

**Opportunity Title:** Microwave to optics conversion  
**Opportunity Reference Code:** 0237-NPP-NOV23-JPL-TechDev

**Organization** National Aeronautics and Space Administration (NASA)

**Reference Code** 0237-NPP-NOV23-JPL-TechDev

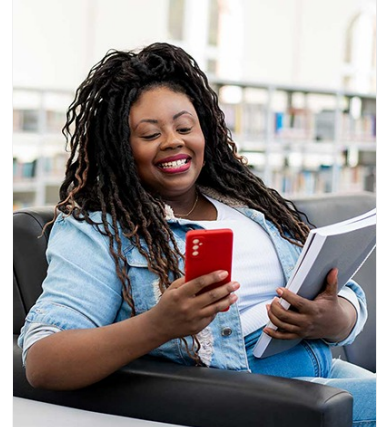
**Application Deadline** 11/1/2023 6:00:59 PM Eastern Time Zone

**Description** High-efficiency conversion of microwave signals to the optical domain offers an advanced technique for the microwave signal coherent, frequency- and polarization-sensitive detection and processing with potentially unparalleled sensitivity and low noise. Our approach is based on using high quality factor, optically nonlinear whispering gallery resonators to facilitate such a conversion. While the future applications of this technique range from terahertz spectroscopy to building quantum computing networks, in the framework of our on-going project we focus on creating a prototype of a photonic receiver for ultra-compact W-band (94 GHz) radar designed for the Cubesat and Smallsat atmospheric studies.

We seek applicants with a background in this research field who can effectively demonstrate interest, competence, and original research ideas in developing and applying nonlinear microwave photonics.

References:

1. W-band Photonic Receiver for Compact Cloud Radars, D. Strekalov, N. Majurec, A. Matsko, V. Ilchenko, S. Tanelli, and R. Ahmed, to appear in *Sensors* (2022).
2. Sensitivity limits of mm-wave photonic radiometers based on efficient electro-optic up-converters, G. Santamaria-Botello, F. Sedlmeir, A.R. Rueda, K.A. Abdalmalak, E.R. Brown, G. Leuchs, S. Preu, D. Segovia-Vargas, D.V. Strekalov, L.E.G. Muñoz, H.G.L. Schwefel, *Optica* 5, 1210-1219 (2018).
3. Efficient microwave to optical photon conversion: an electro-optical realization, A. Rueda, F. Sedlmeir, M. C. Collodo, U. Vogl, B. Stiller, G. Schunk, D. V. Strekalov, Ch. Marquardt, J. M. Fink, O. Painter, G. Leuchs, and H. G. L. Schwefel, *Optica* 3, 597-604 (2016).
4. Microwave whispering gallery resonator for efficient optical up-conversion, D. V. Strekalov, H. G. L. Schwefel, A. A. Savchenkov, A. B. Matsko, L. J. Wang, and N. Yu, *Phys. Rev. A.*, 80, 033810 (2009).
5. Efficient upconversion of sub-THz radiation in a high-Q whispering gallery resonator, D. V. Strekalov, A. A. Savchenkov, A. B. Matsko and N. Yu, *Opt. Lett.* 34, 713-715 (2009).
6. Towards counting microwave photons at room temperature, D. V. Strekalov, A. A. Savchenkov, A. B. Matsko and N. Yu, *Laser Phys. Lett.*, 6, 129 (2009).
7. Sensitivity of THz photonic receivers, A. B. Matsko, D. V. Strekalov and N. Yu, *Phys. Rev. A*, 77, 043812 (2008).



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**Location:**

Jet Propulsion Laboratory  
Pasadena, California

**Field of Science:**Technology Development

**Advisors:**

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**Applications with citizens from Designated Countries will not be accepted at this time, unless they are Legal Permanent Residents of the United States.** A complete list of Designated Countries can be found at: <https://www.nasa.gov/oior/export-control>.

Eligibility is currently open to:

- U.S. Citizens;
- U.S. Lawful Permanent Residents (LPR);
- Foreign Nationals eligible for an Exchange Visitor J-1 visa status; and,
- Applicants for LPR, asylees, or refugees in the U.S. at the time of application with 1) a valid EAD card and 2) I-485 or I-589 forms in pending status

**Eligibility  
Requirements**

- **Degree:** Doctoral Degree.