The University of California High-Performance AstroComputing Center presents

Computational Astrophysics 2014-2020: Approaching Exascale

Lawrence Berkeley Lab - March 21-22

Saturday 8:30 am – 9:30 am **Breakfast** on site

9:30 am – 12:30 pm **Greatest Challenges for This Decade** – Chair: Joel Primack

Progress porting applications to manycore architectures, NERSC-8 procurement
– Katie Antypas (NERSC Services Director and NERSC-8 Procurement lead)

Capabilities of and simulation software for new high performance computers
– Mike Norman (UCSD), Piyush Mahrotra (NAS)

Time domain computing – Peter Nugent (LBNL)

Big Data: storing, moving, mining, visualizing – Mike Norman (UCSD)

Cooperating – e.g., AGORA high-resolution galaxy simulation comparison project
– Joel Primack (UCSC)

12:30 pm **Lunch** provided on site for all registered participants

Competitive Cooperation

The AGORA High-resolution Galaxy Simulations Comparison

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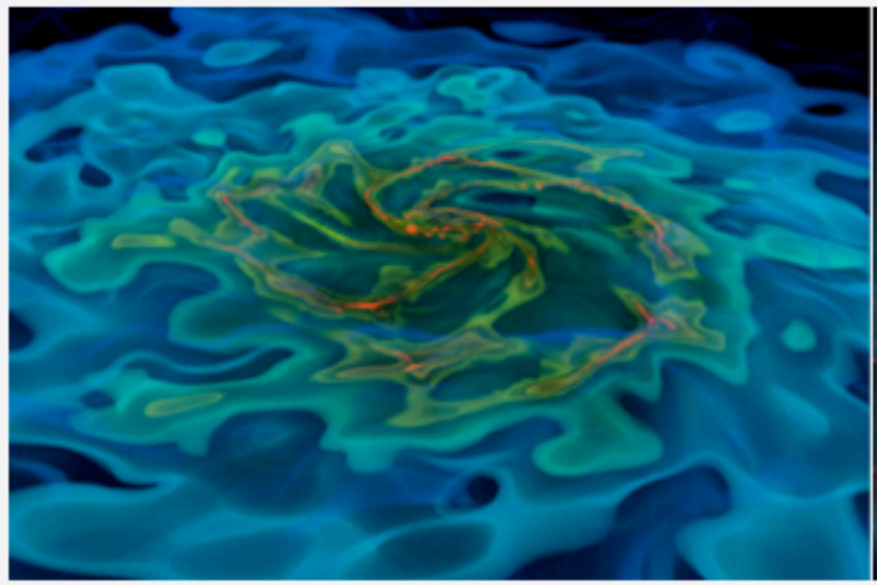


Welcome to Project AGORA! We investigate galaxy formation with high-resolution simulations and compare the results across code platforms and with observations. This is a massive inter-institutional effort by 104 participants from 51 institutions worldwide (as of Mar. 2014). We welcome anybody who is interested in participating in the Project. Click the image on the right to see the one-slide introduction of the Project. For the consensus reached at the Starting Workshop and the working groups formed, please visit here.

Project Announcements & News

Fifth AGORA Web Conference + yt-AGORA Workshop (Mar. 23-25) This post is to announce that the 5th Web Conference of the AGORA Project will be held on Mar. 25, 2014 (Tue, 10am PDT/6pm CET), tentatively, via SeeVogh. Note ...
Posted Feb 10, 2014, 6:19 PM by Ji-hoon Kim

Fourth Web Conference: Discussed Items Dear All, Thank you very much for your participation in the 4th Web Conference of the AGORA Project today. With 30+ people joining, we had another very productive session. Please ...
Posted Dec 13, 2013, 12:32 PM by Ji-hoon Kim

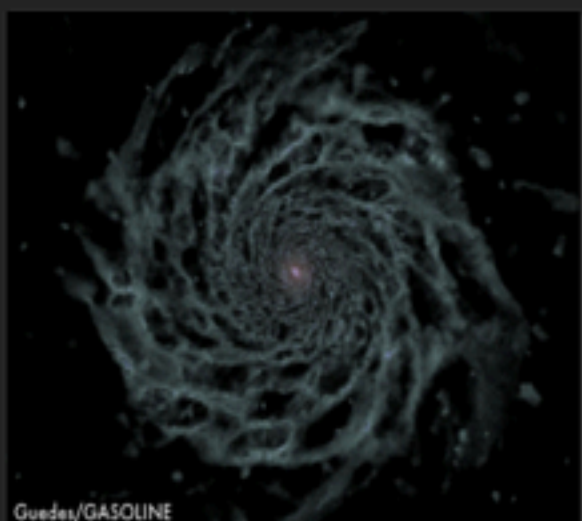
AGORA Flagship Paper Accepted / Press Releases The Flagship paper was accepted by the ApJS in November 2013, and published in January 2014 (local version). The published version of the

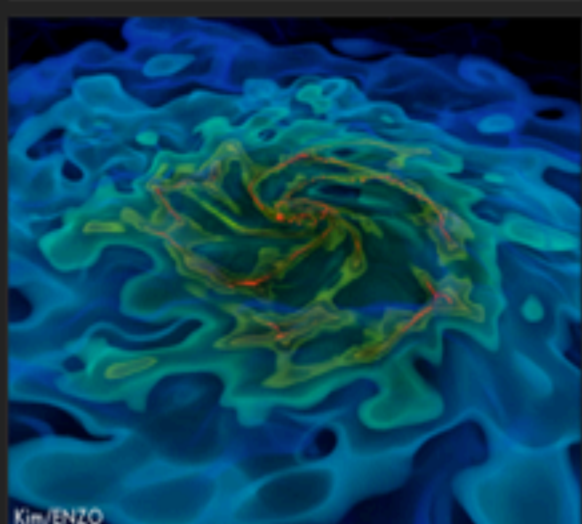
AGORA Assembling Galaxies of Resolved Anatomy

A High-resolution Galaxy Simulations Comparison Initiative To Tackle Longstanding Challenges in Galaxy Formation

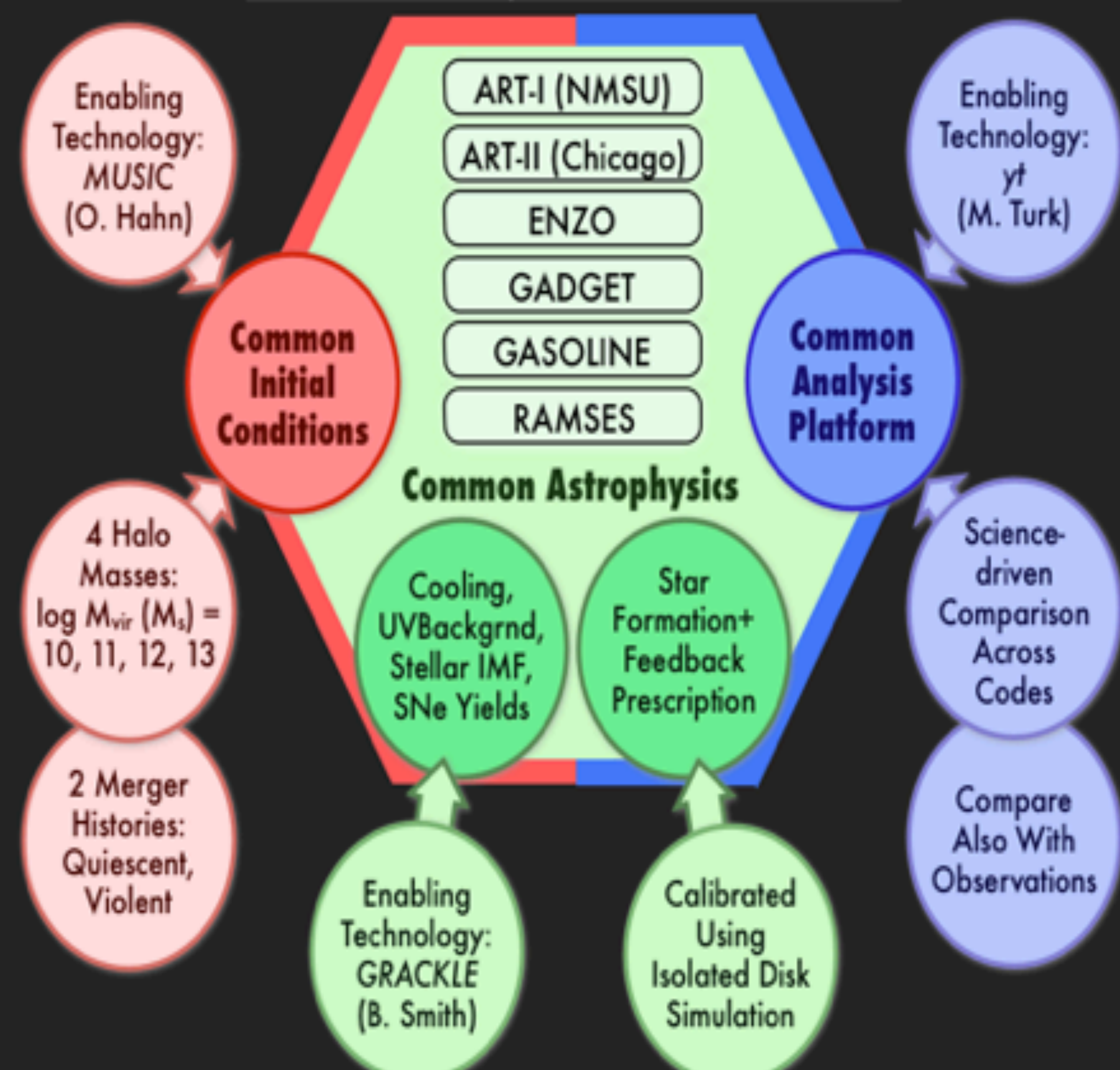
Steering Committee: Piero Madau & Joel Primack (UCSC), co-chairs; Tom Abel (Stanford), Nick Gnedin (Chicago), Romain Teyssier and Lucio Mayer (Zurich), James Wadsley (McMaster)

High-res Galaxy Simulations





AGORA Comparison Infrastructure



AGORA Goal & Team

- GOAL: A multi-platform study to raise the realism and predictive power of high-resolution (<100 pc) galaxy simulations collectively
- TEAM: 4 task working groups and 9+ science working groups, 94 participants from 47 institutions as of 2nd Workshop, Aug. 2013
- DATA SHARE: Simulation data will be radpily available to public

- AGORA First light: Flagship paper by Ji-hoon Kim et al. (arXiv:1308.2669; www.AGORAsimulations.org) ApJS, 210, 14 (2014)
- Project funded in part by:

AGORA High-Resolution Simulation Comparison

Initial Conditions for Simulations

MUSIC galaxy masses at z~0: ~10^{10}, 10^{11}, 10^{12}, 10^{13} $M_\odot$
with both quiet and busy merging trees
isolation criteria agreed for Lagrangian regions

Isolated Spiral Galaxy at z~1: ~10^{12} $M_\odot$

Astrophysics that all groups will include

UV background (Haardt-Madau 2012), Grackle cooling code, stellar IMF, supernovea metal yields

Tools to compare simulations based on *yt*, to be available for all codes used in AGORA

Images and SEDs for all timesteps from *yt* ➠ *Sunrise*

www.AGORAsimulations.org

Key Earlier Galaxy Simulation Comparison

The Aquila comparison Project: The Effects of Feedback and Numerical Methods on Simulations of Galaxy Formation

C. Scannapieco,[1] M. Wadepuhl,[2] O.H. Parry,[3,4] J.F. Navarro,[5] A. Jenkins,[3] V. Springel,[6,7] R. Teyssier,[8,9] E. Carlson,[10] H.M.P. Couchman,[11] R.A. Crain,[12,13] C. Dalla Vecchia,[14] C.S. Frenk,[3] C. Kobayashi,[15,16] P. Monaco,[17,18] G. Murante,[17,19] T. Okamoto,[20] T. Quinn,[10] J. Schaye,[13] G. S. Stinson,[21] T. Theuns,[3,22] J. Wadsley,[11] S.D.M. White,[2] R. Woods[11]
2012 MNRAS 423, 1726

ABSTRACT

We compare the results of various cosmological gas-dynamical codes used to simulate the formation of a galaxy in the ΛCDM structure formation paradigm. **The various runs** (thirteen in total) differ in their numerical hydrodynamical treatment (SPH, moving-mesh and AMR) but **share the same initial conditions and adopt in each case their latest published model of gas cooling, star formation and feedback.** Despite the common halo assembly history, **we find large code-to-code variations in the stellar mass, size, morphology and gas content of the galaxy at z = 0, due mainly to the different implementations of star formation and feedback**. Compared with observation, **most codes tend to produce an overly massive galaxy, smaller and less gas-rich than typical spirals, with a massive bulge and a declining rotation curve**. A stellar disk is discernible in most simulations, although its prominence varies widely from code to code. There is a well-defined trend between the effects of feedback and the severity of the disagreement with observed spirals. In general, **models that are more effective at limiting the baryonic mass of the galaxy come closer to matching observed galaxy scaling laws, but often to the detriment of the disk component.** Although numerical convergence is not particularly good for any of the codes, our conclusions hold at two different numerical resolutions. Some differences can also be traced to the different numerical techniques; for example, more gas seems able to cool and become available for star formation in grid-based codes than in SPH. However, this effect is small compared to the variations induced by different feedback prescriptions. **We conclude that state-of-the-art simulations cannot yet uniquely predict the properties of the baryonic component of a galaxy, even when the assembly history of its host halo is fully specified. Developing feedback algorithms that can effectively regulate the mass of a galaxy without hindering the formation of high-angular momentum stellar disks remains a challenge.**

Aquila Comparison Project

Code	Reference	Type	UV background ($z_{\rm UV}$)	UV background (spectrum)	Cooling	Feedback
G3 (GADGET3)	[1]	SPH	6	[10]	primordial [13]	SN (thermal)
G3-BH	[1]	SPH	6	[10]	primordial [13]	SN (thermal), BH
G3-CR	[1]	SPH	6	[10]	primordial [13]	SN (thermal), BH, CR
G3-CS	[2]	SPH	6	[10]	metal-dependent [14]	SN (thermal)
G3-TO	[3]	SPH	9	[11]	element-by-element [15]	SN (thermal+kinetic)
G3-GIMIC	[4]	SPH	9	[11]	element-by-element [15]	SN (kinetic)
G3-MM	[5]	SPH	6	[10]	primordial [13]	SN (thermal)
G3-CK	[6]	SPH	6	[10]	metal-dependent [14]	SN (thermal)
GAS (GASOLINE)	[7]	SPH	10	[12]	metal-dependent [16]	SN (thermal)
R (RAMSES)	[8]	AMR	12	[10]	metal-dependent [14]	SN (thermal)
R-LSFE	[8]	AMR	12	[10]	metal-dependent [14]	SN (thermal)
R-AGN	[8]	AMR	12	[10]	metal-dependent [14]	SN (thermal), BH
AREPO	[9]	Moving Mesh	6	[10]	primordial [13]	SN (thermal)

All simulations share the same initial conditions a zoomed-in resimulation of the Aquarius Project halo "Aq-C".

Code	$f_{\rm b}$ ($\Omega_{\rm b}/\Omega_{\rm m}$)	$m_{\rm DM}$ [$10^6 {\rm M}_\odot$]	$m_{\rm gas}$ [$10^6 {\rm M}_\odot$]	Softening $\epsilon_{\rm g}^{z=0}$ [kpc]	Softening $z_{\rm fix}$
G3 G3-BH G3-CR G3-CS G3-CK Arepo	0.16	2.2 (17)	0.4 (3.3)	0.7 (1.4)	0 (0)
G3-TO G3-GIMIC	0.18	2.1 (17)	0.5 (3.7)	0.5 (1)	3 (3)
G3-MM	0.16	2.2 (17)	0.4 (3.3)	0.7 (1.4)	2 (2)
GAS	0.18	2.1 (17)	0.5 (3.7)	0.46 (0.9)	8 (8)
R R-LSFE R-AGN	0.16	1.4 (11)	0.2 (1.8)	0.26 (0.5)	9 (9)

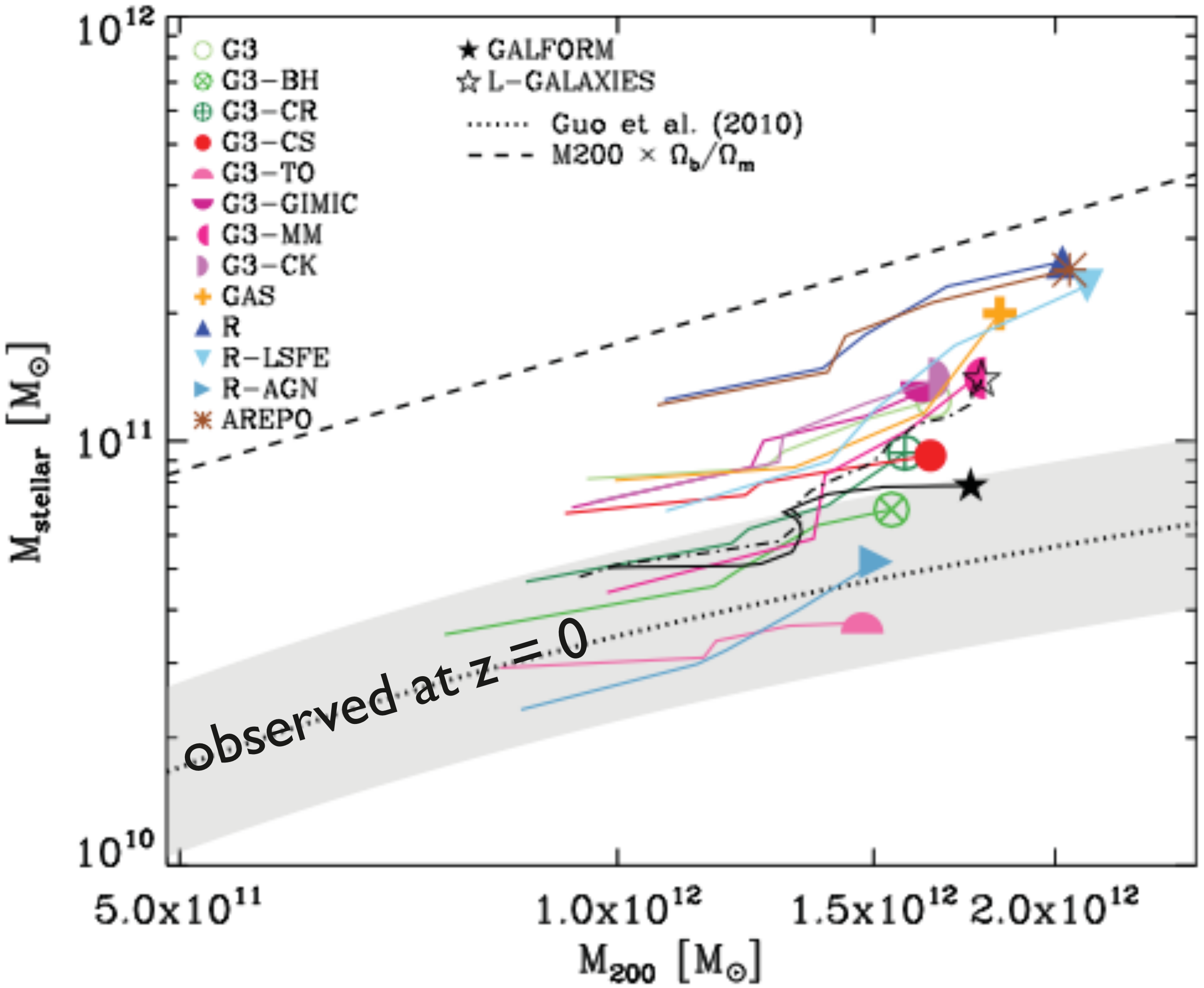
Most stars form in galactic disks, so realistic simulations should resolve disks. The scale height of the MWy disk is about 100 pc. It's better yet to resolve GMCs, 10s of pc.

Softening is 500 pc or worse (fixed in comoving coordinates at $z = z_{\rm fix}$).

Softening is 260 pc (fixed in comoving coordinates at $z_{\rm fix} = 9$)

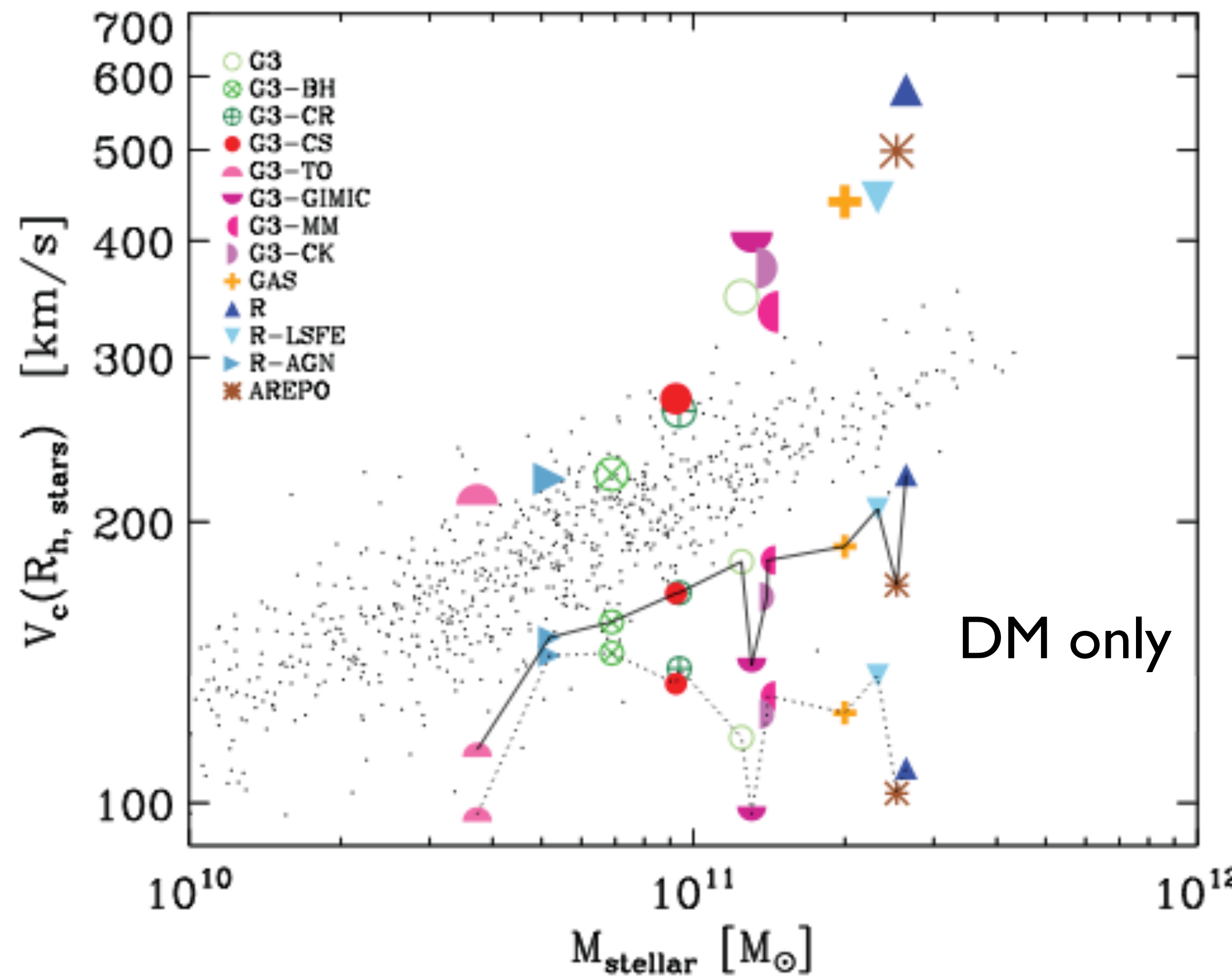
Aquila Comparison Project

$M_{stellar}$ vs M_{vir}



Curves track evolution z = 2 to 0.

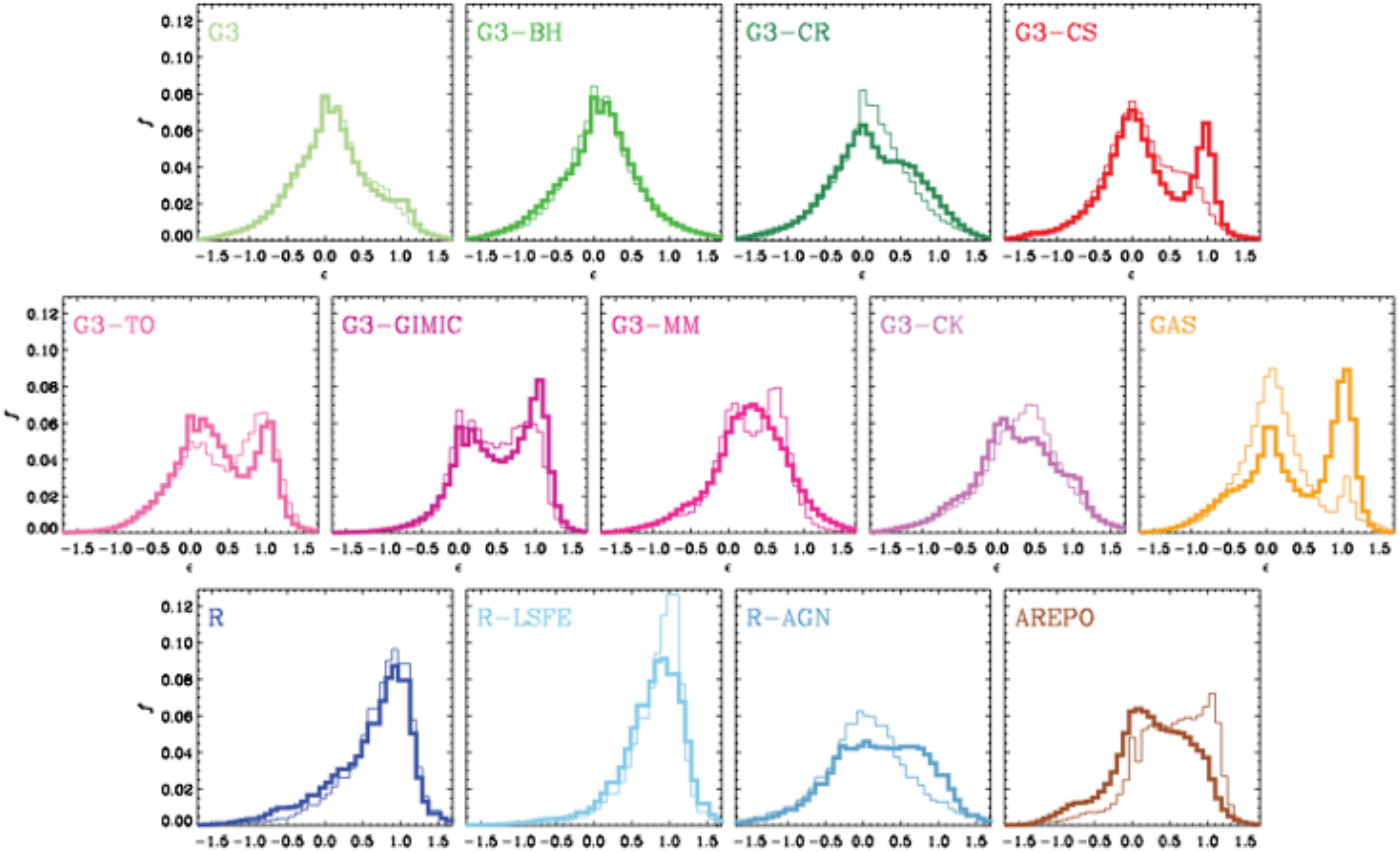
Tully-Fisher Relation

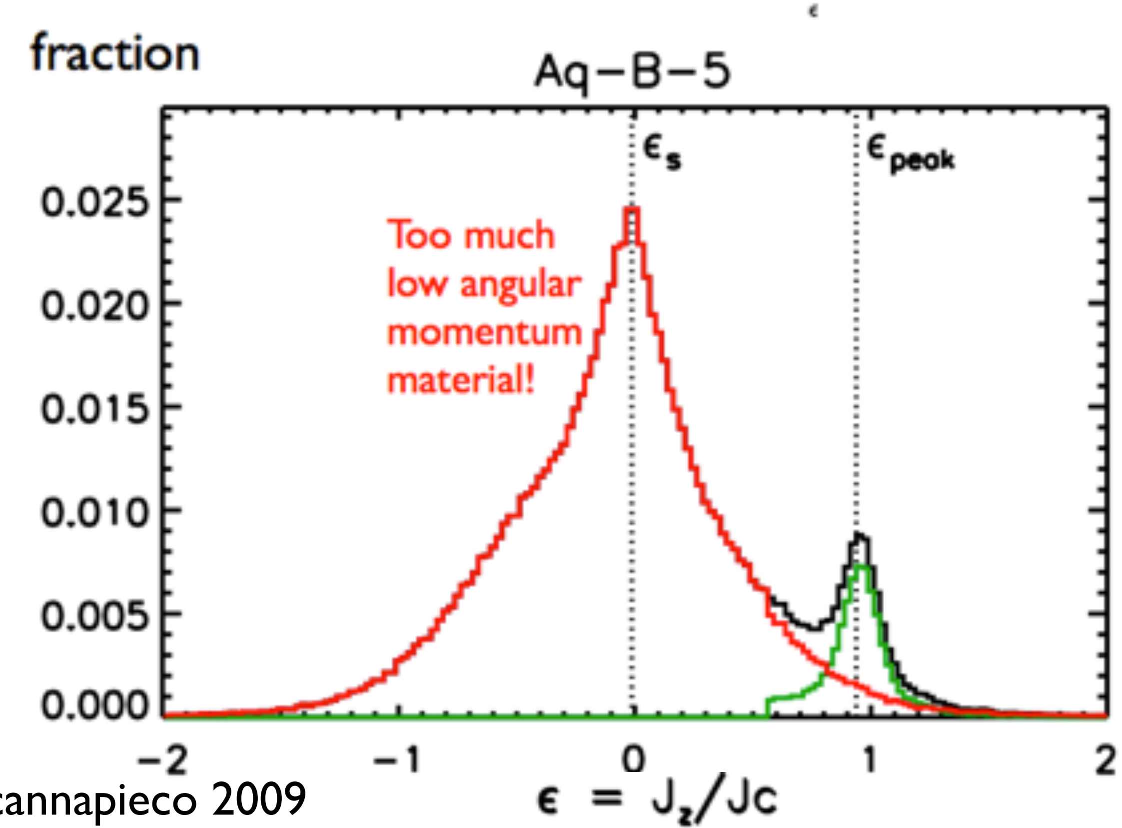


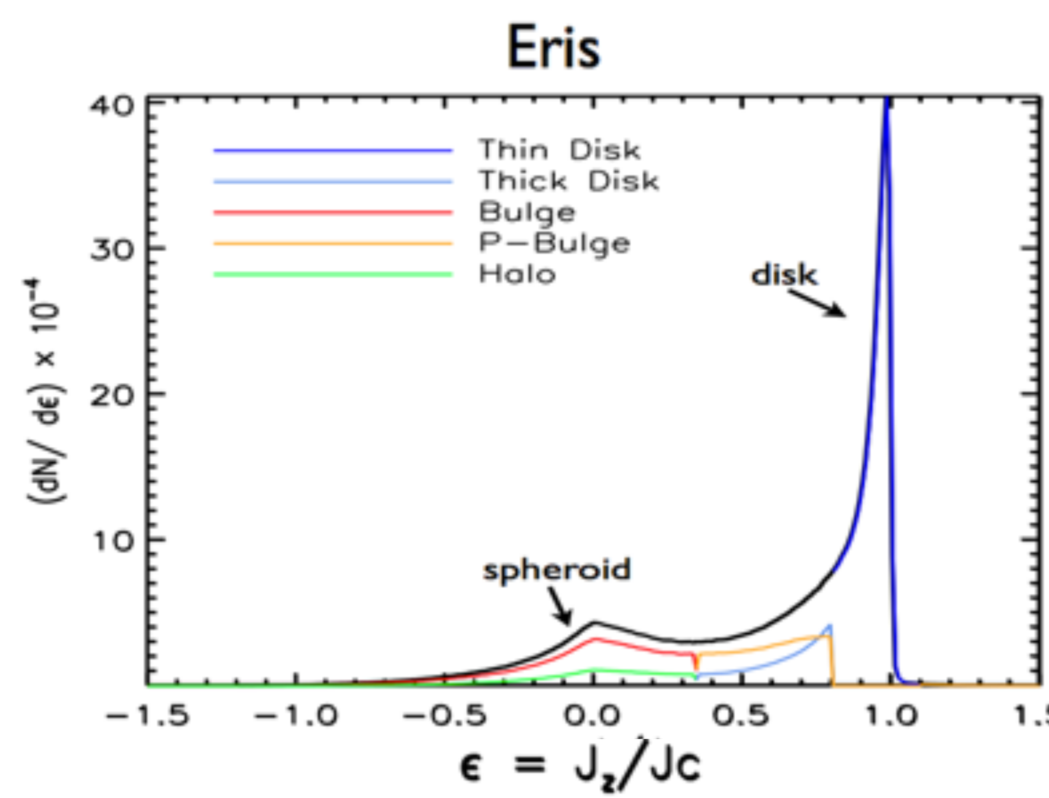
Circular velocity at stellar half-mass radius.

Aquila Comparison Project Stellar Circularities

$$\frac{j_z}{R\,V_{circ}(R)}$$







C. Scannapieco 2009

AGORA High-Resolution Simulation Comparison

AGORA Goals

(1) Inaugurate framework to compare high-resolution galaxy simulations (with resolution better than ~100 parsecs) across different high-resolution numerical platforms

(2) Establish cosmological and isolated disk initial conditions and shared astrophysics so each participating group can run a suite of simulations

(3) Maintain the collaboration online (telecon+webpage) between the in-person meetings

(4) Compare simulations with each other, with theory, and with observations

(5) Produce a set of simulation comparisons and scientific papers starting ~ 2014

AGORA Is Timely

We are launching this project at the time when several key technologies have just become available including

the **MUlti-Scale Initial Conditions generator (MUSIC)**,
the new **UV-background model CUBA,**
the new **Grackle hydro cooling code**,
several of the **simulation codes**, and
the **yt code for analyzing the outputs** from all the simulations in a parallel way, including using Nvidia GPUs to generate **visualizations on the fly**.

This project will be state-of-the-art, and it will surely advance the entire field of galaxy simulations.

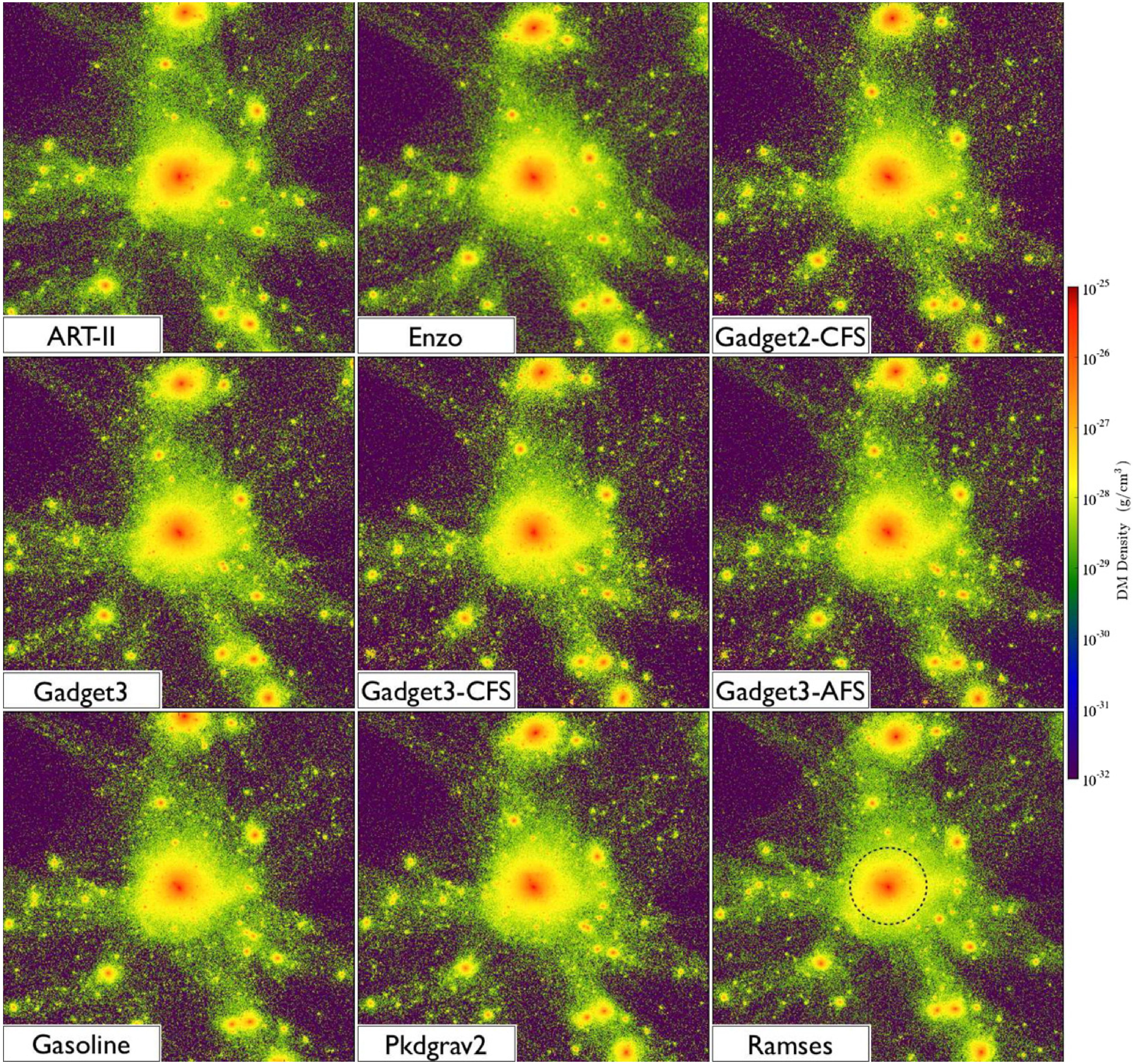
The Astrophysical Journal Supplement Series, 210:14 (20pp), 2014 January

THE AGORA HIGH-RESOLUTION GALAXY SIMULATIONS COMPARISON PROJECT

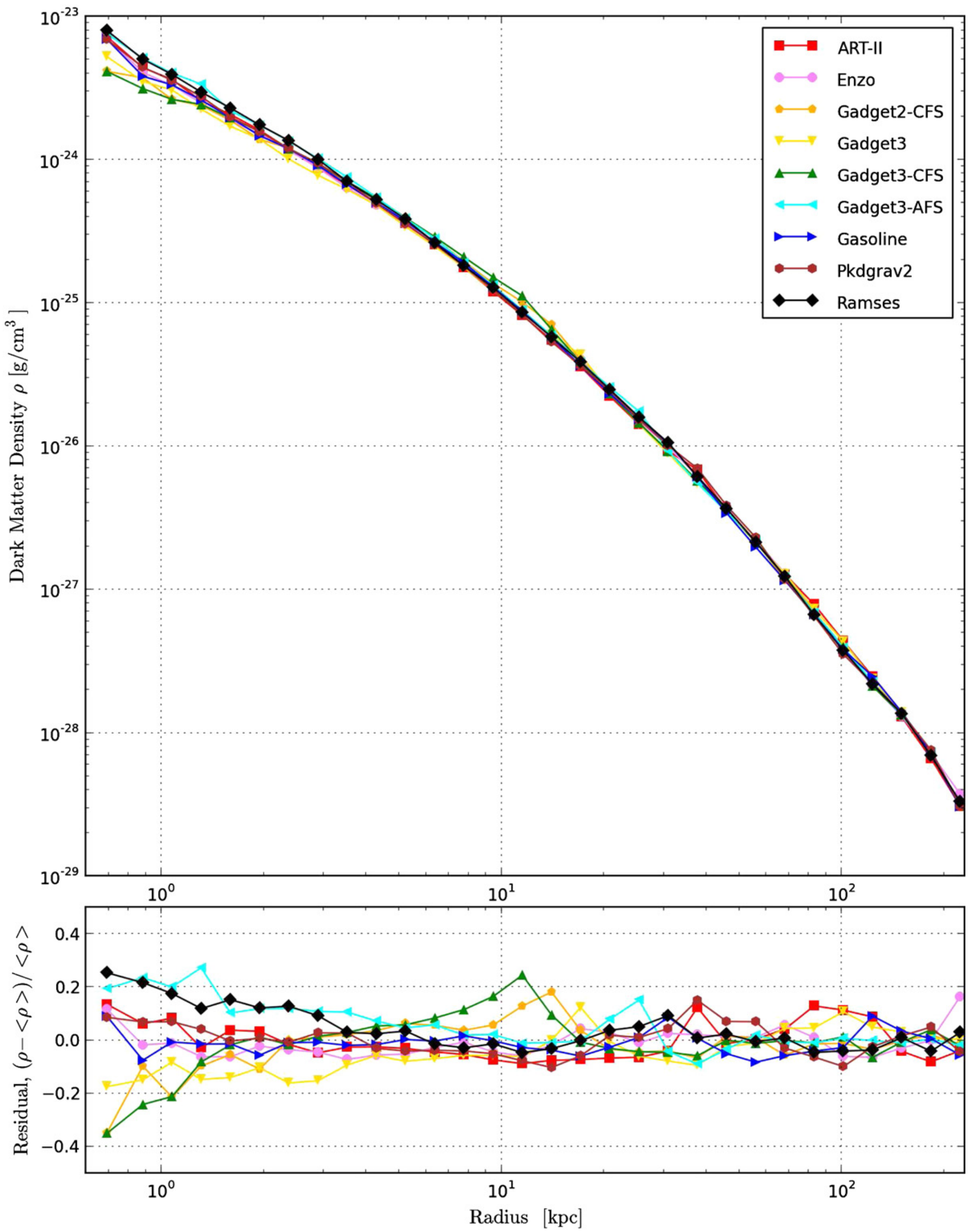
Ji-hoon Kim[1], Tom Abel[2], Oscar Agertz[3,4], Greg L. Bryan[5], Daniel Ceverino[6], Charlotte Christensen[7], Charlie Conroy[1], Avishai Dekel[8], Nickolay Y. Gnedin[3,9,10], Nathan J. Goldbaum[1], Javiera Guedes[11], Oliver Hahn[11], Alexander Hobbs[11], Philip F. Hopkins[12,13], Cameron B. Hummels[7], Francesca Iannuzzi[14], Dusan Keres[15], Anatoly Klypin[16], Andrey V. Kravtsov[3,10], Mark R. Krumholz[1], Michael Kuhlen[1,13], Samuel N. Leitner[17], Piero Madau[1], Lucio Mayer[18], Christopher E. Moody[1], Kentaro Nagamine[19,20], Michael L. Norman[15], Jose Onorbe[21], Brian W. O'Shea[22], Annalisa Pillepich[1], Joel R. Primack[23], Thomas Quinn[24], Justin I. Read[4], Brant E. Robertson[7], Miguel Rocha[21], Douglas H. Rudd[10,25], Sijing Shen[1], Britton D. Smith[22], Alexander S. Szalay[26], Romain Teyssier[18], Robert Thompson[7,19], Keita Todoroki[19], Matthew J. Turk[5], James W. Wadsley[27], John H. Wise[28], and Adi Zolotov[8]
for the AGORA Collaboration[29]

ABSTRACT

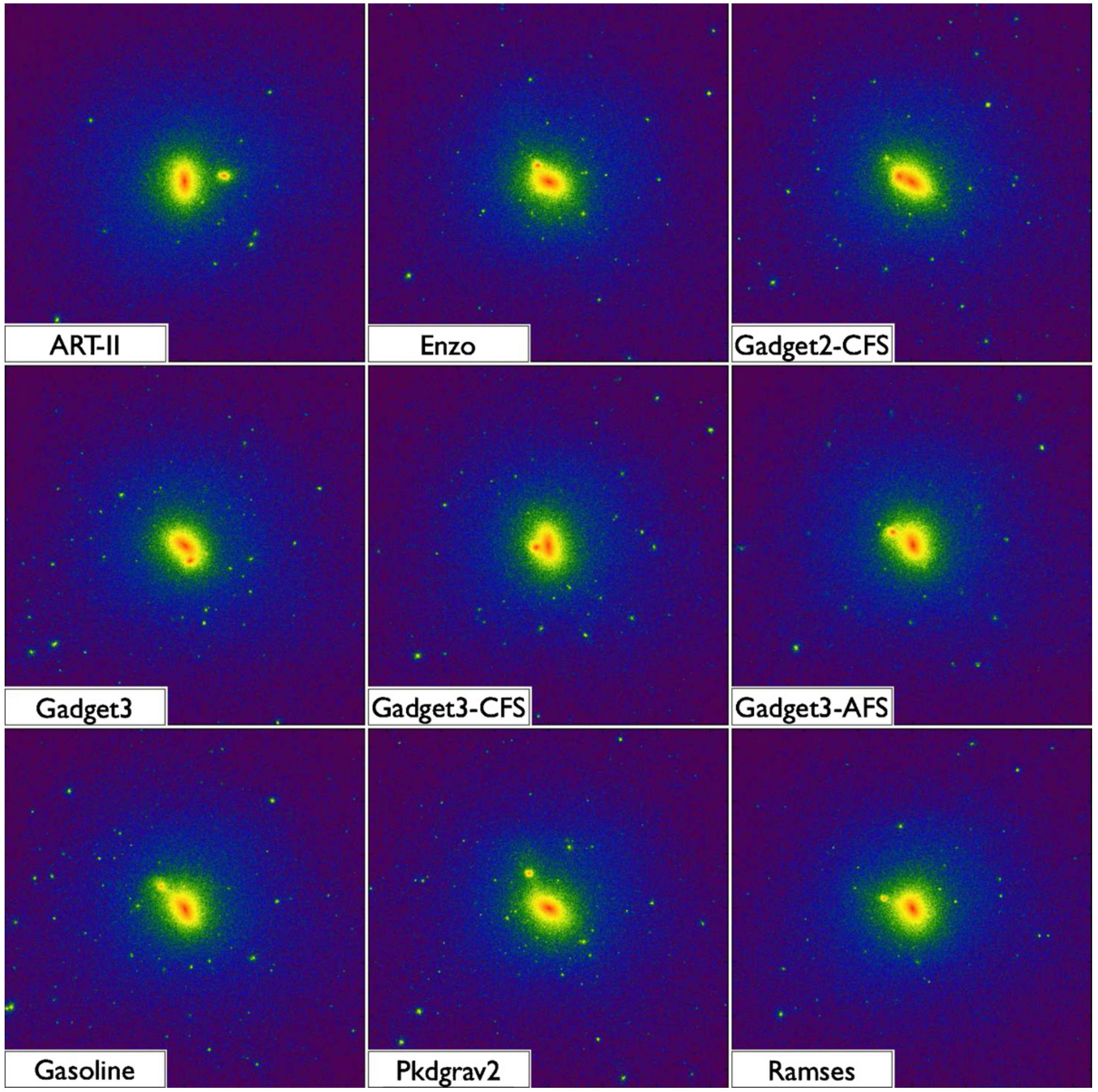
We introduce the Assembling Galaxies Of Resolved Anatomy (AGORA) project, a comprehensive numerical study of well-resolved galaxies within the ΛCDM cosmology. Cosmological hydrodynamic simulations with force resolutions of ∼100 proper pc or better will be run with a variety of code platforms to follow the hierarchical growth, star formation history, morphological transformation, and the cycle of baryons in and out of eight galaxies with halo masses $M_{\rm vir} \simeq 10^{10}$, 10^{11}, 10^{12}, and $10^{13}\,M_\odot$ at $z = 0$ and two different ("violent" and "quiescent") assembly histories. The numerical techniques and implementations used in this project include the smoothed particle hydrodynamics codes Gadget and Gasoline, and the adaptive mesh refinement codes Art, Enzo, and Ramses. The codes share common initial conditions and common astrophysics packages including UV background, metal-dependent radiative cooling, metal and energy yields of supernovae, and stellar initial mass function. These are described in detail in the present paper. Subgrid star formation and feedback prescriptions will be tuned to provide a realistic interstellar and circumgalactic medium using a non-cosmological disk galaxy simulation. Cosmological runs will be systematically compared with each other using a common analysis toolkit and validated against observations to verify that the solutions are robust—i.e., that the astrophysical assumptions are responsible for any success, rather than artifacts of particular implementations. The goals of the AGORA project are, broadly speaking, to raise the realism and predictive power of galaxy simulations and the understanding of the feedback processes that regulate galaxy "metabolism." The initial conditions for the AGORA galaxies as well as simulation outputs at various epochs will be made publicly available to the community. The proof-of-concept dark-matter-only test of the formation of a galactic halo with a $z = 0$ mass of $M_{\rm vir} \simeq 1.7 \times 10^{11}\,M_\odot$ by nine different versions of the participating codes is also presented to validate the infrastructure of the project.



ART-II
Enzo
Gadget2-CFS
Gadget3
Gadget3-CFS
Gadget3-AFS
Gasoline
Pkdgrav2
Ramses
DM Density (g/cm^3)
10^{-25}
10^{-26}
10^{-27}
10^{-28}
10^{-29}
10^{-30}
10^{-31}
10^{-32}



Top: a composite radial profile of dark matter density centered on the target halo at z = 0 formed in the proof-of-concept dark-matter-only tests by nine different versions of the participating codes. Each profile is generated with the common analysis toolkit yt. Bottom: fractional deviation from the mean of these profiles.



Compilation of nine maps of density-weighted projection of squared dark matter density from the proof-of-concept dark-matter-only tests by nine different versions of the participating codes in 200 h^{-1} kpc boxes at z = 0. The field of view for each panel approximately matches the extent of the virial radius of the host halo (R_{vir} ≃ 150 kpc). Panels generated on the common analysis yt platform.

Just one big problem: like the blind men studying only parts of the elephant but whose observational results are not consistent for the entire animal, astrophysicists have been able to model only parts of the universe because of limits to computational power. And the computer models have been inconsistent. Yet reproducibility is a fundamental principle of the scientific method: only if a result from an experiment can be independently reproduced by other scientists can it be regarded as robust.

Now, a new ambitious multiyear international project AGORA is figuring out how to reveal the entire elephant--and also discern which of the inconsistencies are due to complexities of astrophysics versus computational issues.

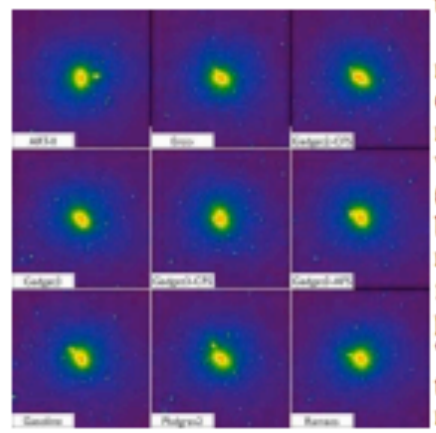
Trudy Bell

AstroShort

AGORA: Seeing the Invisible Elephant

You know the familiar fable about the blind men trying to discern the nature of an elephant simply from feeling the animal with their hands: one at the side of the elephant thought it was like a wall, one at the trunk thought it was like a snake, and one at the tail thought it was like a rope. Each accurately perceived the elephant in part, but their tactile observations were inconsistent with one another.

Astronomers are much in the same position in trying to discern the nature of the Universe. Most of the gravitating mass in the cosmos is cold dark matter—a slowly moving, weakly interacting elementary particle that holds together both individual galaxies such as our own Milky Way as well as entire clusters of hundreds of galaxies. But humans are blind to it: dark matter does not emit light or other electromagnetic radiation.



Differences in supercomputer simulations to be compared in the AGORA project are clearly evident in this test galaxy produced by each of nine different versions of participating codes using the same astrophysics and starting with the same initial conditions. The goal of AGORA is to analyze such differences to improve the realism and predictive power of supercomputer simulations, and thus astronomers' understanding of astrophysical processes. Credit: Simulations performed by Samuel Leitner (ART-II), Ji-hoon Kim (ENZO), Oliver Hahn (GADGET-2-CFS), Keita Todoroki (GADGET-3), Alexander Hobbs (GADGET-3-CFS and GADGET-3-AFS), Sijing Shen (GASOLINE), Michael Kuhlen (PKDGRAV-2), and Romain Teyssier (RAMSES)

Thus, astrophysicists must rely on two tools to discern dark matter's nature: 1) observations of visible ordinary matter (which scientists call baryonic matter) that reveal dark matter's effects, and 2) supercomputer simulations to "reverse engineer" and test ideas of how dark matter might interact with ordinary matter to form galaxies.

Just one big problem: like the blind men studying only parts of the elephant but whose observational results are not consistent for the entire animal, astrophysicists have been able to model only parts of the universe because of limits to computational power. And the computer models have been inconsistent. Yet reproducibility is a fundamental principle of the scientific method: only if a result from an experiment can be independently reproduced by other scientists can it be regarded as robust.

Now, a new ambitious multiyear international project AGORA is figuring out how to reveal the entire elephant—and also discern which of the inconsistencies are due to complexities of astrophysics versus computational issues.

The challenge of scales

One major challenge, for example, has been numerically modeling astrophysical processes over the vast range of size scales in the Universe—all the way from the formation of individual stars to the formation of galaxies to the formation of the cosmic web of large-scale structure in the cosmos. At small scales, computational models can calculate such details as shock waves from supernova explosions, turbulence, and chemical composition of gas and dust with a resolution (ability to discern details) the size of our solar system. At gigantic scales, cosmological simulations trace the evolution of the cosmic web in volumes hundreds of millions of lightyears across. At such scale, even the biggest supercomputers have been limited to handling just gravitational interactions of dark matter, if calculations are to be completed in reasonable time (months) and at affordable cost.

And in the real Universe, both size scales interact: local star formation within individual galaxies is activated or quenched by the way galaxies "breathe" in and out the gaseous intergalactic medium. Often computational simulations do not create realistic-looking galaxies with the right proportion of stars in the central bulge compared with the flat disk or the right amount of clumpiness.

Major international collaboration

Now supercomputers are starting to have the computational power to simulate large regions of the cosmos with sufficient resolution and realism to create galaxies that look like ones actually observed. AGORA—an ancient Greek word for meeting place, and an acronym for Assembling Galaxies of Resolved Anatomy—aims to understand and resolve inconsistencies revealed among simulations.

AGORA got its start in a kick-off workshop at the University of California, Santa Cruz, in August 2012, under the sponsorship of the University of California High-Performance AstroComputing Center (UC-HiPACC). A second workshop was held at UCSC in August 2013.

AGORA, a collaboration of more than 90 astrophysicists and computational modelers in over 40 institutions in eight nations, is described in a flagship paper by Ji-hoon Kim and 45 co-authors that has been accepted for publication in *The Astrophysical Journal Supplement*. The collaborators have set up methodology to compare and contrast the results with nine variants of different codes (programs for computer simulations), which numerically handle the physics and the computation in significantly different ways. Although not the first comparison of supercomputer simulations of galaxy evolution, AGORA is the most comprehensive and the highest-resolution (finest detail). The project is expected to be completed in 2015 and result in many papers. Stay tuned! –*Trudy E. Bell, M.A.*

Further reading: The AGORA website is at https://sites.google.com/site/santacruzcomparisonproject/. A UC-HiPACC press release is at http://hipacc.ucsc.edu/PressRelease/AGORA.html. A UC Santa Cruz press release at http://news.ucsc.edu/2013/12/agora-project.html. The flagship paper preprint "The *AGORA* High-Resolution Galaxy Simulations Comparison Project," for *Astrophysical Journal Supplement*, is at http://arxiv.org/abs/1308.2669/.

The University of California High-Performance AstroComputing Center (UC-HIPACC), based at the University of California, Santa Cruz, is a consortium of nine University of California campuses and three affiliated Department of Energy laboratories (Lawrence Berkeley Lab, Lawrence Livermore Lab, and Los Alamos National Lab). UC-HIPACC fosters collaborations among researchers at the various sites by offering travel and other grants, co-sponsoring conferences, and drawing attention to the world-class resources for computational astronomy within the University of California system. More information appears at http://hipacc.ucsc.edu

Competitive Cooperation

Project AGORA Workspace

Workspace Home | Task-oriented WGs | Science-oriented WGs | Collaborative Docs | Simulations Tracker (TBA) | Contacts/Info

Navigation

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- AGORA Public Webpage
- Sitemap

582
days since
the project launch on
08/17/2012

Recent site activity

Discussion Agenda 03/25/2014
edited by Ji-hoon Kim

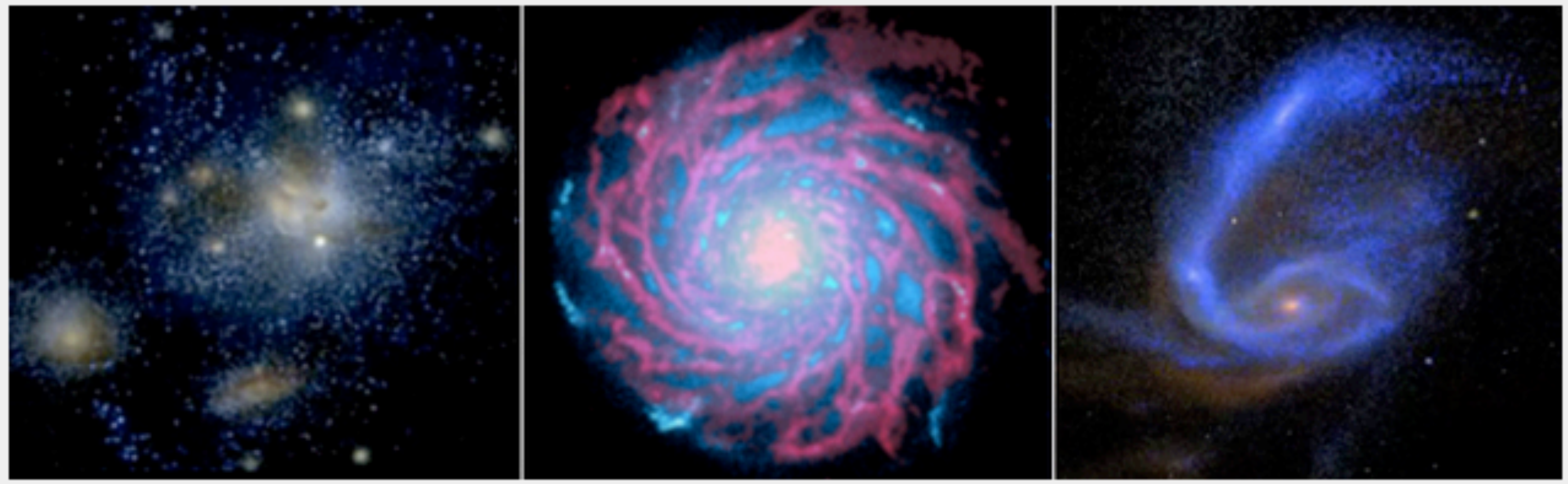
[Paper "4"] Isolated Disk Simulations
edited by Oscar Agertz

[Paper "1"] DM-only Run of A ~1e11 Ms Halo for the Flagship Paper
edited by Ji-hoon Kim

Discussion Agenda 03/25/2014
edited by Ji-hoon Kim

[Paper "1"] DM-only Run of A ~1e11 Ms Halo for the Flagship Paper

Workspace Home



Welcome!

Welcome to AGORA Workspace! If you are looking for the common ICs and examples of common analysis yt scripts used in the Project, see these **quick links**.

This is a Wiki

This workspace is a Wiki with a WYSIWYG interface. A registered collaboration member has a full permission to edit the content of the entire webpage. You may learn how to use this interface **here**. We ask the members to respect each other's contribution, and restrain themselves from an invasive change.

Because this page is hosted by Google without charge, we do not have a lot of disk space (only 100 MB available). If you'd like to share a big file in your working group, we kindly ask you to post only the link to the file that is stored locally in your institutions.

Collaboration Blog

AGORA Flagship Paper Accepted / Press Releases The Flagship paper was accepted by the ApJS in November 2013, and published in January 2014 (local version). The published version of the manuscript is also available on the ...
Posted Mar 5, 2014, 9:29 AM by Ji-hoon Kim

One-slide Introduction of AGORA Thanks greatly to the help of Fabio Governato and Piero Madau, we have created a one-slide introduction of the AGORA Project. Please feel free to use this slide in ...
Posted Sep 6, 2013, 6:07 PM by Ji-hoon Kim

Quick Links Quick links for the new members of the AGORA Project. Contact us if you have any question![1] Common Physics Package: – Described in Section 3 of the Flagship paper[arXiv ...
Posted Sep 6, 2013, 6:09 PM by Ji-hoon Kim

Showing posts 1 - 3 of 7. View more »

www.AGORAsimulations.org

AGORA Task-Oriented Working Groups

	Working Group	Objectives and Tasks
T1	Common Astrophysics	UV background, metal-dependent cooling, IMF, metal yields
T2	ICs: Isolated	common initial conditions for isolated low-z disk galaxies
T3	ICs: Cosmological	common initial conditions for cosmological zoom-in simulations
T4	Common Analysis	support `yt` and other analysis tools, define quantitative and physically meaningful comparisons across simulations

AGORA Science Working Groups

	Working Group	Science Questions (includes, but not limited to)
S1	Isolated Galaxies and Subgrid Physics	tune the subgrid physics across platforms to produce similar results for similar astrophysical assumptions
S2	Dwarf Galaxies	simulate $\sim 10^{10} M_\odot$ halos, compare results across all platforms
S3	Dark Matter	radial profile, shape, substructure, core-cusp problem
S4	Satellite Galaxies	effects of environment, UV background, tidal disruption
S5	Galactic Characteristics	surface brightness, stellar properties, metallicity, images, SEDs
S6	Outflows	outflows, circumgalactic medium, metal absorption systems
S7	High-redshift Galaxies	cold flows, clumpiness, kinematics, Lyman-limit systems
S8	Interstellar Medium	galactic interstellar medium, thermodynamics
S9	Massive Black Holes	black hole growth and feedback in galactic context

Thanks to the National Energy Research Scientific Computing (NERSC) Center at LBL ...

We have 100 TB of workspace for 10 AGORA simulation teams, and 5M cpu-hrs to analyze simulations using yt to create images and videos on the fly using GPUs, and to produce *Sunrise* images of simulated galaxies including stellar evolution and scattering, absorption, and reemission of light by dust. Each team has agreed to store 200 time steps at agreed scale factors, and each will make their results available to the collaboration when they are satisfied that they are ready. The science working groups will compare simulations with each other, with fundamental theory, and with observations. The Steering Committee is helping to keep the AGORA project focused on cooperation, getting quick results, and making our simulations widely available. Most of the science working groups are led by young astrophysicists, who are eager to write papers quickly. I hope that AGORA will be a model for future efforts at competitive coopertation.