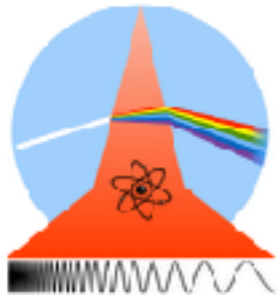


Quantum S&T Program at IMOD

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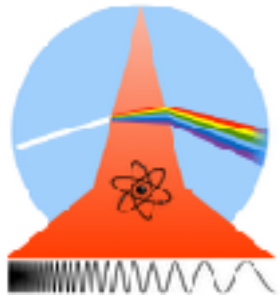
**Head, Quantum and EO Technologies Branch
EPQ Division, R&T Base Unit
Directorate for Defense R&D (DDR&D)
Israel Ministry of Defense (IMOD)
2017**



Who Are We?

- ❖ **DDR&D (Maf'at) - Directorate for Defense R&D**
 - ❖ **Single organization in charge of defense R&D in Israel**
 - ❖ Funding agency
 - ❖ Dual-hatted organization
 - ❖ From basic research to operational deployment in the IDF
 - ❖ In charge of defense R&D international collaborations
 - ❖ In charge of developing elite technological personnel



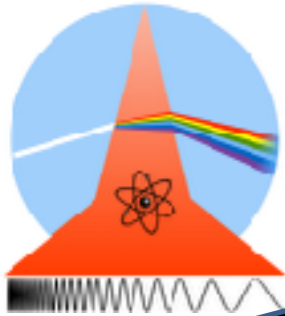


Quantum Technology in DDR&D

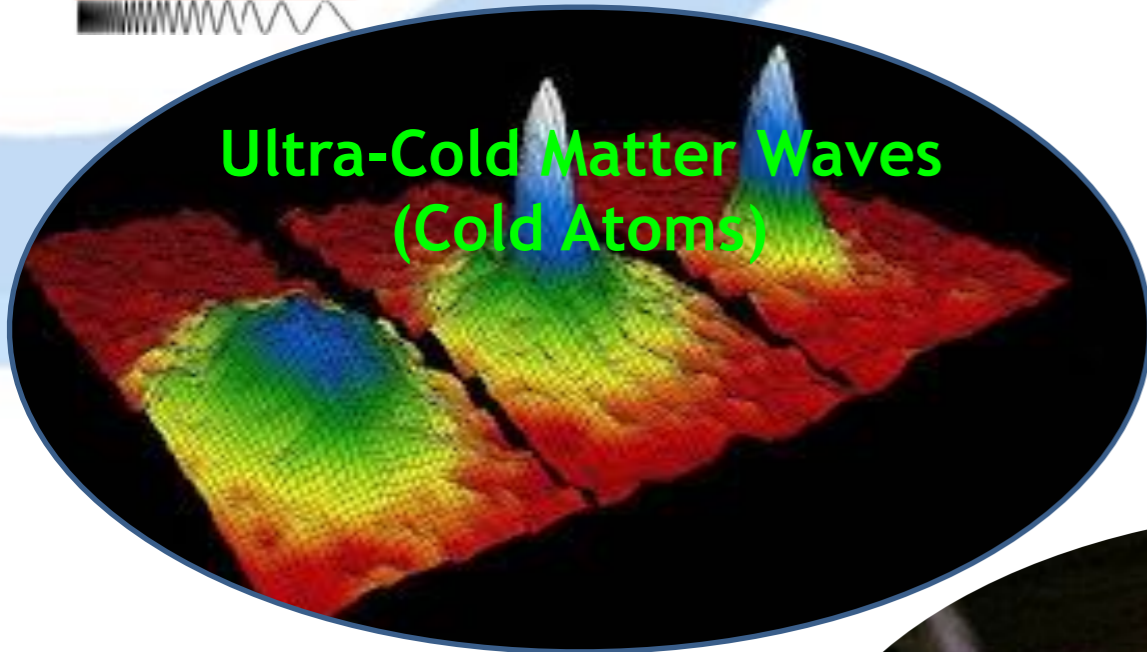
Devices which directly utilize and engineer quantum properties or phenomena for defense applications

- ❖ Wide span: from basic research to applied R&D
 - ❖ Strong connection to operational needs / requirements
 - ❖ Integrated project teams with various R&D bodies
- ❖ Main vectors
 - ❖ Precision measurement devices
 - ❖ Quantum communication
- ❖ Emphasis on increased international collaboration where possible
 - ❖ Direct academic research, G2G projects, (G2C projects)

Technological Platforms



Ultra-Cold Matter Waves
(Cold Atoms)



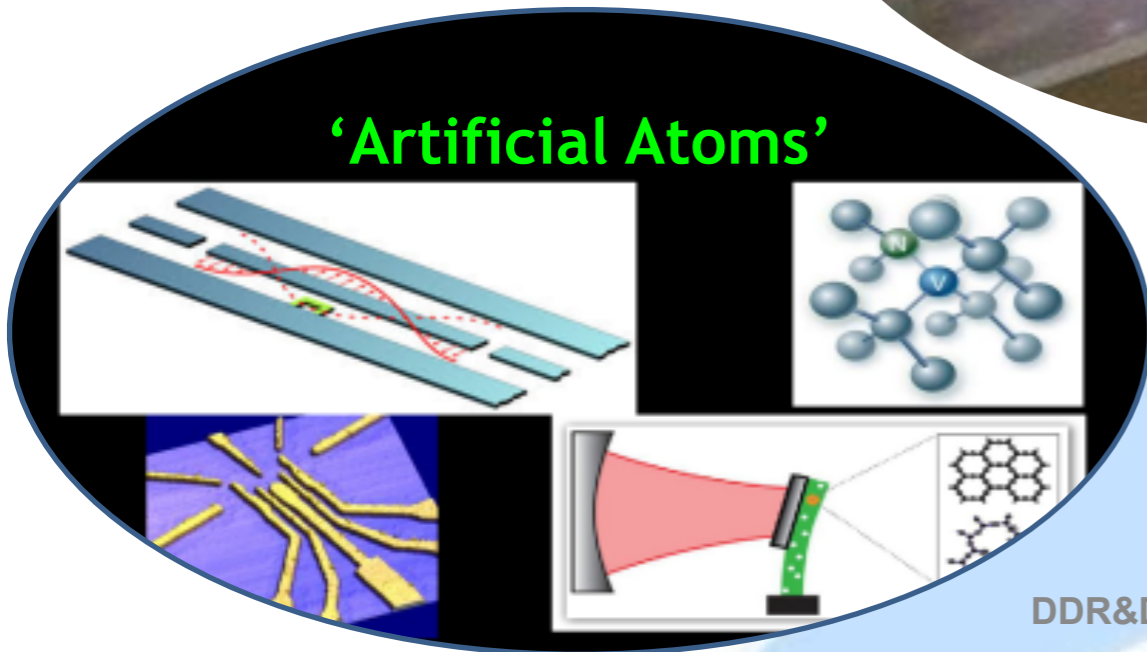
Photons (Light)



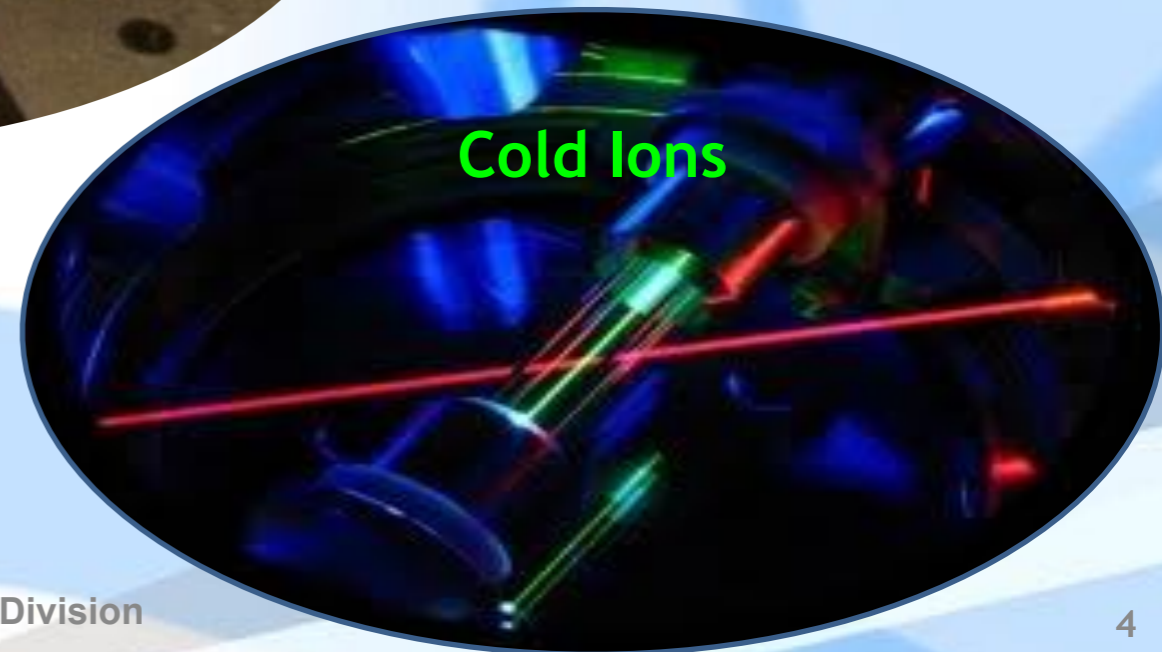
Hot Atoms

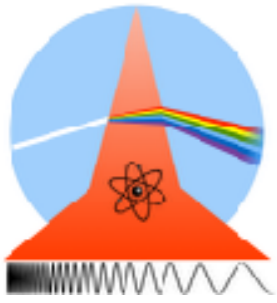


'Artificial Atoms'



Cold Ions



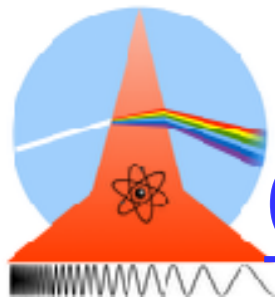


Israel as an Innovative Arena

- ❖ Israel
 - ❖ Small country, few resources, imminent needs
 - ❖ Only resource: our people

- ❖ Same people in all disciplines:
 - ❖ Mandatory military service
 - ❖ IDF relying on reserves
 - ❖ Technological units in the IDF
 - ❖ DDR&D as dual organization (part MOD, part IDF)
 - ❖ Well developed defense industries
 - ❖ High level of academic researchers
 - ❖ Civilian population under threat

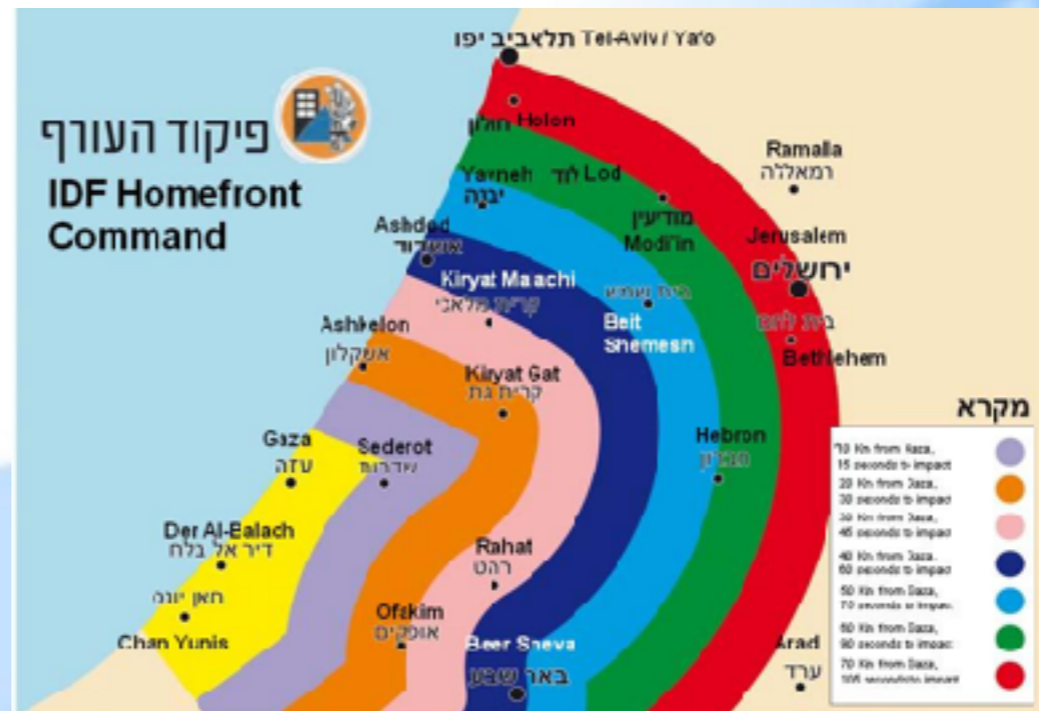
- ❖ ⇒ Highly fast, creative, and innovative R&D processes

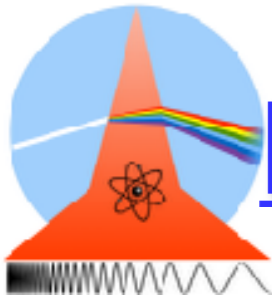


Quantum Technology in the battle-field

Operation “Protective Edge”

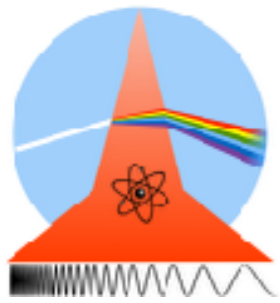
- ❖ Summer, 2014
 - ❖ Following >450 rockets fired at civilian targets since Jan 2014 alone
 - ❖ During the operation: >4500 rockets fired at areas covering >70% of Israel’s civilian population
 - Iron Dome missile defense system presenting ~90% success in intercepting rockets which were on their way to hit a populated area
 - Iron Dome system employing multiple time/frequency references (**atomic clocks**) for precise radar, C&C, and interceptor control





DDR&D's Role in the Short Cycles

- ❖ Develop future capabilities
 - ❖ Have technology ready for when it is needed
 - ❖ ⇒ Invest in long term R&D, bring it to maturity
- ❖ Junction connecting basic research, technological R&D, and the operational needs
 - ❖ Enable fast route from concept to testing, development, and on...
- ❖ Develop elite technological personnel
 - ❖ For military service, and future recruitment in Israeli academia and industry
- ❖ Collaborate internationally to enhance local expertise
- ❖ *All, in a single, agile agency*



Thank you!

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