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Subject: NSF AST proposal bits
Date: Fri, 20 Aug 1999 15:34:54 -0400
From: "Marc J. Feldman" <feldman@ece.rochester.edu>
To: akerr@NRAO.EDU

Tony, here is every mention to you in last year's proposal:

Development of Superconducting Back-end Components for Radio Astronomy Receivers

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This proposal is submitted by the University of Rochester. A.R. Kerr's participation in this research effort is detailed herein, and has been approved by NRAO. NRAO is funded by NSF under Cooperative Agreement #AST-9223814. Therefore Kerr will not draw salary or other financial support from the proposal funding.

I. Introduction

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on page 8:

Filtering / matching network: In any case it will be necessary to include a filtering / matching network in the input to the ADC. Superconducting filters and transformers are very compact with essentially ideal characteristics. This is because superconducting thin films have zero loss at these frequencies, and because a slowing factor of up to 20 is common for superconducting transmission lines. In fact, high-Tc superconducting filters are now being installed in cellular base stations in spite of the high packaging costs. Superconducting transformers, which work from dc up to a cutoff frequency determined by geometrical resonances with negligible loss, are used in the commercial SQUID magnetometer. One standard design is [45]. The design of the filtering / matching network appropriate for the ADC input in an SIS receiver will be done by Kerr.

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on page 14:
VI. Research plan sketch
The following is a brief outline/sketch of some of the tasks to be accomplished and our expectation as to when each will occur.
YEAR 1 -- We will develop a theoretical model for the noise temperature of the ADC. Then we will consider a variety of ADC designs and derive theoretical Tn as a function of source impedance for each, to help decide which to investigate more thoroughly in experiments. We will design and build several different ADC's and begin to determine their noise temperatures by measurements of the threshold curves at various temperatures, using a high-speed clock. We will design and build a 16-lag autocorrelator with 16-GHz clock and begin digital testing to determine failure modes. **ARK** will begin preliminary work on the design of superconducting IF transformers and filters appropriate for SIS receivers.
YEAR 2 -- Using the experimental results we will refine the theoretical model and make a final determination of which ADC design appears best for an SIS receiver. We will fabricate the ADC integrated with an SIS junction

to use as a calibrated noise source with variable source resistance, and measure the threshold curve of the ADC at various temperatures to better determine the noise temperature. We will refine the YR1 correlator design and fabricate the improved design. Then we will fabricate the ADC as input to the correlator, and use an externally fed 1-5 GHz sinusoidal input to measure the noise of the ADC as a function of frequency. **ARK** will design the input section for the sinusoidal input to the ADC/correlator. YEAR 3 -- We will use the theoretical model to develop new designs to minimize the noise of the ADC, and then experimentally test these designs. We will design and build a 64 lag autocorrelator with 16-GHz clock (redesign for density). We will design and build a 16 lag autocorrelator with 32-GHz clock using the new 5 kA/cm2 process. If appropriate we will integrate our ADC/autocorrelator into an off-the-shelf real SIS receiver for total receiver tests. If progress has been slower we will concentrate on the complete characterization of the ADC/autocorrelator by the end of YR3. **ARK** will design the SIS-to-ADC section for 4 GHz bandwidth.

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on page 15:
Kerr is currently responsible for the design of the SIS receiver front-ends for NRAO's Millimeter Array. His work proposed here on superconducting filters and impedance matching circuits is a natural extension of his current research, which involves more and more superconductor integrated circuitry, for instance in the design of image-separating and balanced SIS mixers. He is eager to realize the dramatic improvements in SIS receivers made possible by lifting the back-end constraints.

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on Budget pages:
Anthony R. Kerr is employed by the National Radio Astronomy Observatory (NRAO) which is funded by the NSF under Cooperative Agreement #AST-9223814. Kerr has committed one calendar month per year to this proposed project, and this has been approved by his employer. His salary will come from NSF as usual through normal NRAO funds, not from this proposed grant.

**********I would change this to "up to one calendar month**********
********** per year to this proposed project, as required, and **********
********** this has been approved by his employer. "**********