
Surrounding matters . . .
Surrounding Matter Theory (**SMT**)
Nessie molecular cloud, Spitzer Space Telescope, NASA.

Introduction

- Presentation
- SMT is:
  - a new model (2015)
  - An alternative to dark matter, a modification of Newton’s law

Content of the presentation

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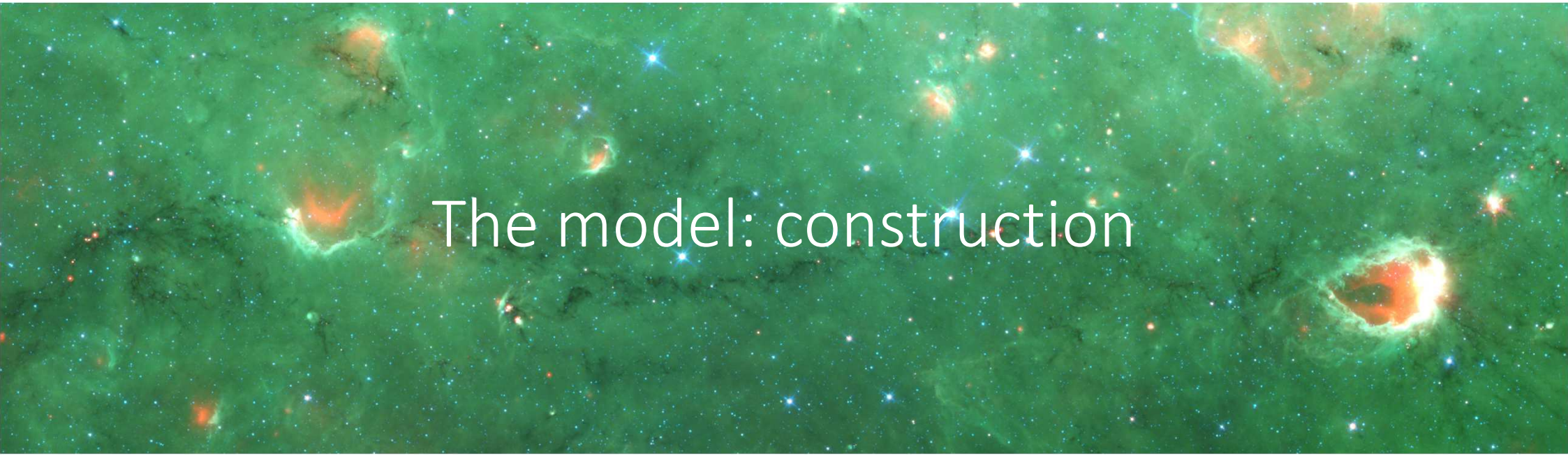
- Introduction
- Content of the presentation
- The model
- Behaviour of the model
- Back to theory
- Caveats and limitations
- What next ?
- Summary
- Discussion

The model



The model: construction

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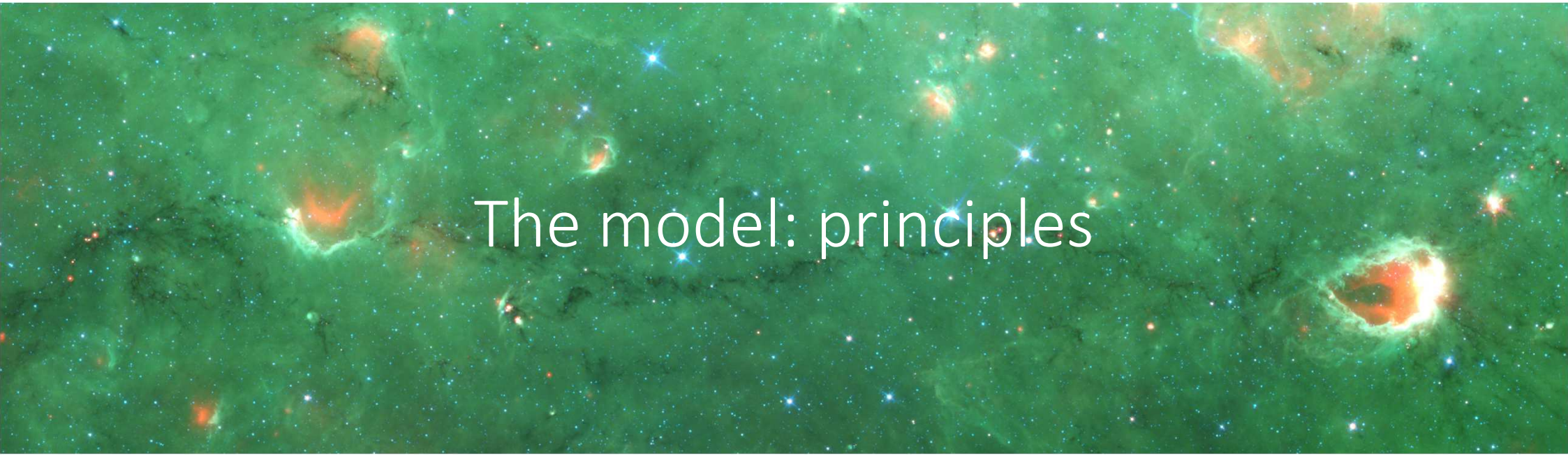
- 1987 : first ideas
- 1999 : the Three Elements Theory (unpublished rough and big draft)
- 2011 : publication of the 1rst article : Gravitational Model of the Three Elements Theory (IJMP 2011)
- 2013 : publication of a 2nd article describing some maths (JMP 2013).
- 2015 : copyright and submission of the 3rd article : **SMT**
- 2018 : publication of **SMT** (EPJ 2018, COSMOLOGY ON SMALL SCALES 2018).



The model: principles

The model: principles

- Remarks about General Relativity (GR):
  - Singularities, closed time-like curves, Mach's principle, over-densities.

- « Surrounding » model as an answer to those remarks:
  - Re-using absolute matter density,
  - at the location where the force is exerted.

The model: equations

Non relativistic equation

This Newtonian potential $\Phi_n = -\frac{MG}{x}$

is multiplied by a factor : $\Phi = -\frac{MG}{x}\underbrace{\frac{\alpha_0\rho_0 + \rho_{u0}}{\alpha\rho + \rho_u}}_{C_{SMT}}$

ρ is mass density at the location where the force is applied.
ρ_0 is today's value of mass density in the vicinity of the sun.
ρ_u is the Universe mass density.
ρ_{u0} is today's Universe mass density.
α is 1 outside of any galaxy, and $\alpha = \alpha_0 = 1.6\,10^{-5}$ inside a galaxy.

Relativistic version

$$R_{\mu\nu} - \frac{1}{2} R g_{\mu\nu} = \frac{8\pi G}{c^4} S_{\mu\nu}$$

$$S_{\mu\nu} = C_{\mu}^{l} C_{\nu}^{m} T_{lm}$$

$$C_0^{\nu} = \sqrt{C_{SMT}}\,\delta_0^{\nu} \qquad C_i^{\nu} = \sqrt{s}\,\delta_i^{\nu}$$

Lagrangian

$$L_{SMT} = \int \sqrt{-g}\, R_{SMT} dx^4 + L_M + L_{CSMT}$$

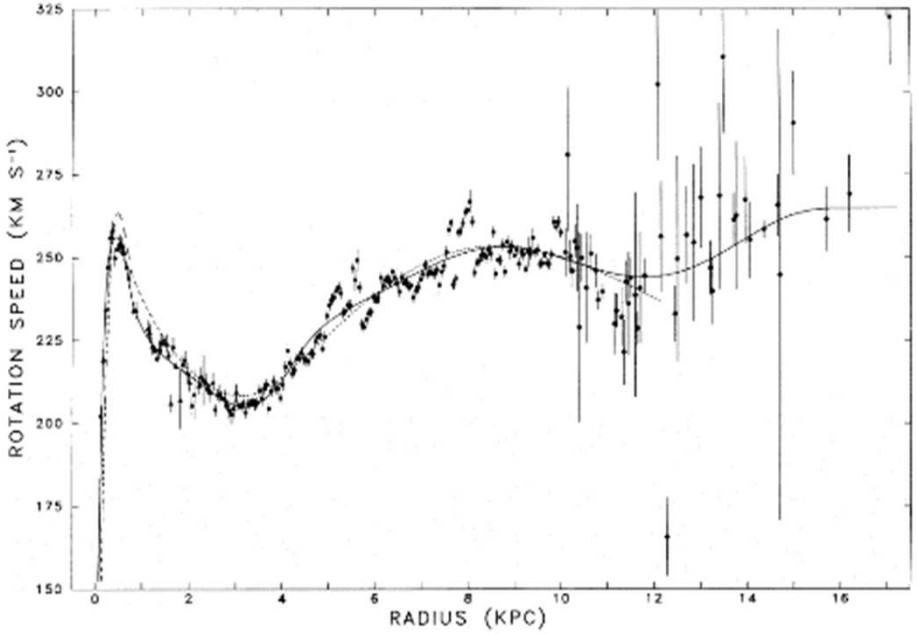
Behaviour of the model

Virial theorem

Supposing IGM matter density over
Universe density being equal to $\rho_{IGM} / \rho_{u0} = 7$

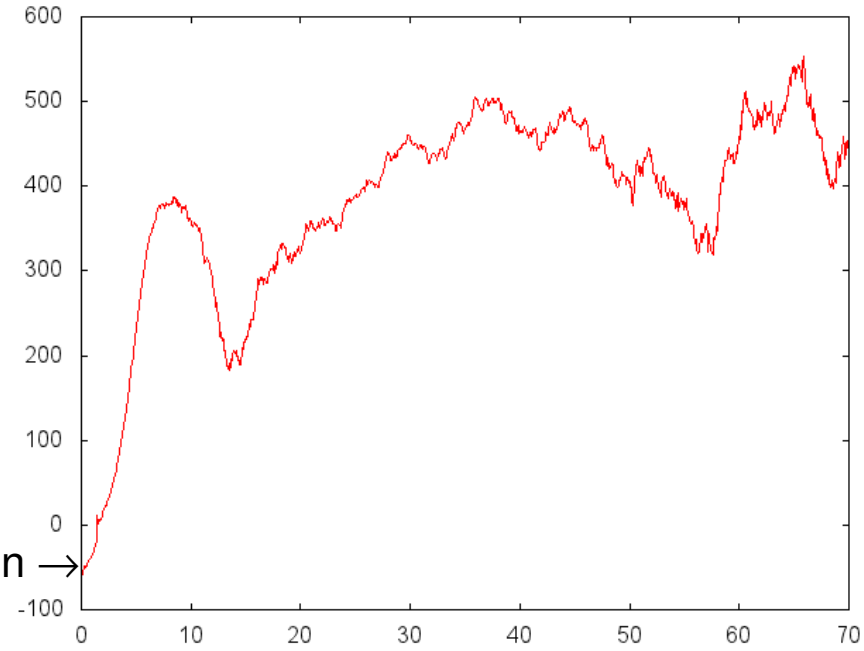
=> G is **5 times** greater : $C_{SMT} = \frac{\alpha_0 \rho_0 + \rho_{u0}}{\rho_{IGM} + \rho_{u0}} = 5$

Simulated galaxies: speed profiles



← Reality*

SMT prediction →



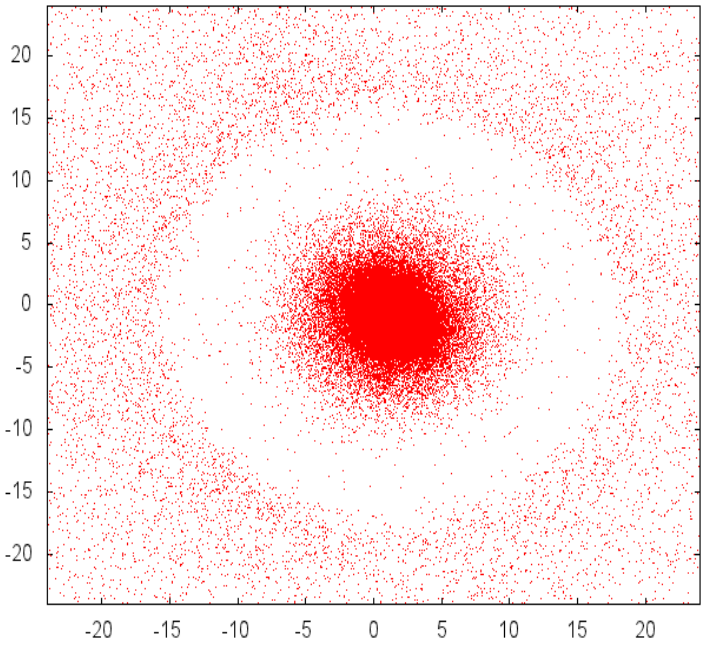
* : Milky-Way speed profile. Clemens 1985, ApJ

Simulated galaxies: ring galaxies

Self-generated ring galaxies :

← Reality (Hoag's object)*

SMT prediction →



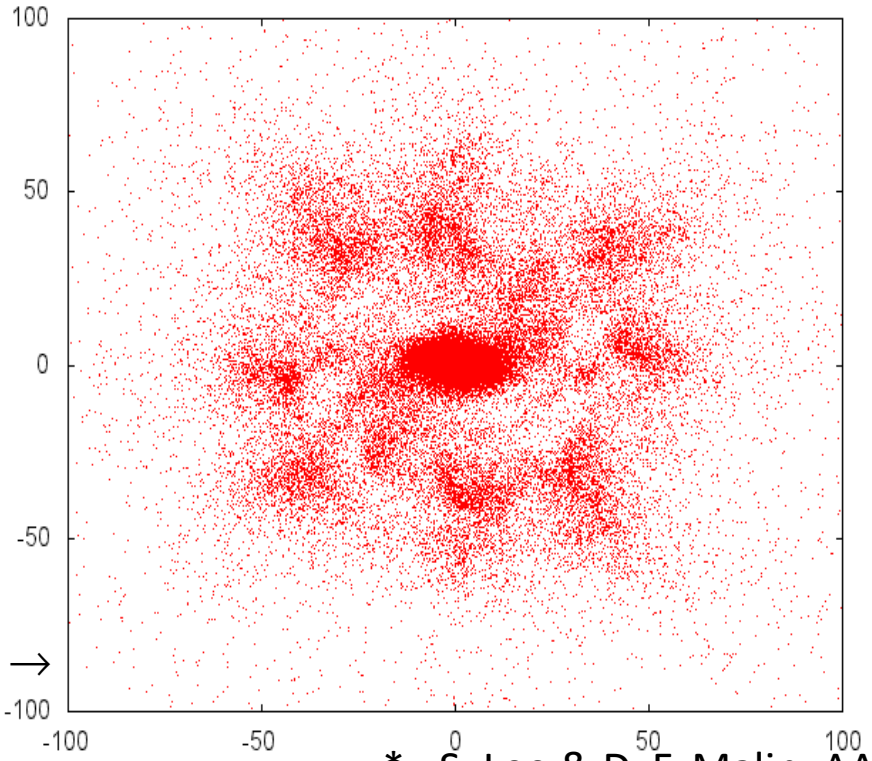
* : NASA and The Hubble Heritage Team (STScI/AURA)

Simulated galaxies: structure

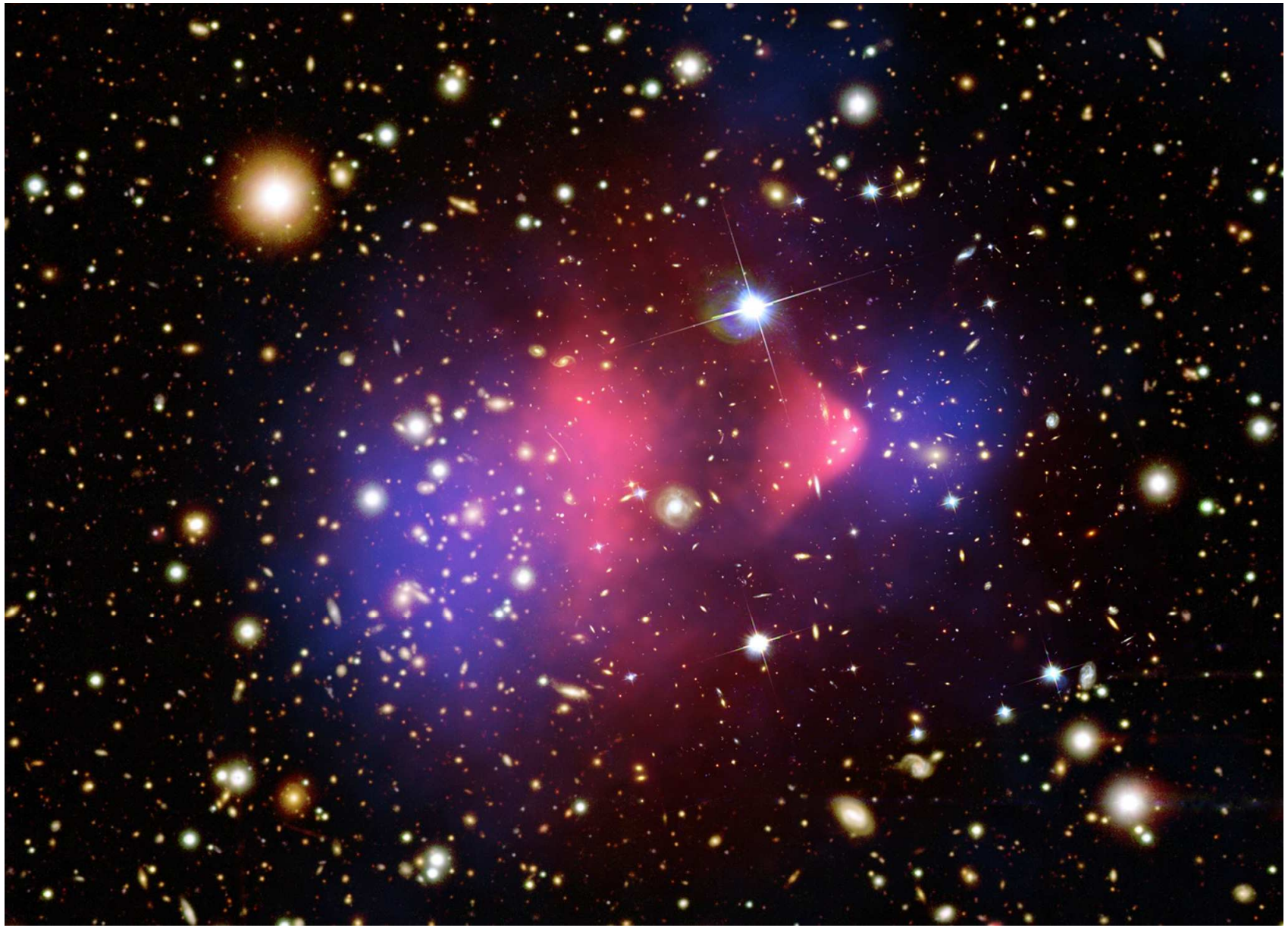
- fully unrolled arms,
- fast rotating bars,
- self-generated dwarf galaxies
- ….

← NGC 1300*

SMT prediction →



* : S. Lee & D. F. Malin, AAO



Composite Credit: X-ray: NASA/CXC/CfA/ M. Markevich et al.; Lensing Map: NASA/STScI; ESO WFI; Magellan/U.Arizona/ D.Clowe et al. Optical: NASA/STScI; Magellan/U.Arizona/D.Clowe et al.;

Bullet cluster: attraction of the gas

Potential of the attracting gas :

$$\Phi_g(M) \propto \frac{\frac{G}{d(M,N)} * \rho_g(N)}{D_M(N) * \rho_g(N)}$$

$\rho_g(N)$ is the mass density of the gas.

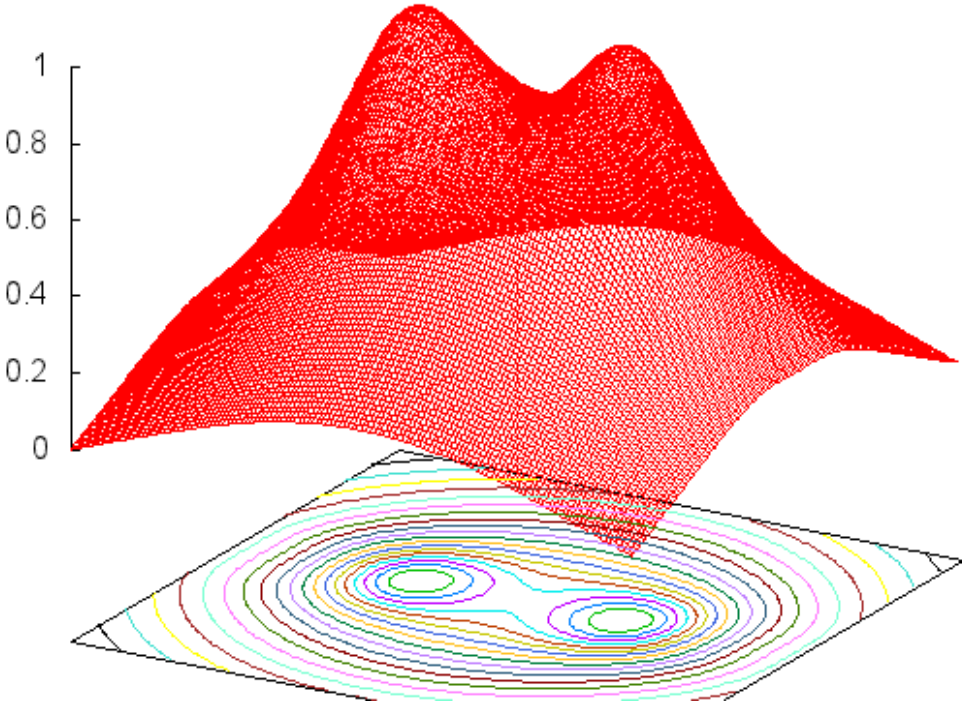
$d(M,N)$ is the distance between the convoluting N variable and the M point.

$D_M(N)$ is equal to 1 in the sphere centered on M, of a 15 kpc ray, equal to 0 elsewhere.

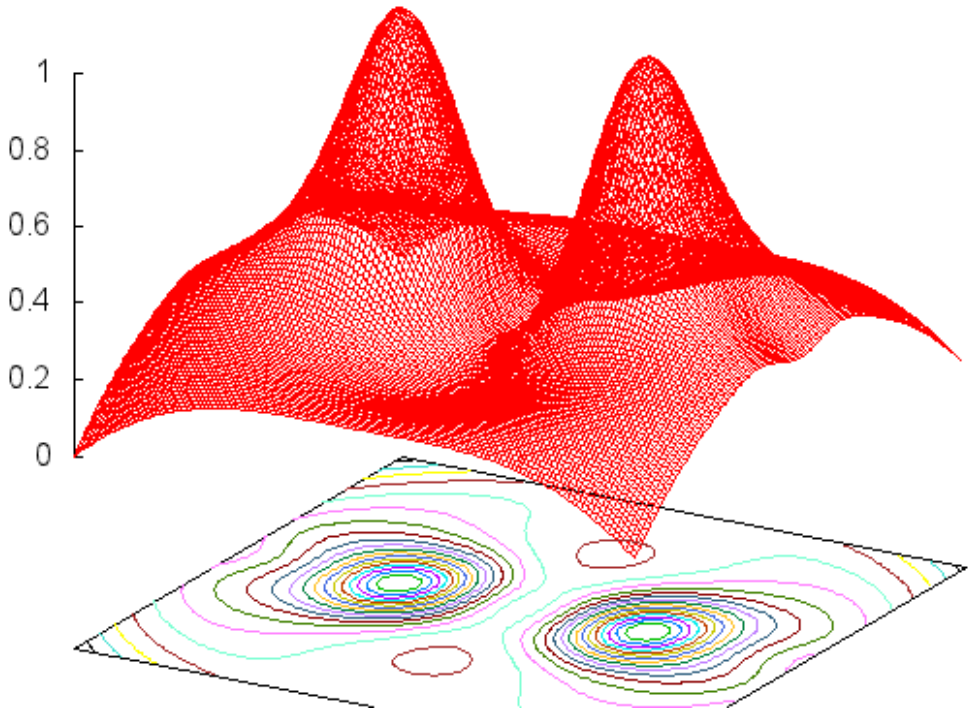
$\Phi_g(M)$ is the resulting acceleration potential generated by the gas only, in SMT.

Composite Credit: X-ray: NASA/CXC/CfA/ M. Markevich et al.;
Lensing Map: NASA/STScI; ESO WFI; Magellan/U.Arizona/ D.Clowe et al.
Optical: NASA/STScI; Magellan/U.Arizona/D.Clowe et al.;

Bullet cluster: weak-lensing mass reconstructions

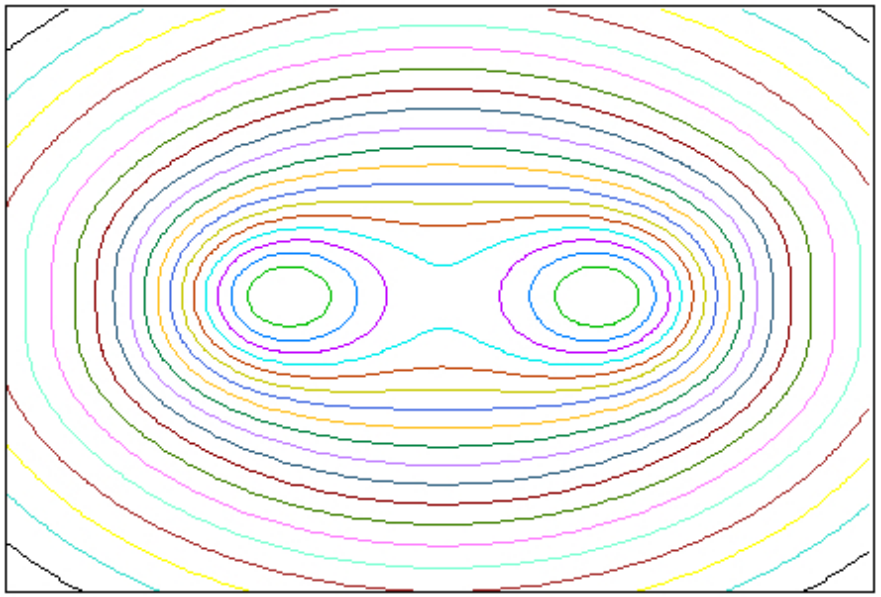


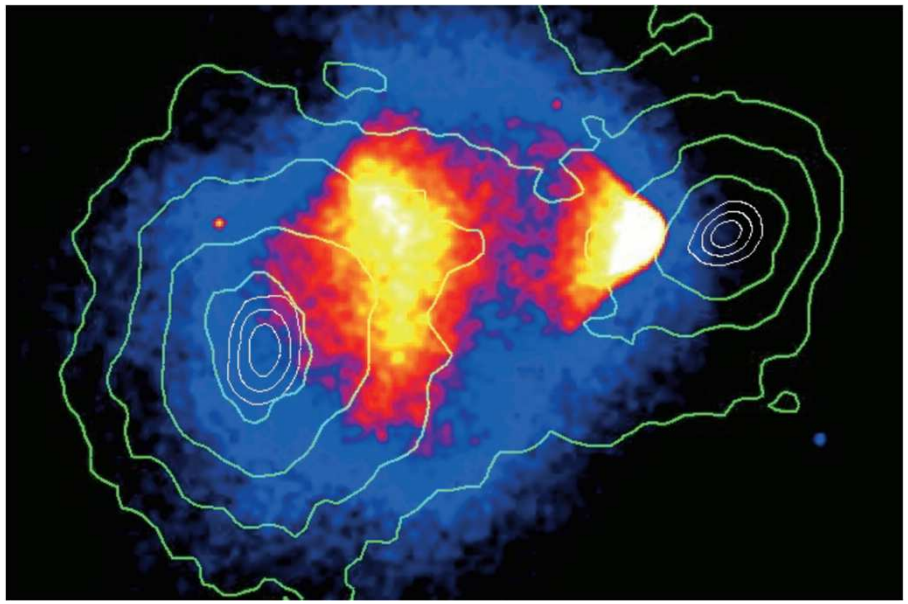
Newton's law



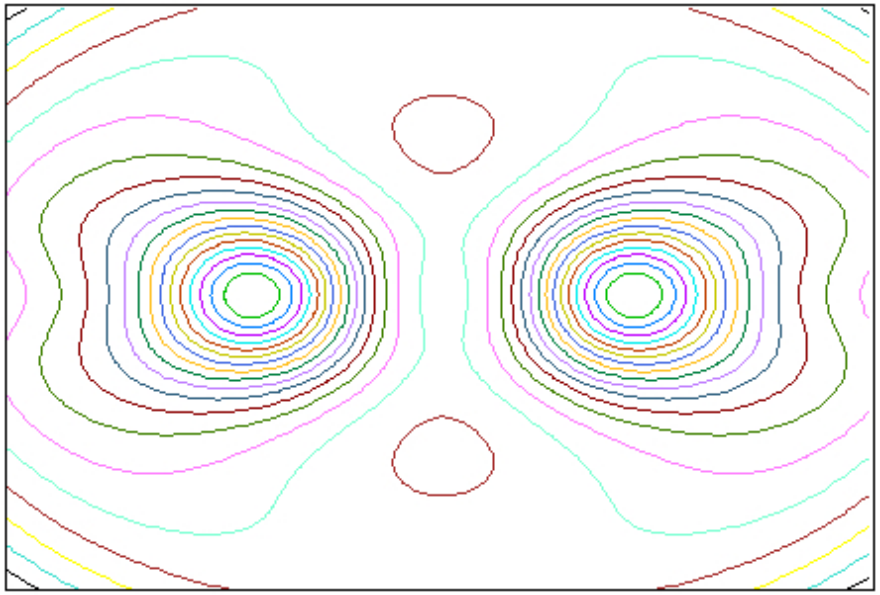
SMT

Newton's law



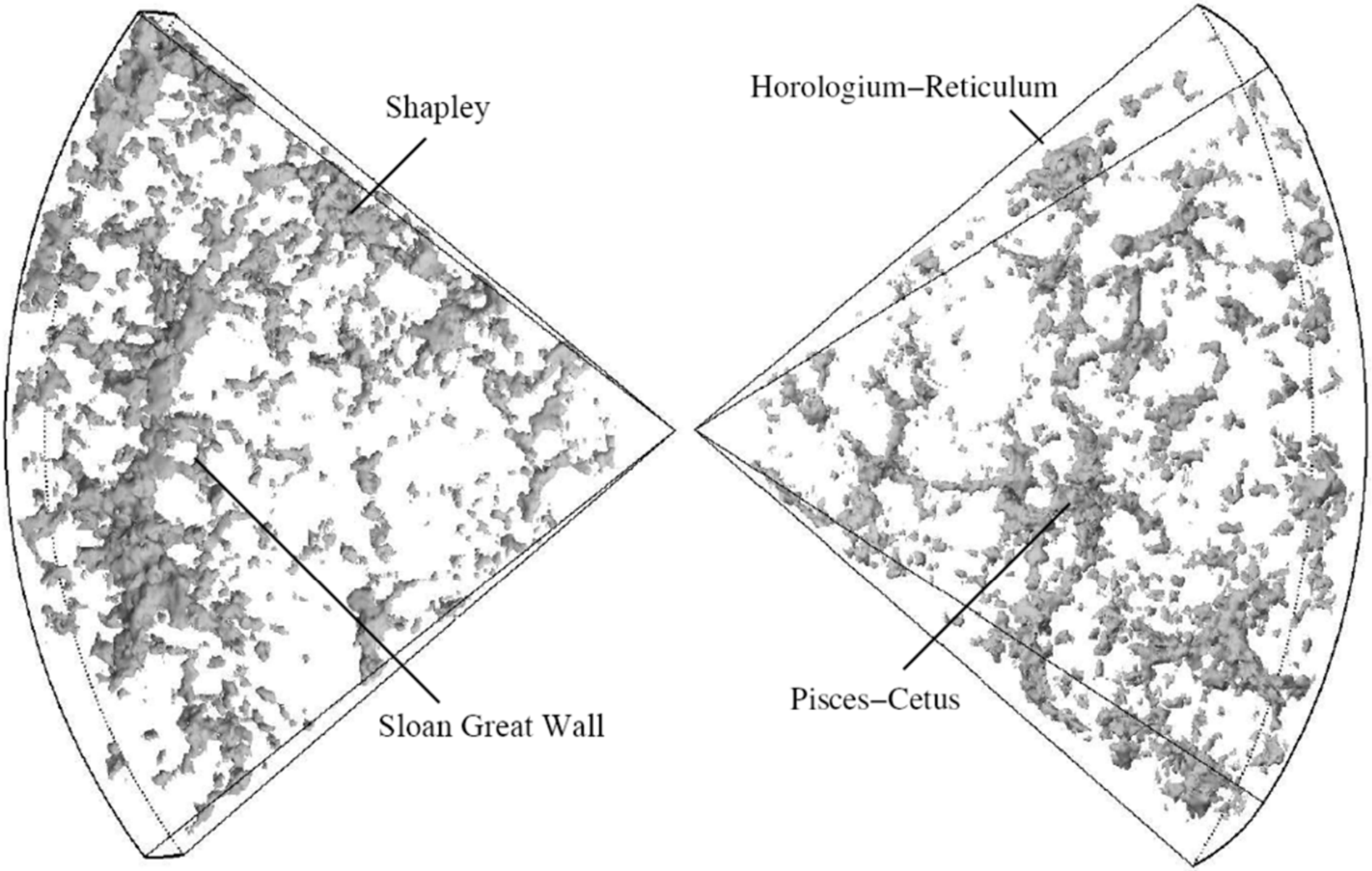


*Reality**



SMT

* : D. Clowe et al : The Astrophysical Journal Letters, 2006



Credit & Copyright: W. Schaap (Kapteyn Institute, U. Groningen) et al., 2dF Galaxy Redshift Survey

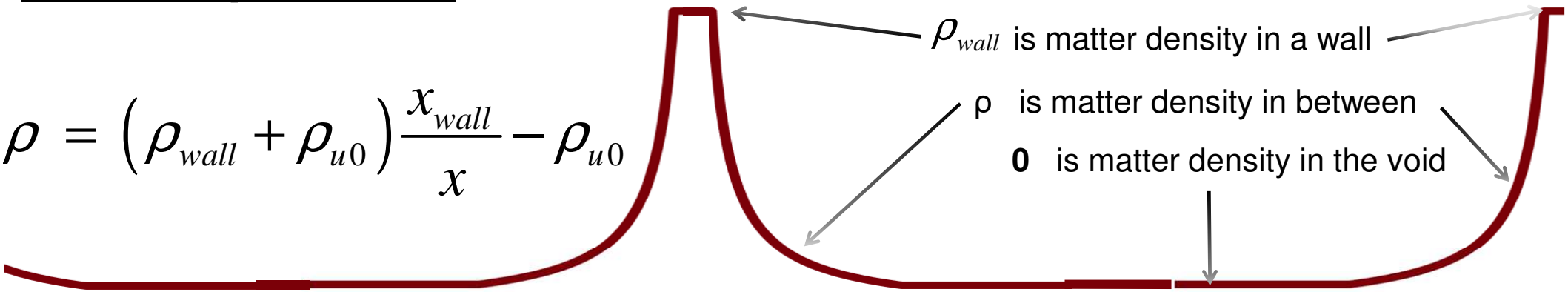
Heterogeneities of large scale structures

In a **void**, G is **40 times** greater :

$$C_{SMT} \cong \frac{\alpha_0 \rho_0 + \rho_{u0}}{\rho_{u0}} = \frac{2}{\Omega} = 40$$

Empty voids are predicted, in a **<u>stable equilibrium</u>** :

$$\rho = \left(\rho_{wall} + \rho_{u0}\right)\frac{x_{wall}}{x} - \rho_{u0}$$



Cosmology

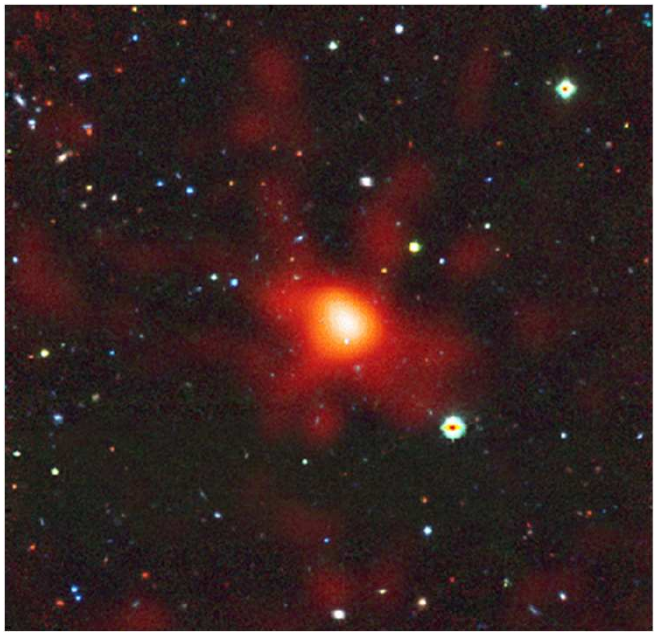
New Friedmann-Lemaître equation $H^2 = \frac{8\pi G}{3}\rho_c$

$\Rightarrow$ a **de Sitter Universe** is predicted, with :

- alternative to dark energy
- explanation of fine tuning issue
- space curvature $K = 0$
- deceleration parameter $q = -1$

Cosmology

Time since last scattering prediction: $68\ h^{-1}\mathrm{Gyr}$,
7 times greater than with ΛCDM.



*

=> High-z clusters are predicted

=> Existence of UGC 2885 is possible.

* :Mullis et a 1985, arXiv.org > astro-ph > arXiv:0910.1716v2 2009

Other addressed mysteries

- Low matter density environments
- Dwarf galaxies
- Galaxies alignments
  - in clusters,
  - in a major galaxy environment
- . . . (please refer to my article)

Remaining mysteries which were not addressed yet

- Tully-Ficher relation (in progress)
- Galaxy mass to size proportionality
  - Would need to know also the evolution of the structure and content of a galaxy, when varying its size
  - Would need a simulation of this evolution in the context of SMT.


Back to theory

What is *new* in physics, in this gravitational model ?

only 1 assumption :

« Matter is made of indivisible particles sharing the same constant speed ».

- Suggests the principles of:
  - a unification of the 4 forces,
  - a unifying theory.

- The rest is logical deduction and maths in the context of GR :
  1) This speed is c
  2) Gravitational waves are only microscopic ones, Lorentz transforms at c speed
  3) A corrective factor is inserted in Newton's potential equation: $\Phi = \frac{MG}{x}\frac{\mathbf{1}}{\boldsymbol{\rho}}$
  4) This yields « Gravitational model of the three elements theory » (GMTET)

- « Surrounding » just fits this corrective factor. $\Phi = -\frac{MG}{x}\frac{\alpha_0\rho_0 + \rho_{u0}}{\underbrace{\alpha\rho + \rho_u}}$
  - « Surrounding » : a simplified version of GMTET.

Caveats and limitations

Caveats and limitations

- Violation of momentum conservation at large scale
- Time since last scattering ?
- Nucleo-synthesis
- q = -1
- The α parameter


What next ?

Collaborations

I am looking forward for any kind of collaborations. For example:

- Astrophysicists: validation or invalidation of SMT.
  - experimental data
  - simulations
- Physicists:
  - publications as single author or co-author
  - applying to Research Project Grants.
    - Could this project succeed in finding funds ?
- Laboratories:
  - for example as a 1 year invited associate researcher.
  - Shared projects . . .

Summary

Summary

- Newton’s law modification
- Behaviour: galaxies, IGM and clusters, large scale, cosmology.
- Some caveats
- Comparison with experimental data is required

. . .

- Looking forward for any kind of collaboration

Discussion