

### **A Novel Tunable Micro-Disk (BGN)**

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**T**his invention discusses a micro-scale optical device that includes a tunable micro disk resonator possessing a high quality factor. The device comprises of a waveguide and a micro-disk, optically coupled to the waveguide. The high quality factor allows for a single photon to interact several times with the same atom, ion or molecule so that a significant interaction can be achieved. However, this strong coupling can be reached only if the optical device is kept in strict resonance with the frequency similar to that of the desired quantum transition, and hence the crucial importance of the tuning mechanism offered by this invention.

Although most of the light intensity is confined within the disk, a small part of it exists as an evanescent field outside the disk. This external light can interact with the particle we want to measure and this coupling alters the optical properties of the disk mode and consequently changes the intensity or phase of the light at the output port of the linear waveguide. The ability to measure these changes enables the detection of the presence of the external particles.

#### **Advantages**

A high quality factor that allows for multiple interactions between the single photon and a single atom, ion or molecule, thus achieving great sensitivity as well as capabilities of non-destructive measurements.

The micro-disk resonator is tunable, thus enabling operation on resonance (i.e. on the required frequency determined by the measured particle type). This enables the selection of the desired particle type to be measured, as well as operation in real conditions of fluctuations in temperature. A powerful tool for deducing the presence of the external particles.

#### **Potential Commercial Uses and Strategic Partners**

The use of this invention allows for tunable photonics that is essential for quantum technology (detection of atoms), and bio/chemical sensors (detection of molecules).

#### **Development Stage and Development Status Summary**

First prototypes of microdisks were fabricated at Ben-Gurion University for all kinds of applications such as bio sensing and quantum technology (e.g. quantum computer and interferometry for sensors). However, the time line for a device ready for demonstration is about 2-3 years from now.

#### **Patent Status**

Patent Pending

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