

# Theory in the virtual observatory

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... SPAP ... SNAP ... TSAP ... SIMDB ... SIMDAP ... S3 ... SIMDM ... SIMDAL ...

# What are we talking about?

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Theory (in IVOA): everything to do with modelling and simulations, but not with paper and pencil

## Focus on

- The large-scale 'cosmo' simulations vs 'micro'-physics simulations/modelling debate
- The lengthy, delicate and sometimes difficult IVOA recommendation process (especially when it comes to Theory)
- The lack of implementation

## Topics not mentioned here (because you can't talk about everything)

- Semantics (although essential for theory)
- GRID (Grid5000, EGEEIII, EGI, etc.)
- Atomic and molecular data spin-off

# A 20-year look back

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(WELL, A BIT MORE...)

# 2001

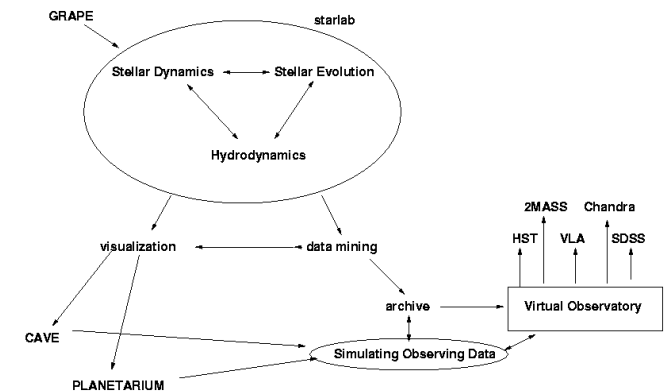


Courtesy of Peter Teuben (Univ. Maryland)  
<https://bima.astro.umd.edu/nemo/nvo/>

- |                |         |                 |             |
|----------------|---------|-----------------|-------------|
| Tod Boroson    | NOAO    | Charles Liu     | AMNH        |
| Robert Brunner | Caltech | Jun Makino      | U. Tokyo    |
| Romeel Dave    | Steward | Arcot Rajasekar | Sdsc        |
| Dave De Young  | NOAO    | Peter Teuben    | U. Maryland |
| Piet Hut       | IAS     | Wolfgang Voges  | MPI         |
| Stuart Levy    | NCSA    | Joel Welling    | PSCC        |
| Roger Lynds    | NOAO    | David Zurek     | AMNH        |

Mar. : US theoreticians meeting in Tucson  
 “The VO – integration with theoretical modelling and visualization issues”

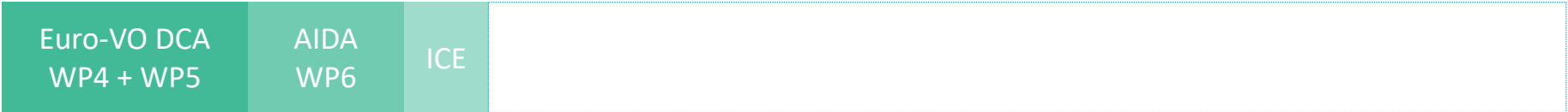
- Ongoing VIRGO consortium for Cosmological N-Body Simulations (created in ‘94)
  - MPA : Simon White, Jörg Colberg, etc.
  - UK : Carlos Frenck, etc.
- Org. by Dave De Young, Peter Teuben, George Djorgovski, Piet Hut and Alex Szalay



2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022

Funding

Projet HORIZON



S3  
CR + MC + PM

SimDM (GL+HW)

SimDM erratum/1.1/2.0 (?)

SimDB (GL, Laurent Bourgès, etc.)

SPAP (Peter Teuben)

SNAP  
GL + HW

SimDAP  
CG + RW

SimDAL (FLP + DL)

2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022

UCD, Vocabularies, semantics, SKOS, ...

Shaw

MC + TIG

FLP + ...

IVOA Theory Interest Group chairs and vice-chairs



GL : Gerard Lemson / CG : Claudio Gheller / RW : Rick Wagner / FLP : Franck Le Petit / CR : Carlos Rodrigo / SO'T : Simon O'Toole / GT : Giulano Taffoni  
DL : David Languignon / MC : Miguel Cerviño / PM : Patrizia Manzato

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Funding

WBS	Task Name	Duration	Start	End	2005		2006		2007		2008		2009		2010	
					H1	H2	H1	H2	H1	H2	H1	H2	H1	H2	H1	H2
5	[TBD] SimDB	40.81 mons	Mon 03/04/06	Tue 11/08/09	03/04 [TBD] SimDB 11/08											
5.1	in Theory Interest Group	26.95 mons	Mon 03/04/06	Tue 01/07/08	03/04 in Theory Interest Group 01/07											
5.1.1	Discussion about SNAP	503 days	Mon 03/04/06	Tue 01/04/08	03/04											
5.1.2	Split SNAP into SimDB, SimDAP	0 mons	Tue 01/04/08	Tue 01/04/08	01/04											
5.1.3	Define PR track and tiger team for SimDB	0 days	Tue 01/07/08	Tue 01/07/08	01/07											
5.1.4	SimDB v0.1 Technical Note	0 days	Tue 01/07/08	Tue 01/07/08	01/07											
5.2	in Working Group	11.38 mons	Tue 01/07/08	Fri 29/05/09	01/07 in Working 29/05											
5.2.1	Work within WG	239 days	Tue 01/07/08	Fri 29/05/09	01/07											
5.2.2	SimDB v0.5 WD	0 days	Sat 01/11/08	Sat 01/11/08	01/11											
5.3	RFC period within interop	1 mon	Mon 01/06/09	Mon 29/06/09	01/06											
5.4	TCG review	1 mon	Tue 30/06/09	Tue 28/07/09	30/06											
5.5	PR submission to Exec	0 days	Tue 28/07/09	Tue 28/07/09	28/07											
5.6	IVOA Exec review	2 wks	Wed 29/07/09	Tue 11/08/09	29/07											
5.7	REC SimDB	0 days	Tue 11/08/09	Tue 11/08/09	11/08											
5.8	[DAL] SimDAP	40.81 mons	Mon 03/04/06	Tue 11/08/09	03/04 [DAL] SimDAP 11/08											
5.8.1	in Theory Interest Group	26.95 mons	Mon 03/04/06	Tue 01/07/08	03/04 in Theory Interest Group 01/07											
5.8.1.1	Discussion about SNAP	503 days	Mon 03/04/06	Tue 01/04/08	03/04											
5.8.1.2	Split SNAP into SimDB, SimDAP	0 mons	Tue 01/04/08	Tue 01/04/08	01/04											
5.8.1.3	SimDAP v0.1 Technical Note	0 days	Tue 01/07/08	Tue 01/07/08	01/07											
5.8.2	in Working Group	11.38 mons	Tue 01/07/08	Fri 29/05/09	01/07 in Working 29/05											
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5.8.7	REC SimDAP	0 days	Tue 11/08/09	Tue 11/08/09	11/08											

SPAP (F

2001 2002

UCD, Vo  
semanti

IVOA Theory Interest  
Group chairs and  
vice-chairs

GL : Gerard Lem  
DL : David Langu

tum/1.1/2.0 (?)

20 2021 2022

GL + SO'T

Taffoni

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## Simple Numerical Access Protocol (SNAP) for theoretical data

Version 0.1

IVOA Technical Note 2006/09/14

This version:  
Snap0.1-20060914  
Latest version:  
Previous version(s):  
Author(s):  
Claudio Gheller  
Gerard Lemson  
Laurie Shaw  
Herve Wozniak

## Simulation Data Model Version 1.0


IVOA Recommendation 03 May 2012

Interest/Working Group:  
<http://www.ivoa.net/twiki/bin/view/IVOA/ivoaTheory>  
Author(s):  
Gerard Lemson, Laurent Bourges, Miguel Cervino, Claudio Gheller, Norman Gray, Franck LePetit, Mireille Louys, Benjamin Ooghe, Rick Wagner, Herve Wozniak  
Editor(s):  
Gerard Lemson, Herve Wozniak  
DOI:  
10.5479/ADS/bib/2012ivoa.spec.0503L

## Implementations of the Simulation Data Model Version 1.0

IVOA Note 02 April 2012

Interest/Working Group:  
<http://www.ivoa.net/twiki/bin/view/IVOA/ivoaTheory>  
Author(s):  
Franck Le Petit, Benjamin Ooghe-Tabanou, David Languignon, Gerard Lemson, Hervé Wozniak, Laurent Bourges, Nicolas Moreau, Jonathan Normand  
Editor(s):  
Franck Le Petit, Benjamin Ooghe-Tabanou, David Languignon



2/06/2004

### Theory in the VO

Gerard Lemson<sup>1</sup> and Jörg Colberg<sup>2</sup>



Astronomical Data Analysis Software and Systems XII  
ASP Conference Series, Vol. 295, 2003  
H. E. Payne, R. I. Jedrzejewski, and R. N. Hook, eds.

### Small Theory Data in the Virtual Observatory

Jonathan C. McDowell  
Smithsonian Astrophysical Observatory, 60 Garden St, Cambridge, MA  
02138

**Abstract.** The integration of large theoretical simulation archives with the VO has been widely discussed. I suggest that it is also important to include smaller theoretical datasets and functional relationships in a structured way, and outline some possible conventions.

## Proposal for a Simulation Database Standard Version 1.00

IVOA Note 11 July 2008

Interest/Working Group:  
<http://www.ivoa.net/twiki/bin/view/IVOA/ivoaTheory>  
Author(s):  
Gerard Lemson Hervé Wozniak Rick Wagner Claudio Gheller Laurent Bourges  
Editor(s):  
Gerard Lemson Hervé Wozniak Rick Wagner

## Simulation Data Access Layer Version 1.0

IVOA Recommendation 20 March 2017

Interest/Working Group:  
<http://www.ivoa.net/twiki/bin/view/IVOA/ivoDAL>  
Author(s):  
David Languignon, Franck Le Petit, Carlos Rodrigo, Gerard Lemson, Marco Molinaro, Hervé Wozniak  
Editor(s):  
David Languignon, Franck Le Petit  
DOI:  
10.5479/ADS/bib/2017ivoa.spec.0320L

## Data Model for Simulation

Version 0.2

IVOA Working Draft  
2005 May 23

This version:  
0.2 <http://www.ivoa.net/internal/IVOA/ivoaTheory/SimulationDM.doc>  
Latest version:  
0.2 <http://www.ivoa.net/internal/IVOA/ivoaTheory/SimulationDM.doc>  
Previous version(s):  
0.1 <http://www.ivoa.net/internal/IVOA/ivoaTheory/SimulationDM.pdf>  
Author(s):  
Laurie Shaw  
Nicholas Walton  
IVOA Theory Interest Group



R1031675  
EuroVO-DCA  
The European Virtual Observatory Data Centre Alliance

COORDINATION ACTION  
RESEARCH INFRASTRUCTURE  
COMMUNICATION NETWORK DEVELOPMENT

D11 – TEG REPORT: FRAMEWORK FOR THE INCLUSION OF THEORY DATA AND SERVICES IN THE VOBS

## Proposal for a Simulation Database Standard

Version 0.5

Note 2009 May ...

This version:  
0.5-20090504  
Latest version:  
<http://www.ivoa.net/Documents/latest/NOWHERE>  
Previous version(s):  
Author(s):  
Gerard Lemson  
Hervé Wozniak  
Laurent Bourges  
Rick Wagner  
Claudio Gheller

workshop  
ASSNA  
@IDRIS

workshop  
ASSNA-ASOV  
@IAP



TVO  
@Lyon

OV School  
@Obernai

SimDB  
@Lyon

Workshop  
ASN-ASOV  
@CINES

Projet HORIZON



Workshop Euro-VO DCA  
Theory in the VO  
@ Garching

SimDAL meeting  
@ Meudon



Tucson



Cambridge



# 2022-Today

Oct '22: workshop ASOV-ASN @ CINES

- Re-compute or store ? Sets a (rather) short duration of storage
- Only “Simulations of Interest”
- Linked to published papers
- Platforms à la “Data Centers” for simulations ?
  - ISMDB
  - Galactica ?

Many people interested to publish their simulations but not involved in ASOV and IVOA developments

SimDM → VO-DML by Gerard Lemson

No progress on addressing the vocabulary, on updating SimDM

TIG : Simon O’Toole & Giuliano Taffoni

refocusing on pure cosmo simulations

Last email on TIG mailing list (Oct '23):

- The discovery of theory and simulation data – do we need a TAP like service? We would need a suitable data model.
- Can ObsCore be extended to allow for data to be found and queried in this way?
- There is a need for a standardised way to describe mock data (catalogues, images, etc)
- How much can be covered by a “Simple Data Access Protocol”? If it is designed with non-observational data in mind, as well as observational
- One of the main outcomes was that we need to be pragmatic – simulation data is extremely diverse, so we should look at what is already being done and build a methodology and standards around that.

# Take-home messages

## ASOV

needing a new lease of life

- Young colleagues
- ANO-CC ?

federating of French community

implementing available standards

- ISMDB
- Galactica
- Pollux

reinforcing links with IVOA

## IVOA

not so much activity in TIG but :

- Science platforms =? new paradigm

Cf May 2021 on-line Interop:

<https://wiki.ivoa.net/twiki/bin/view/IVOA/InterOpMay2021SPW>

- Artificial intelligence (both ML and DL)
- refocusing on cosmological simulations (step backwards ??)

Need for next SimDM, SimDB

**Need of an European federative project ?**