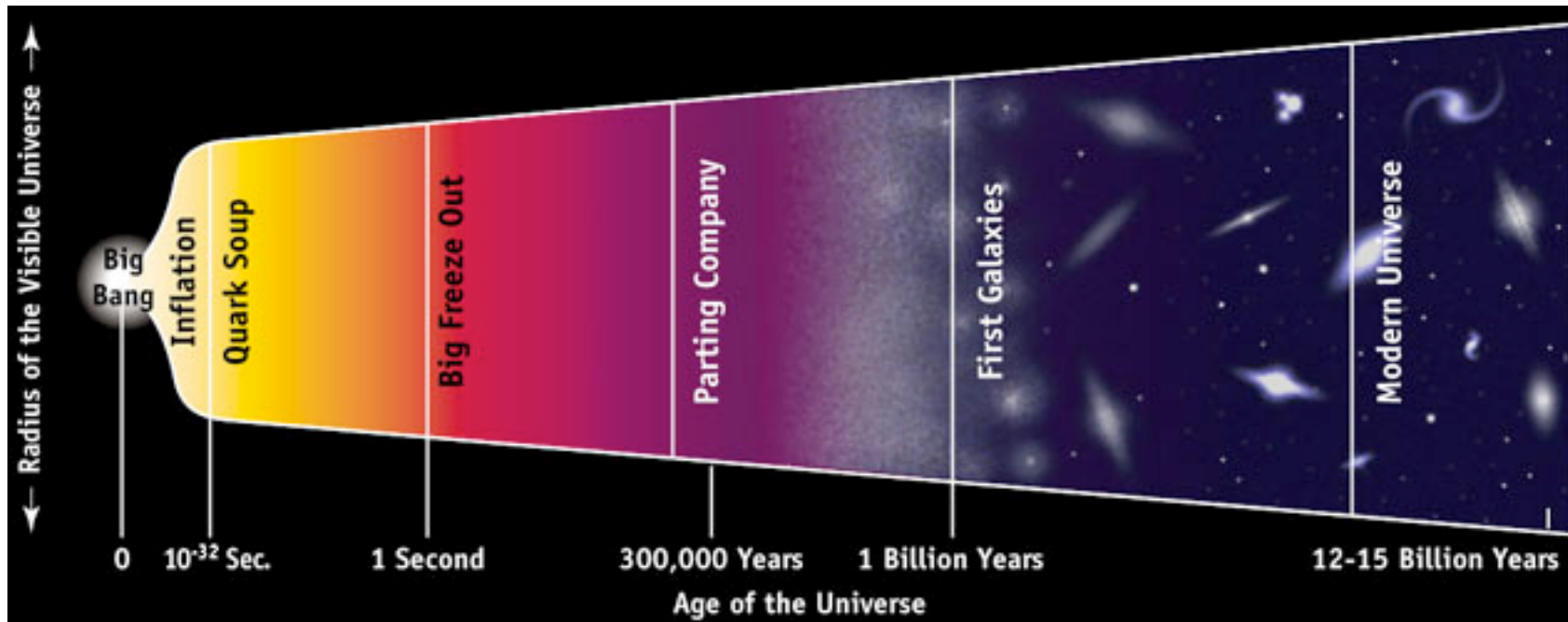


Spider: A Suborbital Polarimeter for Inflation, Dust, and the Epoch of Reionization

Natalie Gandilo April 15, 2010

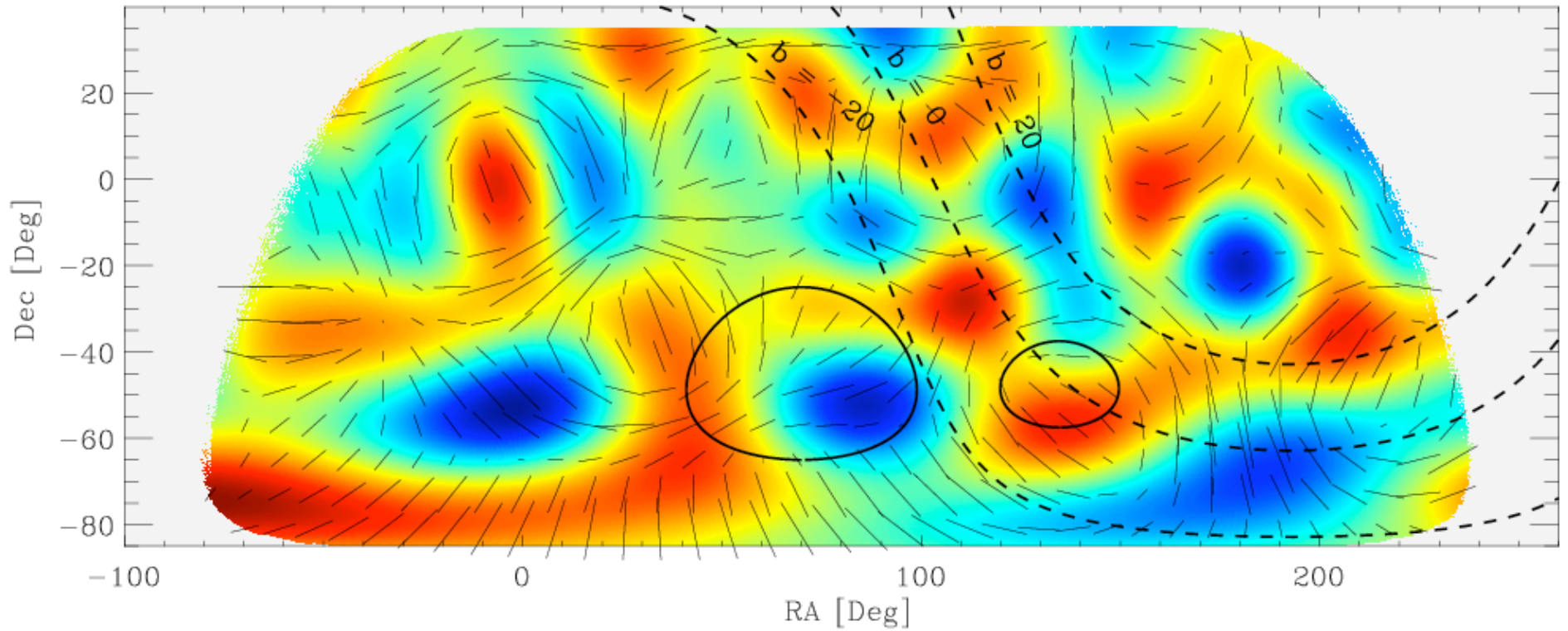
Spider science



- Spider's goal is to search for the signature of inflationary gravity waves that is (hopefully) encoded in the polarization of the Cosmic Microwave Background (CMB)

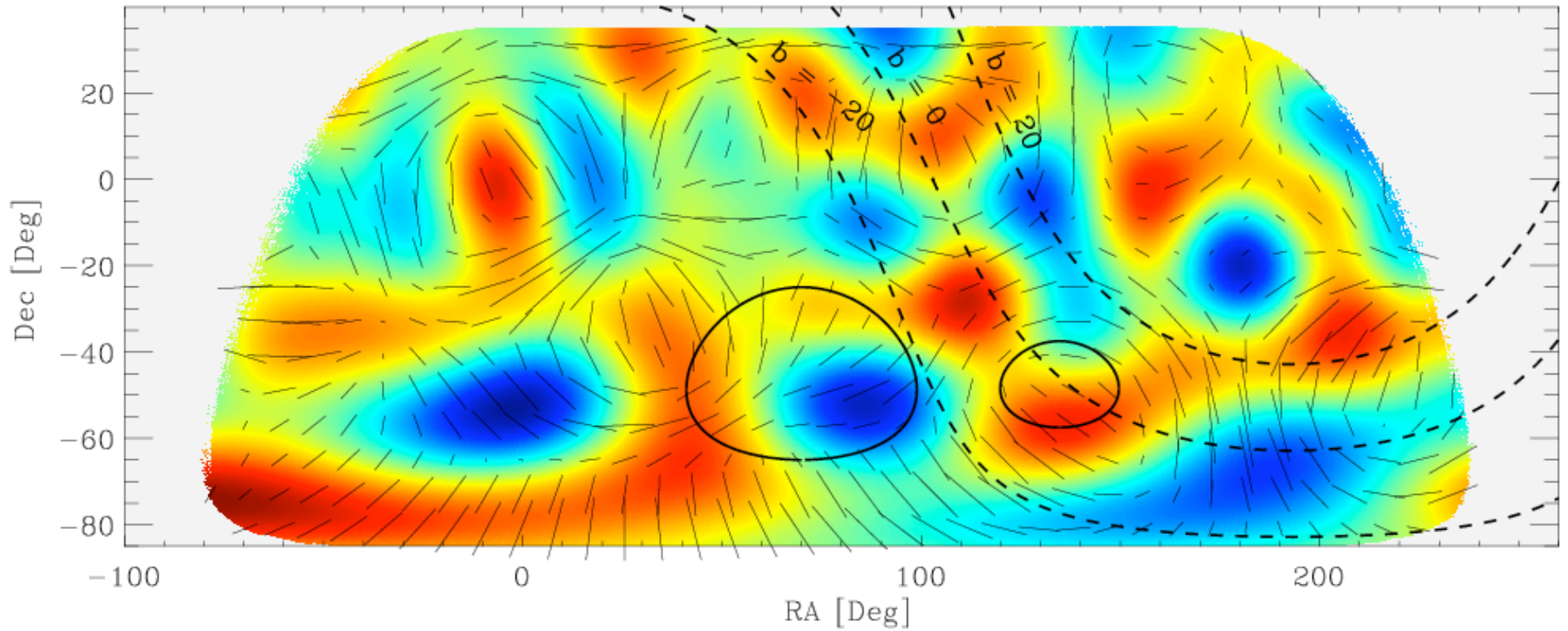
Simulated Spider Polarization Map

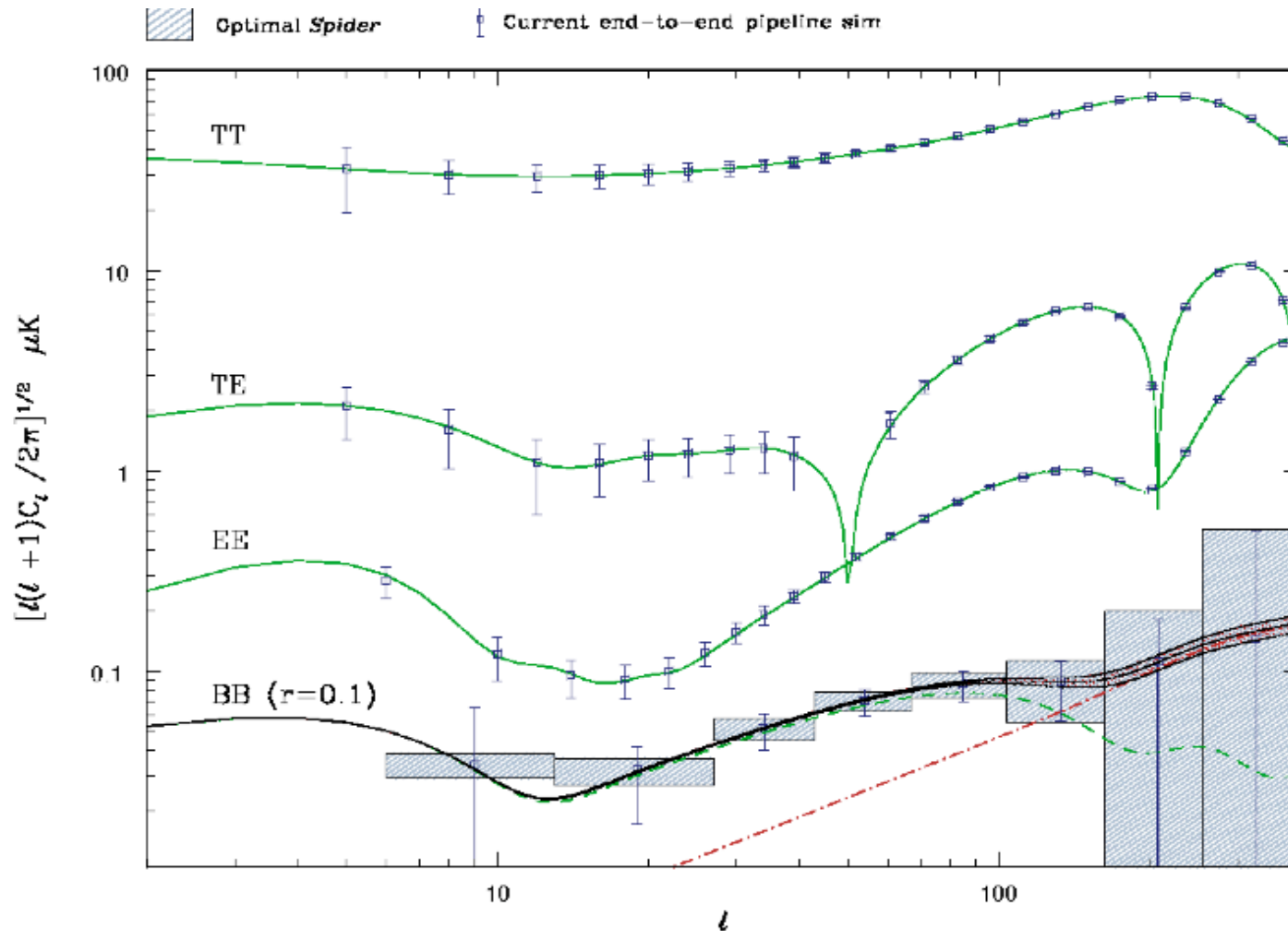
Without B-modes



Simulated Spider Polarization Map

With B-modes, $r=0.1$

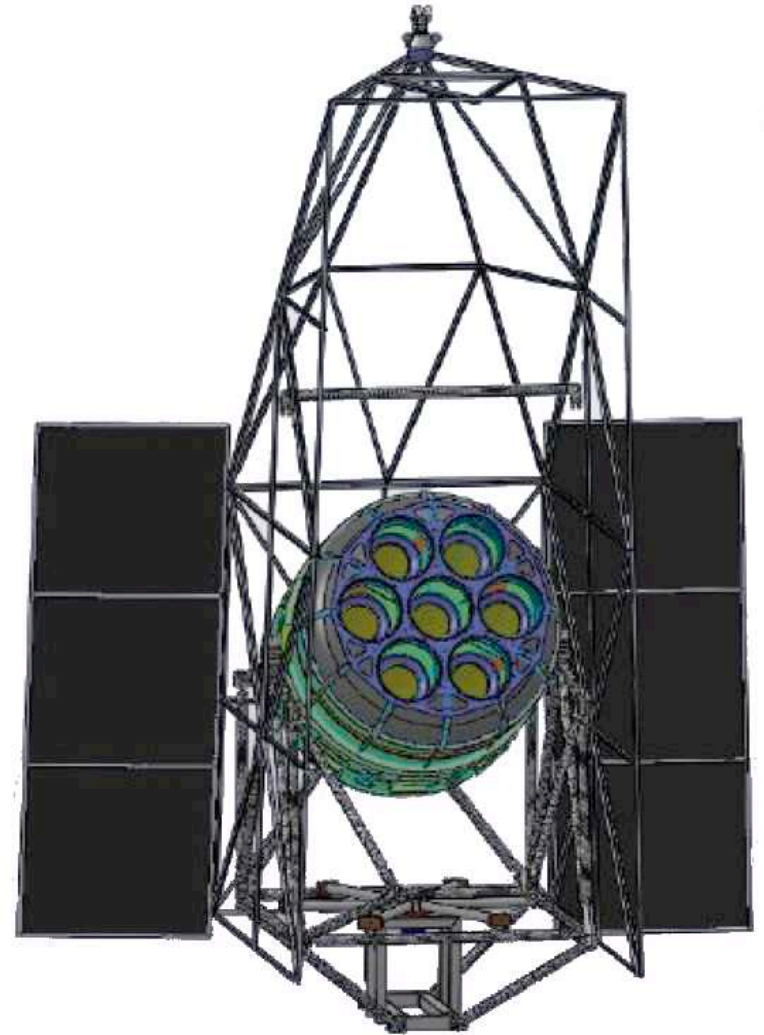
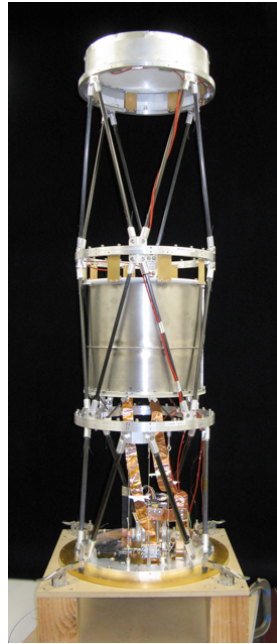




Spider excels in the low- ℓ (large angular scale) part of the spectrum where the lensed BB signal (dashed red line) is least important

Instrument

- 6 independent telescopes (30cm aperture) operating at three frequencies (100, 150, 220GHz), with optics cooled to 4K and bolometric detectors cooled to 0.3K



Schedule

- Summer 2010 - completion of gondola
- Spring 2011 - integration with cryostat
- Summer 2011 - Mission Readiness Review (MRR) in Palestine, TX
- Dec 2011 - Long Duration Balloon (LDB) flight

Funding


- Funded by NASA in the U.S.
- Selected in the cancelled 2007 Small Payloads Program. Interim funding from NSERC RTI and development funding from CSA. Full CSA funding expected imminently.



Launch requirements

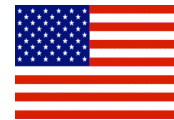
- Science payload mass: 2230kg (~5000lbs)
- Altitude: for CMB polarimetry, 23-38km (75,000-125,000 ft) is more than adequate
- Duration: we need 20 days scanning ~10% of the sky
- Location: currently, only antarctic flights can achieve our flight duration (McMurdo Station, Antarctica)

The Spider team

- Spider is a multinational collaboration with groups in Canada, the U.S., and the UK
- U. of Toronto - Barth Netterfield, Steve Benton, Laura Fissel, Natalie Gandilo, Jamil Shariff, Juan Soler
 - gondola, pointing system, auxiliary data acquisition, software, power systems, overall experiment integration, ground station communications control
- CITA - Dick Bond, Marzieh Farhang 
 - pre-flight simulations, analysis and interpretation of the flight data
- U. of British Columbia - Mark Halpern, Don Wiebe
 - TES detector readout system

Spider team continued...

- Caltech/JPL, NIST, Princeton, Case Western Reserve University
 - Detectors, optics, cryostat, receiver integration
 - NASA funding- access to CSBF facilities
- Cardiff, Imperial College London
 - Optics, filters, pre-flight simulations



Student involvement

- students take part in the end-to-end design, integration and operation of the instrument
- Spider provides a platform for learning which spans a wide array of specializations: theoretical astrophysics, software, electronics, machining

