

STATEMENT OF REQUIREMENTS

Title: Spectroscopic CCD Camera

Requesting Lab/Division/Group: Physical Measurements Lab / Applied Physics Division / Spin Electronics Group

Requisition Number: NB686000-26-01951

I. BACKGROUND INFORMATION

The Spin Electronics Group of the Physical Measurement Laboratory requires the purchase of a Spectroscopic Charge-Coupled Device (CCD) Camera for a virtual imaged phased array-based spectrometer to determine the Heisenberg exchange in ultrathin films. The spectroscopic CCD camera should have at least 1020 x 120 pixels, a high read-out rate per pixel of at least 1 MHz in a fast mode, a typical read out noise of less than 20 electrons at a readout rate of 1 MHz. The quantum efficiency should be larger than 90% at a wavelength of 532 nm. The CCD chip needs to be cooled to at least -60 C.

II. PURPOSE

The CCD camera will be used to record spectra of virtual imaged phased array-based spectrometer. Spectra will be measured at different angles of incidence of the laser beam onto the sample to determine the frequency of magnetic excitations with different momentum. Analyzing the frequency dependence on the angle of incidence allows for the determination of the Heisenberg exchange. The signal from the samples is very weak and consequently requires a spectroscopic CCD camera, which meets the specifications with respect to dark current, read noise and well depth. The measurements require a sufficiently high spectral resolution to determine the Heisenberg exchange with high accuracy. This research is critical to support and advance the microelectronics industry. The Heisenberg exchange is a critical magnetic materials parameter, which determines the performance of magnetic random-access memory.

The Contractor shall deliver a quantity of one (1), inclusive of FOB Destination delivery, and warranty.

III. MINIMUM REQUIREMENTS

The Contractor shall provide a system that meets all technical specifications identified below. All items must be new. Used or remanufactured equipment will not be considered for award. Experimental, prototype, or custom items will not be considered. The manufacturer must have delivered more than 5 comparable systems. The use of "gray market" components are not authorized for sale in the U.S. by the Contractor is not acceptable. All line items shall be shipped in the original manufacturer's packaging and include all original documentation and software, when applicable.

Line Item 0001:

Description: CCD Camera

Quantity: One (1)

A. Technical Specifications

- a. The CCD camera should have at least 1020 x 120 pixels.
- b. The CCD chip should be backside illuminated.
- c. The CCD camera should have a quantum efficiency > 90% at a wavelength of 532 nm.
- d. The pixel size should be larger than 12 μm x 12 μm and smaller than 28 μm x 28 μm .
- e. The CCD camera should allow full vertical binning and 1x1 binned (aka unbinned).

- f. The CCD camera should have a few readout speeds, including a readout speed of 50 kHz or lower and a readout speed of at least 1 MHz.
- g. The typical dark current at the lowest possible temperature of the CCD chip should be lower than 0.0009 electrons/pixel/second.
- h. The readout noise should be less than 12 electrons at a read-out rate of 50 kHz and 20 electrons at a read-out rate of 1 MHz.
- i. The AD converter resolution should be 18 bit.
- j. The full well capacity should be 400k electrons or more.
- k. The register well capacity should be 1000k electrons or more.
- l. The CCD chip should be able to be cooled to a minimum temperature of -60 C or lower.
- m. The CCD camera should have a USB 3.0 communication interface.
- n. Software to control the camera and view images from the camera.
- o. Drivers that use python-based software can be written to control the camera.

IV. DELIVERABLES

Description	Quantity or Format	Due Date
CCD camera, software and drivers for python	One (1)	18 weeks

Standards of Acceptance: The NIST TPOC or COR shall review (list deliverables) and respond with an acceptance or request for revision email to the Contractor Point of Contact (POC) within 7 days of receipt of deliverable. This section applies to deliverables which must be reviewed and approved for acceptances (draft plans, drawings, etc.)

V. PLACE OF PERFORMANCE

National Institute of Standards and Technology (NIST)
325 Broadway
Boulder, CO 80305

VI. PERIOD OF PERFORMANCE/LEAD TIME

18 weeks lead time.

VII. DELIVERY TERMS

Delivery shall be F.O.B Destination and shall occur in accordance with the delivery due dates provided in the above table.

FOB Destination means: The contractor shall pack and mark the shipment in conformance with carrier requirements, deliver the shipment in good order and condition to the point of delivery specified in the purchase order, be responsible for any loss of and/or damage to the goods occurring before receipt and acceptance of the shipment by the consignee at the delivery point specified in the purchase order; and pay all charges to the specified point of delivery. The contractor shall deliver all Line Items to:

National Institute of Standards and Technology
Shipping and Receiving

325 Broadway, Building 2
Boulder, CO 80305
POC: Hans Nembach, Building 2

VIII. INSPECTION & ACCEPTANCE

In addition to the inspection and acceptance terms articulated in 52.212-4, the Government reserves the right to perform such performance tests and evaluations as defined below to verify specified system performance. Such tests and evaluations, if performed, shall be conducted within the environment that the system is to be operated. The Contractor has the right to be present during the tests and evaluations, if performed, at the Contractor's expense.

Performance Tests:

1. Acquire images at different frame rates and exposure times.
2. Set the camera to minimum temperature and acquire images at different frame rates and exposure times.

NIST may choose at its discretion to forego this part of acceptance testing.

A visual inspection of the equipment will be performed by the NIST TPOC to identify surface defects or any form of indication that any equipment was damaged during transport to NIST. The Government shall have sole discretion to require repair or replacement of damaged and/or nonconforming supplies at no cost to the Government. The Government at any time prior to acceptance shall reject the equipment due to defects and/or nonconformance. The vendor is responsible for latent defects discovered any time after final inspection. However, the extent of its liability shall be prorated over the useful life of the equipment.

Ownership of the equipment shall transfer to NIST upon acceptance by the Government.

The Government will test, inspect, and accept or reject the equipment within **seven (7)** working days of the receipt of the equipment unless otherwise indicated above. The Government reserves the right to conduct quality assurance testing to confirm that a given instrument(s) meets the manufacturer's and/or the Government's performance specifications. It is anticipated that the equipment will meet all manufacturer's specifications and/or the Government's performance specifications identified in the most recent operations and maintenance manual for each piece of equipment and/or in this document.

IX. WARRANTY

The contractor shall warranty the entire system for a period of a minimum of 1 year (after receipt of the equipment and shall be in accordance with terms in FAR 52.212-4. Warranty shall commence upon acceptance of the system by the Government and at a minimum shall include the following: Labor and Parts.

X. PAYMENT SCHEDULE

Advance payment is not authorized. The Contractor must invoice in arrears according to the payment schedule. The Contractor shall be paid, in accordance with Net 30-day payment terms, upon receipt and acceptance of a proper invoice, in accordance with the following schedule:

1. 100% after installation and acceptance by the TPOC of fully installed system, AND
2. After the successful completion of the testing requirements set forth in this document under section set forth in this document, AND

3. After successful demonstration by the instrumentation that it performs IAW the technical requirements set forth in this document AND
4. After receiving an invoice submitted properly, IAW the purchase order terms and conditions.

NOTE: Partial shipments and partial invoices will not be accepted, unless otherwise requested and accepted by the Contracting Officer prior to award offer. Proposed payment schedules shall be submitted with vendor's response to the RFQ for consideration.