Cape Cod Astronomical Society

Minutes of the August 7, 2014 meeting

Attendance: Total 31 (25 members and 6 guests)

At 7:30 p.m. September 4, 2014 Mike Hunter called the meeting to order.

Dr. Colin Bishchoff of the Harvard Smithsonian Center for Astrophysics was our guest speaker. Working at the Dark Sector Lab, 9,500 feet above sea level at the South Pole Station (Antarctica) he is part of a team studying the Cosmic Microwave Background (CMB); i.e., microwave radiation coming from deep in our universe). Their task is to confirm (or deny) the theory of Inflation. Their instrument is the BICEP2 microwave telescope.

The CMB is extremely uniform in temperature and distribution. The CMB temperature is 2.73 degrees Kelvin, plus or minus 500º micro Kelvin, a fluctuation of one part in 100,000. The CMB are uniformly distributed across the sky, in all directions. These observations lead cosmologists to believe the CMB has a common origin, and that origin presumably is the Big Bang.

The BICEP2 microwave telescope is cryostat cooled to 4 degrees Kelvin (4 degrees above absolute zero). It is a double lens refractor with a relatively small aperture (26 cm). Filters block the infrared to help keep the scope cold. The filters are transparent to microwaves but opaque to optical wavelengths.

Inflation Theory states that in the first 10^{-38} seconds after the Big Bang, the universe expanded from the atomic to the astronomical scale. Dr. Bishchoff explained that theoretically, during inflation, the stretching of space/time can move faster that the speed of light.

B mode polarization in primordial microwave radiation is predicted by Inflation. The BICEP2 Temperature/Polarization Maps do verify the presence of B mode polarization, but its origins are not yet fully certain. The B mode signal could be due to foreground radiation (dust within the Milky Way Galaxy), or they could be primordial in origin. The Dark Sector Lab team practices "foreground avoidance". When they point their telescope away from the Milky Way, the dust signal goes down by many orders of magnitude. The predicted B modes do indeed appear to originate from the CMB, bolstering confidence in the Theory of Inflation.

Dr. Bishchoff explained that not everyone is on board with Inflation. The geometric flatness of the CMB is explained by Inflation, but Inflation is not supported at all by particle physics.

Peter Kurtz announced that many members paid their dues at the meeting.

The meeting was adjourned at 9:30 p.m.

After the meeting the observatory was opened up. Four staff members and six guests,
including Dr. Bischoff came out for viewing.

Some websites for further information:

http://bicepkeck.org is the official site for results release but also provides some great photos, links to media coverage of BICEP2, and some FAQs.

http://wwwcfa.harvard.edu/CMB/Bicep2/ is the BICEP2 public site… and…

http://antarctic-adventures.de/ -- The website of Robert Schwarz, who is currently wintering-over at the South Pole for Keck Array operations. This is his 10th(!!) winter at the South Pole and he has photos and videos dating back across that whole period. Amazing photos of Aurora Australis in the Antarctic winter!

Respectfully submitted for Secretary Gus Romano, by

Gail Smith