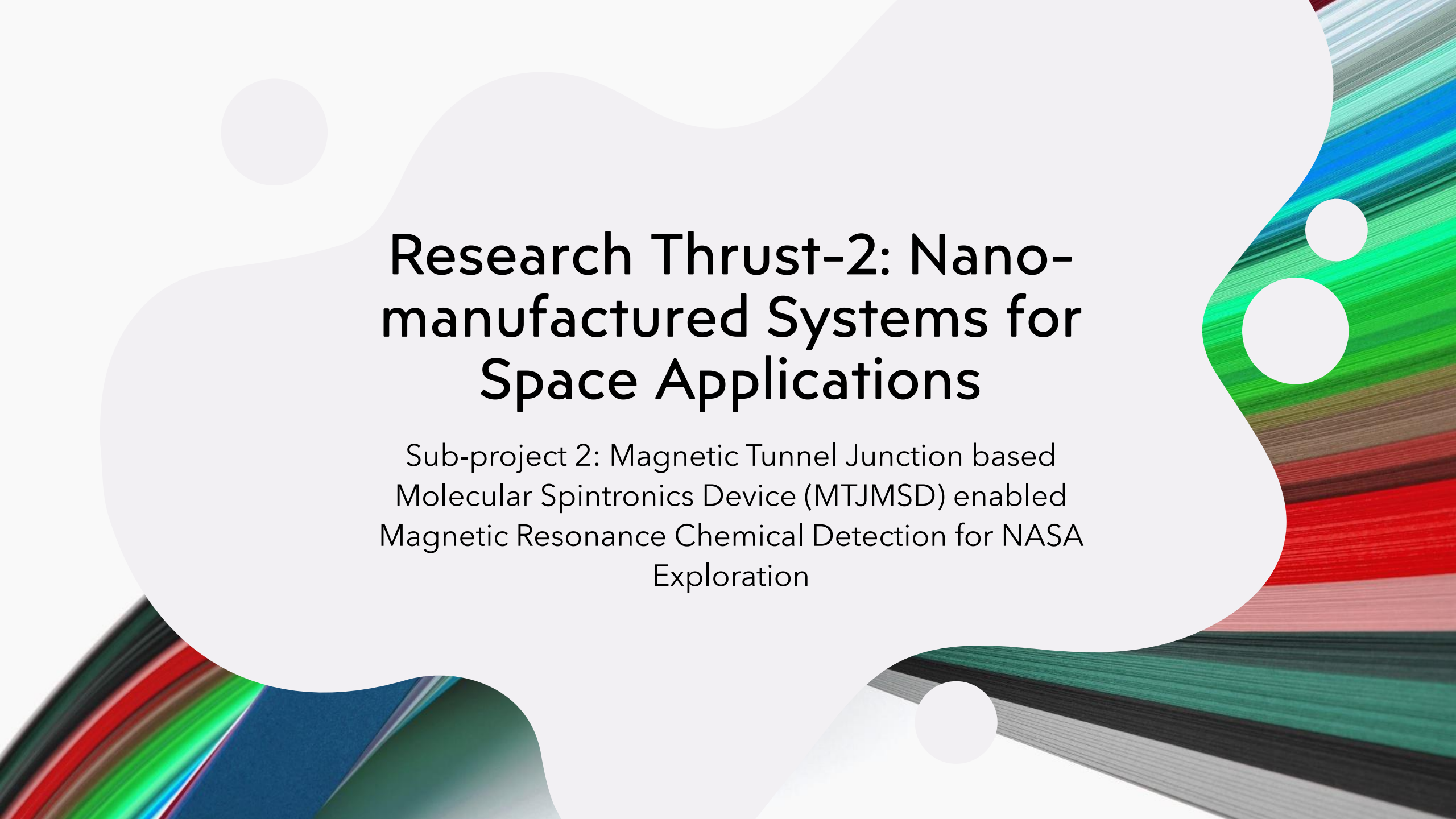
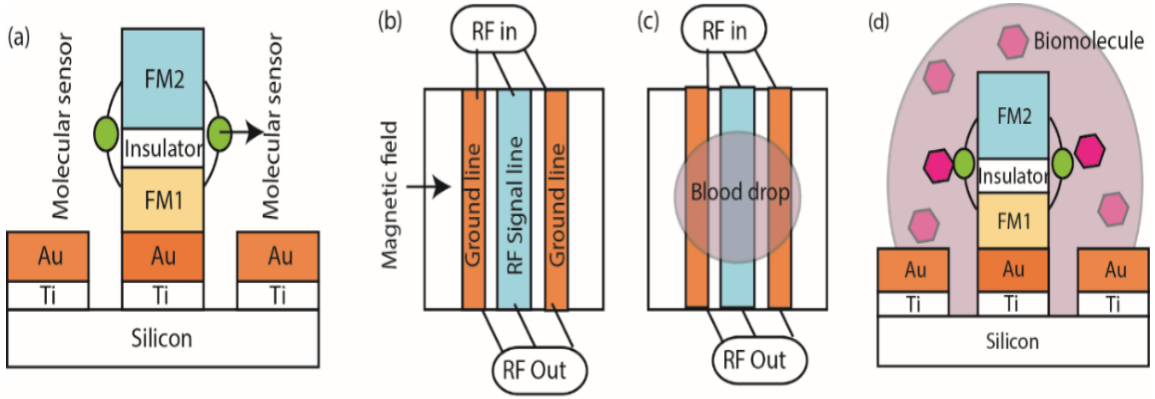
Research Thrust-2: Nano-manufactured Systems for Space Applications

Sub-project 2: Magnetic Tunnel Junction based Molecular Spintronics Device (MTJMSD) enabled Magnetic Resonance Chemical Detection for NASA Exploration



Statement of R&D Problem



(a) Side view and (b) top view of proposed sensor. (d) Patient's blood drop on sensor will supply (d) target biomolecule will interact with the molecular sensor to produce change in RF signal

Detection of the chemical, biological and non-biological, is exceptionally critical in understanding the cause of any health or environmental problem. Detection of chemicals during the treatment or remediation process is even more critical in ensuring the success of a solution to health and environmental issue. The utilization of magnetic resonance property has been explored in the field of chemical and biochemical detection. Interestingly, micro-nano fabrication methods have allowed the fabrication of chemical responsive materials in the form of a chip.

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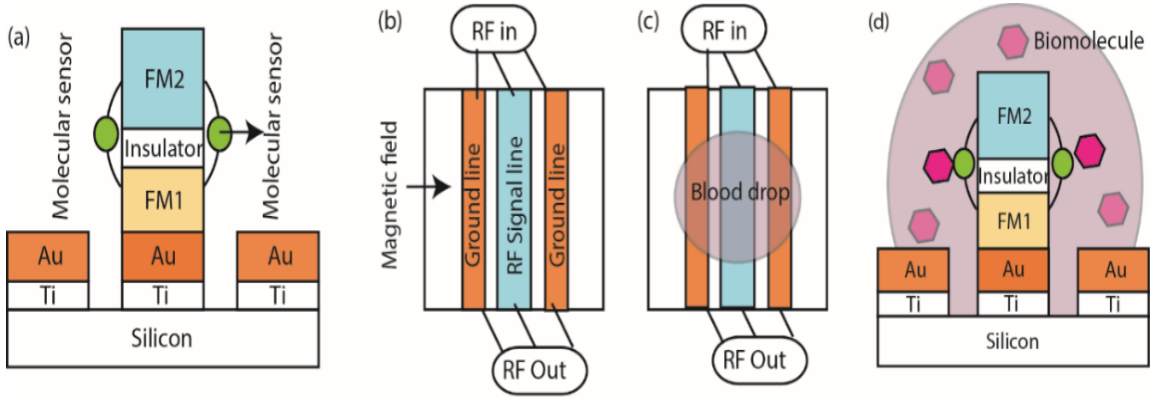

(a) Side view and (b) top view of proposed sensor. (d) Patient's blood drop on sensor will supply (d) target biomolecule will interact with the molecular sensor to produce change in RF signal

A new branch of chemical detection is viable when an analyte with or without unpaired spin can interact with the magnetic material or integrated assembly of patternable magnetic materials and molecular sensors. Prior MTJMSD research has focused on computer technology and requires the monitoring of conductivity property. However, an MTJMSD designed to interact with targeted chemicals and viruses leading to unique magnetic resonance property can produce novel forms of highly compact, portable, specific sensors. The molecule sensor of the MTJMSD can be designed to respond to the target analyte by latching on it by the lock and key mechanism.