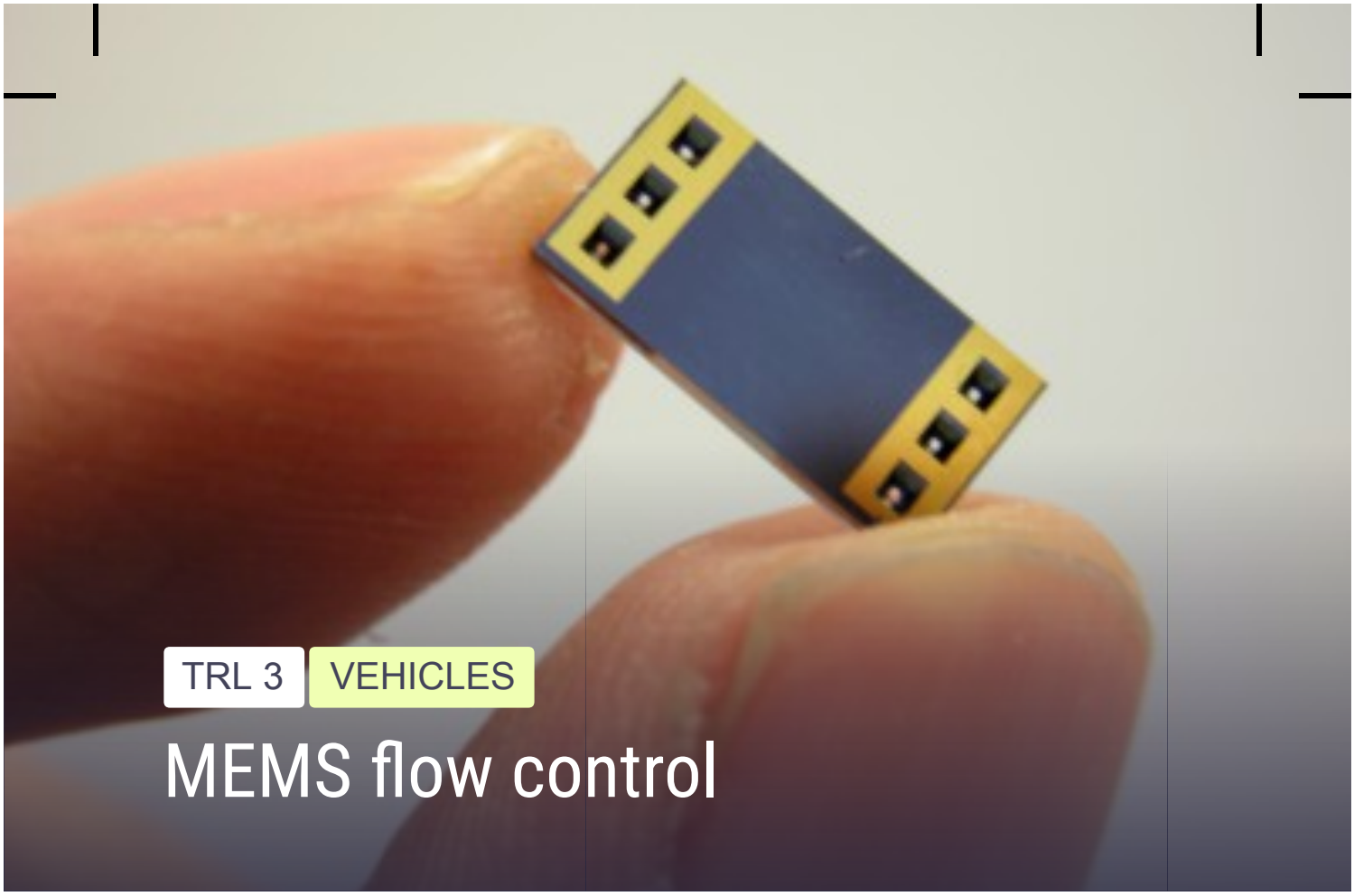
HALE airships

Long endurance, large lift capacity, faster than equivalent seafaring transport options, large sensors. Requires high-altitude, radiation hardened materials. Lightweight solar panels and high density energy storage technologies. Multifunctional sensor structures. Has onboard health monitoring and potential self healing capabilities. Microwave power beaming for propulsion.

TRL 4 VEHICLES

Hybrid wing-body aircraft

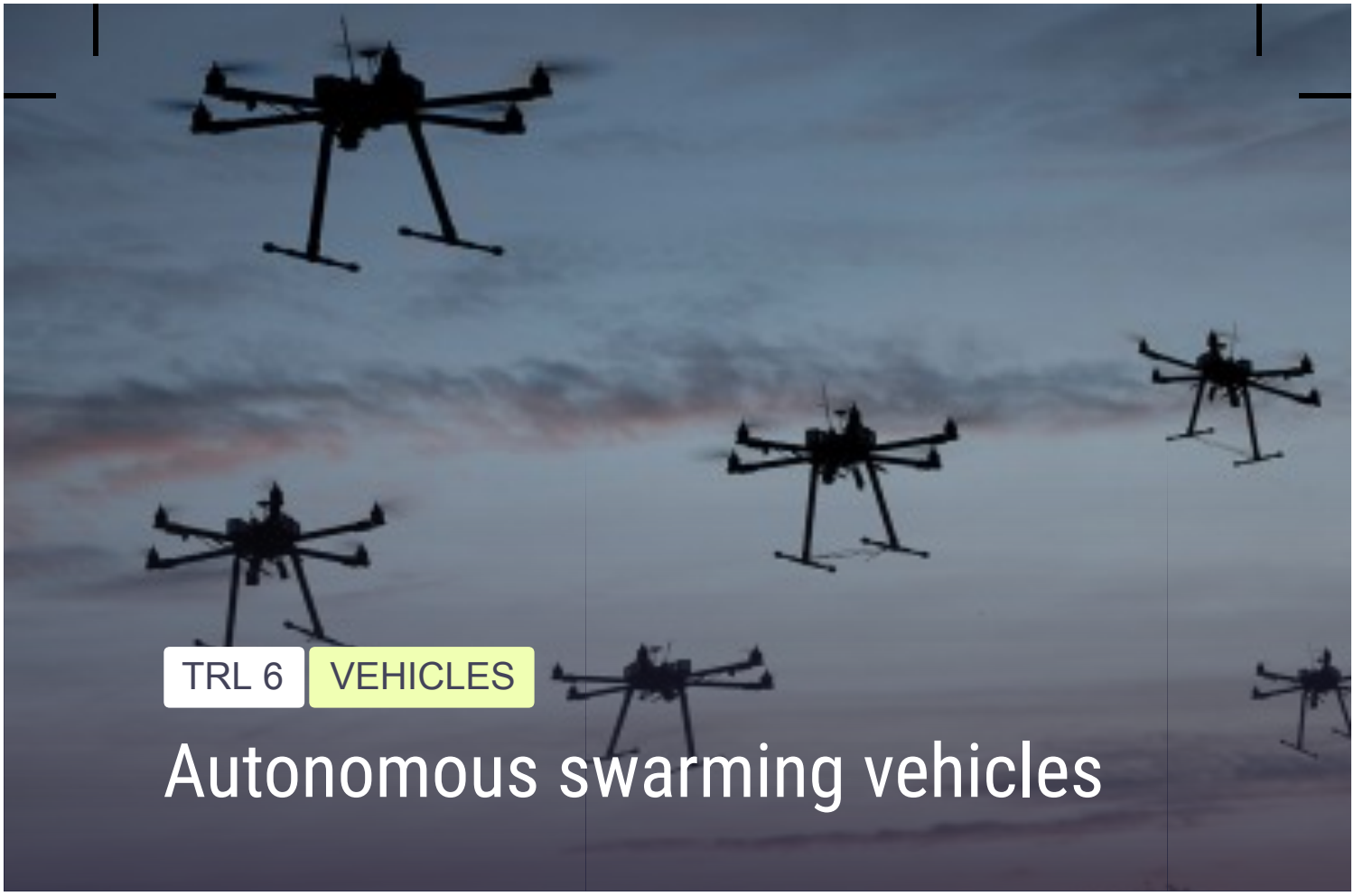
Highly unstable dynamically and requires fully automatic actuation and autonomous control under a variety of environmental conditions.



TRL 3 VEHICLES

MEMS flow control

Micro flow control to eliminate control surfaces and reduce drag by 80%. Application to lifting surfaces and propulsion systems. Observability reduced



TRL 6 VEHICLES

Autonomous swarming vehicles

Miniaturised, autonomous agents with a shared sensory network capable of swarming and re-organising in response to external conditions or operator intent.

TRL 5 VEHICLES

Fractionated, survivable, remotely piloted system

Modular, composable platform that has autonomy in takeoff and landing. Has basic swarming elements for collaborative organisation. Low observable and expendable.

TRL 5 VEHICLES

Wingman UAS

UAS accompanies a manned aircraft to conduct ISR, air interdiction, IADS attacks, offensive counter air, C2 of micro-UAS and provides additional weapons payload to the main aircraft. The wingman UAS can also be a transport or refuelling platform. Has embedded electronic EW (jamming) capability, self repair and diagnosis systems.

TRL 6 VEHICLES

Automated highways and vehicles for increased capacity and safety

Congestion and safety improvements in dense urban infrastructure. Management and autonomous, intelligent coordination of traffic flows both within and without the vehicle. Requires a persistent sensor network for complete traffic monitoring.

TRL 8 | VEHICLES

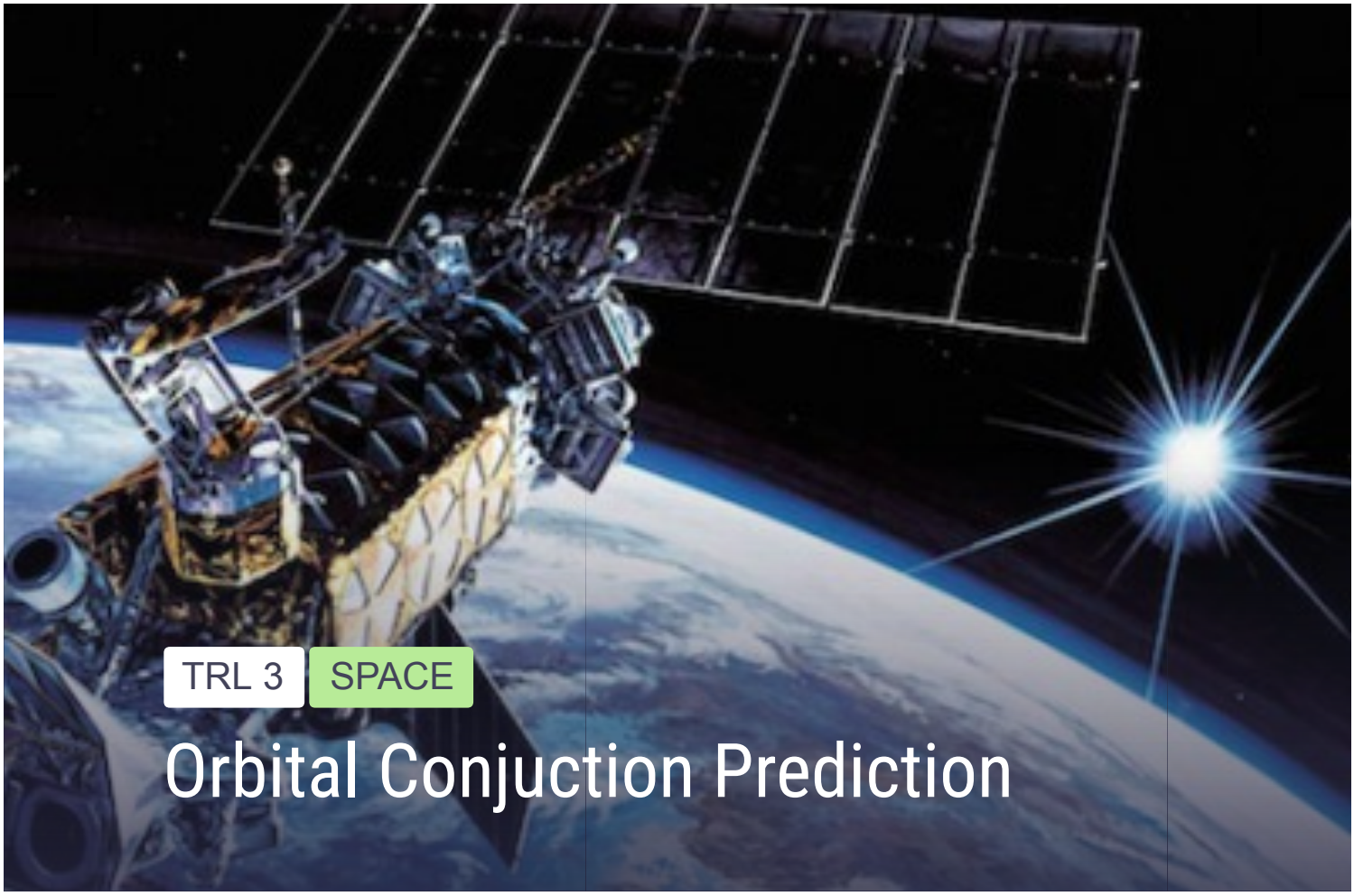
Unmanned space exploration

Unmanned space exploration will continue to far outnumber human space exploration with autonomous and sensor systems advanced as a result.

TRL 2 SPACE

Persistent SSA

Allows birth to death detection, tracking, advanced collision warning. Requires massive data fusion across sensor platforms. Use of a Space Based Surveillance system for detection and tracking including identification of payload using EO/IR sensors.



TRL 3 SPACE

Orbital Conjuction Prediction

Predictions of environmental interactions on spacecraft and their orbits. Monitors space weather, sensors fusion (SSA), satellite drag models. Will provide enough confidence in predictions to manoeuvre space assets out of harms way, if needed.

TRL 3 SPACE

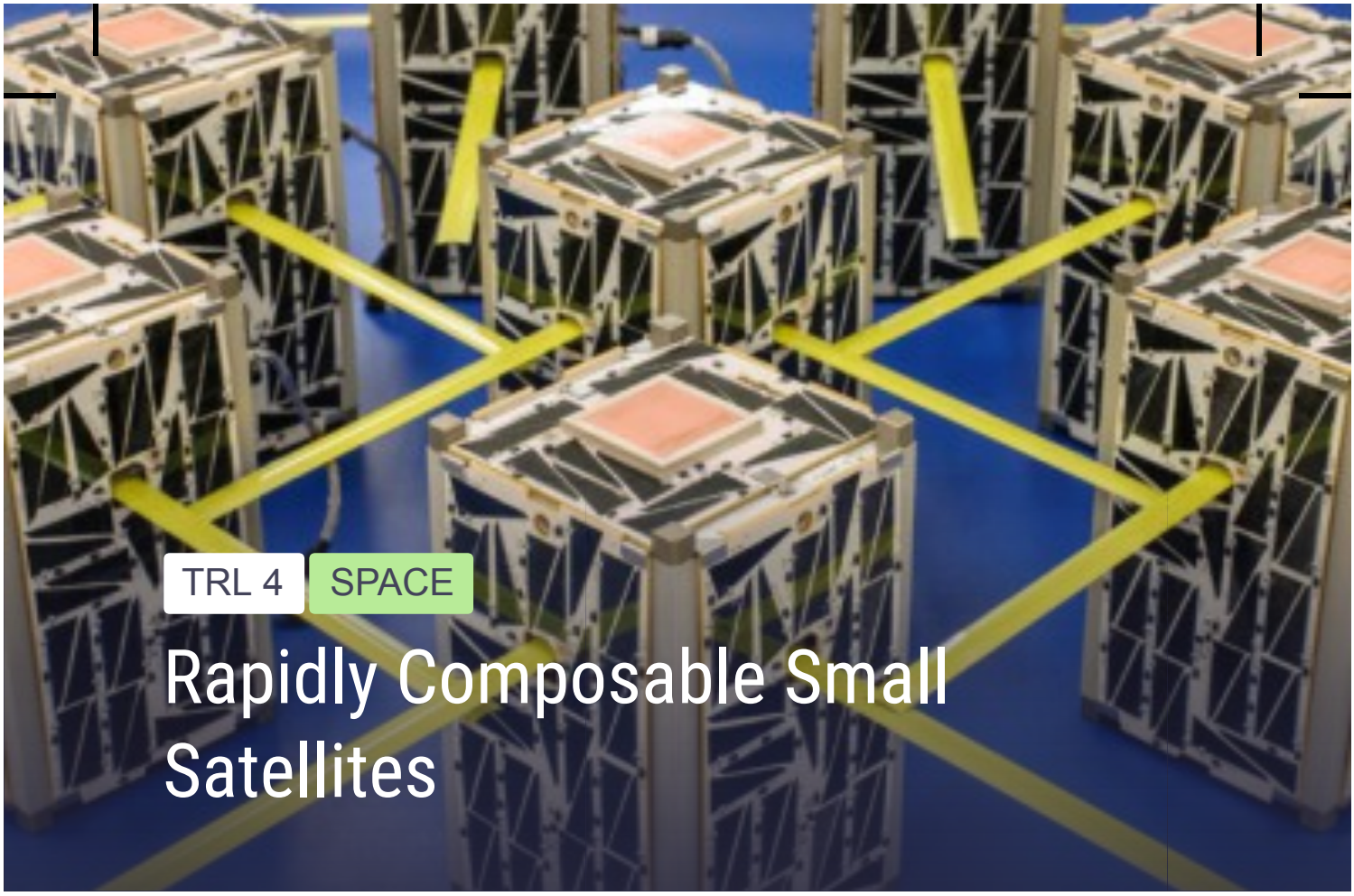
Hypervelocity rod bundles for kinetic bombardmen

Tungsten rods delivered de-orbited from an orbital satellite platform striking global targets at orbital speeds.

TRL 3 SPACE

Reusable Air breathing Access-to-Space Launch

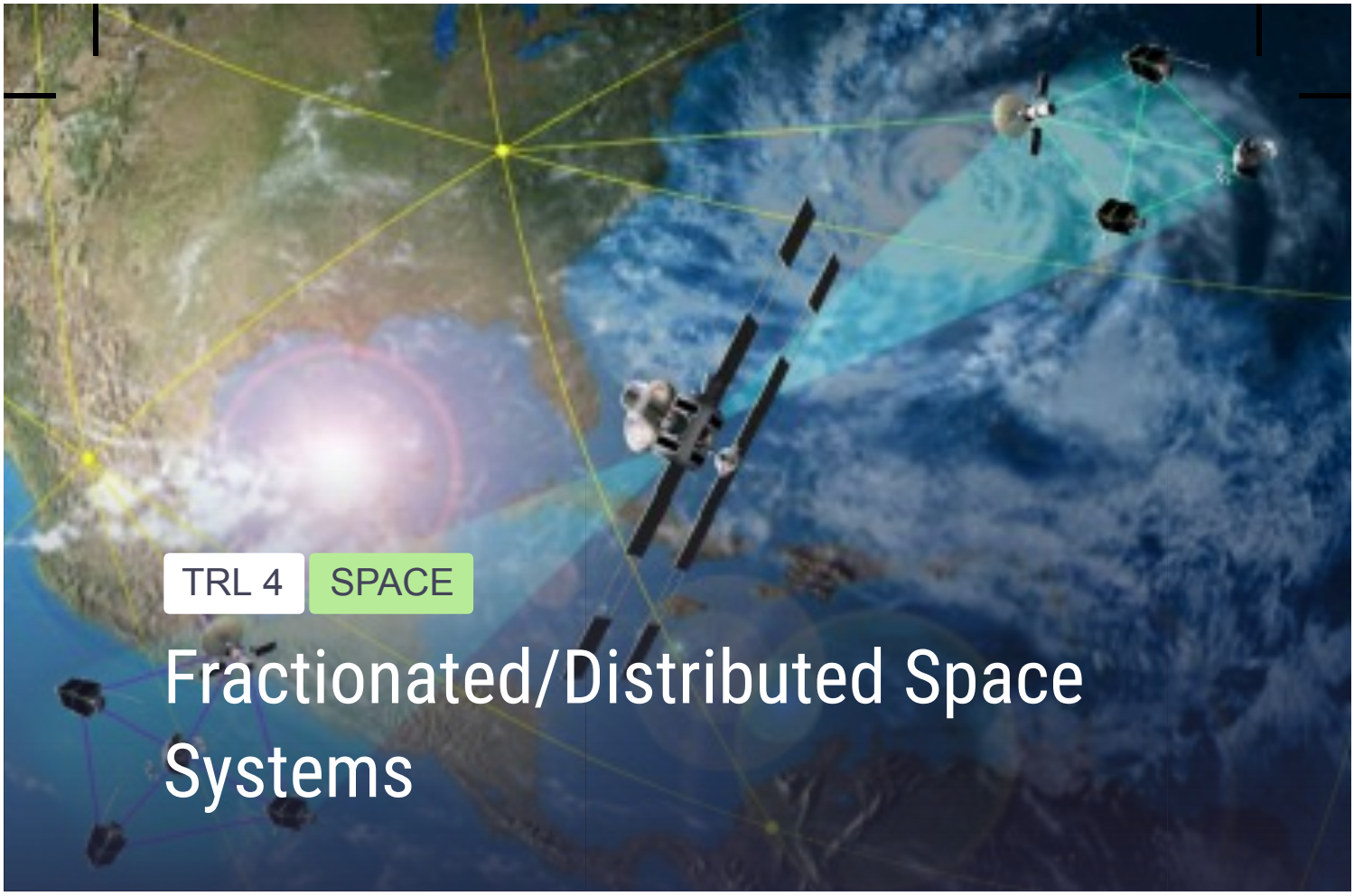
Vertical takeoff space launch using rocket first stage and air breathing rocketscramjet second stage. Requires advanced thermal materials, automation, onboard health monitoring systems.



TRL 4 SPACE

Rapidly Composable Small Satellites

Modular components for fast insertion. Includes automatic recomposition should systems fail, communications via secure links. Cooperative control, guidance, on-orbit self-assembly. Attitude control, orbital manoeuvre, communications, ISR, weapons modules.



TRL 4 SPACE

Fractionated/Distributed Space Systems

Provides redundancy, survivability and system upgradeability. Fractionation will involve system elements that cooperate and communicate via secure, jamresistant links (laser). Such systems are easily added to/repaired by adding or substituting small satellites.