University of Victoria | Graduate Studies

Notice of the Final Oral Examination
for the Degree of Master of Science

of

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BSc (University of Chicago, 2016)

"The Baryonic Matter and Geometry of the Local Group"

Department of Physics and Astronomy

Friday, January 11, 2019
1:00 P.M.
Clearihue Building
Room B007

Supervisory Committee:
Dr. Julio Navarro, Department of Physics and Astronomy, University of Victoria (Supervisor)
Dr. Kim Venn, Department of Physics and Astronomy, UVic (Member)

External Examiner:
Dr. Ferah Munshi, Department of Physics and Astronomy, University of Oklahoma

Chair of Oral Examination:
Dr. Roderick Edwards, Department of Mathematics and Statistics, UVic

Dr. David Capson, Dean, Faculty of Graduate Studies

Abstract

First, the baryonic content of simulated halos of virial masses between $5 \times 10^9 M_\odot$ to $5 \times 10^{12} M_\odot$ in the APOSTLE project is examined in the context of the missing baryon problem. Baryonic particles in APOSTLE can be either stars or gas. Nonstar-forming gas, or the circumgalactic medium (CGM) is further classified by temperature into the Cool CGM (CCGM, $T < 10^5 K$), or the Warm-Hot CGM (WHCGM, $T > 10^5 K$). APOSTLE halos are found to contain less than 60% of the expected mass of baryons ($f_b = \Omega_b / \Omega_m$, Mb = fb ×M200) within their virial radius. The WHCGM contains $29\% \pm 10\%$, the CCGM $12\% \pm 5\%$, and the stars and star-forming gas $19\% \pm 5\%$. The metal content of the same halos is analyzed, and compared to the total metals produced by the stars within the virial radius. Over two thirds of the produced metals are retained within the halo, with $14\% \pm 3\%$. in the WHCGM, $13\% \pm 4\%$.in the CCGM, and $43\% \pm 9\%$ in the stars and star-forming gas.

Next, we focus on the overall distribution of matter within a $3Mpc$ radius from the Milky Way. Using the trends in APOSTLE volumes, I quantify both the ellipticity and orientation of this spatial distribution using the principal axes of the inertia tensor of the positions of these galaxies. The Zone of Avoidance has little impact on this result, and the short axis is aligned with that of the Supergalactic Plane, and is perpendicular to the vector separating the Milky Way and Andromeda galaxies. APOSTLE local group analogues are found to be similarly anisotropic, and like in the observed Local Group, the minor axis of that distribution is found to be perpendicular to the vector separating the two primaries. The angular momentum of the stellar disk shows weak alignment with the minor axis of the field galaxy distribution. In addition the simulations also suggest that the angular momenta of the two primary dark-matter halos tend to be anti-aligned. Additionally, stellar disks tend to orient themselves in the same direction as their halo.