

Southern Maine Astronomers  
Meeting  
1 July 2021, 1830 hrs

Attending were members Paul Howell, Roy Reigel, David Gay, Dave Manchester, Mike Efron, Russell Pinizzotto, Ara Jarahian, Greg Thorup, Jack Gelfand, Bob Dodge, Ron Thompson, Forrest Sumner, Paul Schumann, George Bokinsky, Rob Burgess, new member Thomas Catterall, and guests Ellen & Anita Divito and Carl Gurtmann.

1900: Rob Burgess opened the formal portion of the meeting welcoming new member Thomas Catterall and guests Ellen & Anita Divito. There was discussion of the club's role on June 10<sup>th</sup>'s Partial Annular eclipse, and members were directed to the club's website tab "SMA in the News" for video clips on coverage and articles from the Portland Press Herald and Bangor Daily News. Announcements included a combination full moon and string quartet event on Morse Mountain in Phippsburg on July 24; a "save the date" of Saturday, August 7 for a member Open House at club HQ at Brunswick Landing; a Perseid Meteor Star Party at Crystal Spring Farm in Brunswick on August 11-12 with the Brunswick Topsham Land Trust; the ALCON Virtual Conference August 19-21 and the State of Maine Star Party hosted by Downeast Astronomers at Cobscook Bay State Park August 27-28. Club meetings will resume Thursday, September 2. The club is seeking a facility for simultaneous live and zoom meetings on the USM campus.

**Invited Speaker: Dr. David Batuski, Professor of Physics, U Maine Orono "Tracing Dark Matter in Two Superclusters of Galaxies by Gravitational Lensing Effects"**

Professor Batuski provided a brief overview of several of his graduate students theses and research projects before zeroing in on the work of PhD candidate Sarah Rice's project on dark matter measurement in two superclusters of galaxies – in Aquarius and Microscopium. Professor Batuski explained some of the foundational assumptions of our universe: that the observable universe has an estimated one trillion galaxies, most of which exist in clusters, with potentially hundreds of billions of stars in each. Notwithstanding those enormous numbers it was astronomer Franz Zwicky in the early 1930's who posited that that mass was insufficient to explain the orbital speeds observed. He said there had to be more mass and he coined the phrase "dark matter" to explain it. The early theory was that this matter was like conventional baryonic matter but without an electromagnetic signature. The current view is that dark matter is a different form of matter altogether. This theory was reinforced by the work of astronomer Vera Rubin who concluded that galaxies do not have enough stars to explain their rotational speeds and would otherwise fly apart with some other binding matter. The current pie chart of conventional theory of the universe is that it is 4% regular matter, 23% dark matter and 73% dark energy, with the latter being the source of the observed expansion of the universe.

Since dark matter is visually unobservable its presence is determined by the effects it causes. In computer simulations of its gravitational impact it seems to follow the observable universe with galaxies clustering together with long filamentary streams connecting them. Prof. Batuski reminded the audience that "gravity is not a force as much as an aspect of geometry, curving space."

Prof. Batuski showed several slides of the effects of gravitational lensing, whereby the light from distant objects or galaxies is warped around foreground objects due to the gravitational

bending of space time caused by the mass of these foreground objects. The scope of this warping provides evidence of the extent of dark matter.

Grad student Rice's research focused on very distant galaxies, out as much as 100 million light years, where gravitational lensing is harder to measure. The challenge in such work is to measure very small amounts of distortion. She developed statistical models to eliminate distortion from other causes. Her work in the cluster of galaxies in Aquarius was inconclusive; results were somewhat better in Microscopium but did not establish large clumps of dark matter. It remains an open question whether this is the result of a true lack of such matter or perhaps a uniform distribution of it. Prof. Batuski specifically thanked Paul Howell for his assistance to the research team regarding measurement of gravitational lensing.

Russ Pinizzotto provided a wonderful tour of Hercules identifying a number of observable treasures. Of course, there was M13, the great Globular Cluster. However, there is also M92 which would be star of any constellation but for it being in Hercules and overshadowed by M13. There were a number of NGC objects including 6229 (another Globular Cluster), NGC 6207 and 6210 (a planetary nebula). Abell 39 is one of the largest spherical bubble planetaries, close at 6,800 LY. Abell 2151 and 2199 are two very large and dense clusters of galaxies, the former with about 200 and the latter with 290 galaxies. Although very faint at Mag 14.7 NGC 6020 and IC 1179 are two colliding spiral galaxies. Hercules A is a radio galaxy with spectacular jets. Hercules also contains the "Hercules Corona Borealis Great Wall," a/k/a the Sloan Great Wall, the largest known structure in the universe – a string of galaxies stretching about 10 billion light years! Hercules also contains the north pole of the Supergalactic Coordinates System.

The meeting concluded about 20:45.

Rob Burgess