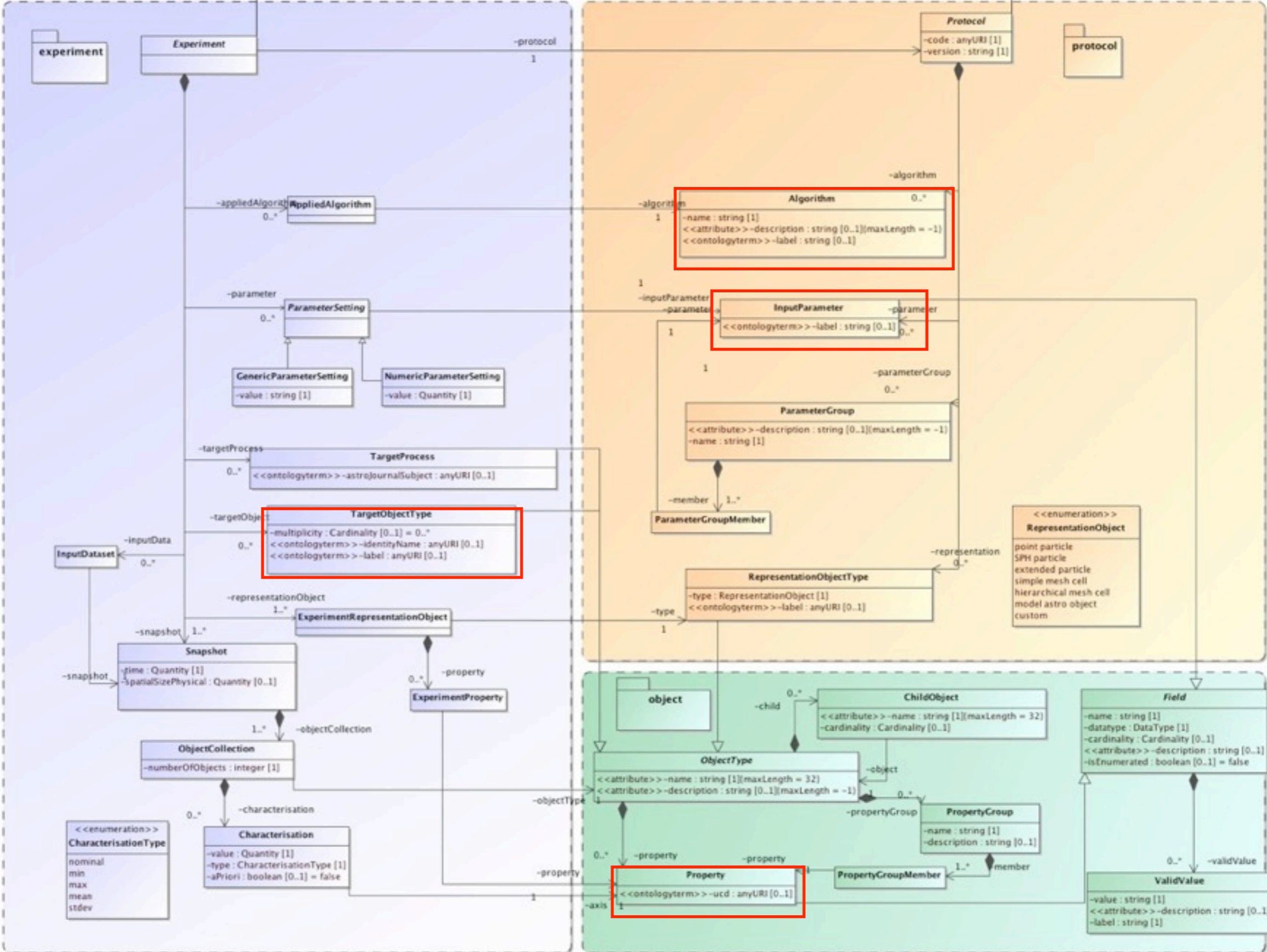


VO-Theory

Semantics & InterOperability

Franck Le Petit & Fabrice Roy

Vocabularies are required for SimDB/DM



Semantics required for:

- **Astrophysical Objects:** Ex: Galaxy, disk, bulk, Cloud, gas, jets, ...
- **Physical quantities:** Ex: Velocity, Temperature, Temperature of electrons, ...
- **Physical processes** Ex: Gravitation, MHD, hydrodynamics, Radiative transfer
- **Algorithms** Ex: Tree, SPH, Vlasov solver, Monte Carlo,
- ***IdentityName*** Ex: *M31*, ...

Efforts in the Semantics WG

Recommendations for vocabularies by **Semantic Working group**

I. Ontology of Astronomical Objects



International
Virtual
Observatory
Alliance

Good starting point but should add some terms

Examples :

- Simulations can model very specific regions of AstroObjects:

- Large scale structure
- Dark matter
- Shock
- Outflows
- Gravitational waves (*IVOAT*)

Ontology of Astronomical Object Types

Version 1.0

IVOA Working Draft 2007 Feb 19

This version:

<http://ivoa.net/Documents/WD/Semantics/AstrObjectOntology-20070219.html>

Latest version:

<http://www.ivoa.net/Documents/latest/AstrObjectOntology.html>

Previous version(s):

Editors:

S. Derriere
A. Preite Martinez
A. Richard

Author(s):

L. Cambrésy – cambresy@astro.u-strasbg.fr
S. Derriere – derriere@astro.u-strasbg.fr
P. Padovani – ppadovan@eso.org
A. Preite Martinez – andrea.preitemartinez@iasf-roma.inaf.it
A. Richard – richard@astro.u-strasbg.fr

Need to separate :

- stellar interior
- photosphere
- Stellar wind
- Sollar wind
- Jets
- ...



2. Vocabularies

- A&A keywords
- AOIM
- UCD
- IAU 93 thesaurus

- UCDs

- IVOAT



Vocabularies in the Virtual Observatory Version 1.19

IVOA Recommendation, 2009 October 7

This version

<http://www.ivoa.net/Documents/RBC/Semantics/Vocabularies-20091007.html>

Latest version

<http://www.ivoa.net/Documents/latest/Vocabularies.html>

Previous versions

<http://www.ivoa.net/Documents/PR/Semantics/Vocabularies-20090825.html> <http://www.ivoa.net/Documents/PR/Semantics/Vocabularies-20081104.html> <http://www.ivoa.net/Documents/PR/Semantics/Vocabularies-20080912.html> <http://www.ivoa.net/Documents/PR/Semantics/Vocabularies-20080729.html> <http://www.ivoa.net/Documents/WD/Semantics/vocabularies-20080320.html>

Working Group

Semantics

Editors

Alasdair J G Gray, University of Manchester, UK
Norman Gray, University of Leicester / University of Glasgow, UK
Frederic V Hessman, University of Göttingen, Germany
Andrea Preite Martinez, INAF, Italy

Authors

Sébastien Derrière, Alasdair J G Gray, Norman Gray, Frederic V Hessman, Tony Linde, Andrea Preite Martinez, Rob Seaman and Brian Thomas

Abstract

This document specifies a standard format for vocabularies based on the W3C's *Resource Description Framework (RDF)* and *Simple Knowledge Organization System (SKOS)*. By adopting a standard and simple format, the IVOA will permit different groups to create and maintain their own specialised vocabularies while letting the rest of the astronomical community access, use, and combine them. The use of current, open standards ensures that VO applications will be able to tap into resources of the growing semantic web. The document provides several examples of useful astronomical vocabularies.

The IVOAT (based on IAU93 thesaurus) is pretty complete and seems to fulfill several needs of Theory I.G.

Semantic for Physics / Physical process

IAU93 contains many physical processes
- need to add a few more

Keyword	A&A vocabulary	IAU93 vocabulary	Keyword	A&A vocabulary	IAU93 vocabulary
Absorption		#Absorption	Magnetohydrodynamics	MHD	#Magnetohydrodynamics
Acceleration of particles	#AccelerationOfParticles	#ParticleAccretion	<i>MHD Hall</i>		
Accretion	#Accretion		Mie scattering		#MieScattering
Astrochemistry	#Astrochemistry	#astrochemistry	Molecular processes		#MolecularProcesses #NewtonianGravitation #MolecularBands
<i>Advection</i>					#NuclearReaction #Nucleosynthesis
Atomic Processes	#AtomicProcesses	#AtomicProcesses	Nuclear reaction		
Bremsstrahlung		#Bremsstrahlung	<i>Photoelectric effect</i>		#Photodissociation
Chaos	#Chaos	None	Photoionization		#Photoionization
Collision		#Collisions	Photodissociation		#PlasmaPhysics
Collisional excitation		#CollisionalExcitation	Plasma physics	#Polarization	#Many narrower
<i>Collisional plasma</i>		#CollisionalPlasmas	Polarization		#RadiativeTransfer
Collisional broadening		#CollisionBroadening	Radiative transfer		#RadiativeBraking
Collisional processes		#CollisionProcesses			#RadiationScattering
Compton effect		#ComptonEffect			#radiativeCapture
<i>Compton scattering</i>		#ComptonScattering			#RadiativeEquilibrium
Conduction	#Conduction	#Conduction			#RadiativeRecombination
Convection	#Convection	#Convection			#RamanScattering
		#CosmicElectrodynamics			#RayleighScattering
Cosmochemistry / Primordial chemistry		#Cosmochemistry	<i>Surface reactions</i>	None	None
Diffusion / Scattering	#Diffusion / #Scattering	#Diffusion / #Scattering	Scattering / diffusion		#Reddening
		#EnergyTransfer	<i>Sunyaev-Zeldovitch effect</i>		#Scattering
Electrodynamics		#Electrodynamics	Synchrotron radiation		#SynchrotronRadiation
Equation of state	#EquationOfState				#ThermalConductivity
Fluorescence		#Fluorescence			#ThomsonScattering
Gravitation	#Gravitation	#Gravitation			
Hydrodynamics	#Hydrodynamics	#Hydrodynamics			
Inverse Compton scattering		#InverseComptonScattering			
Line broadening		#LineBroadening	Turbulence	#Turbulence	None

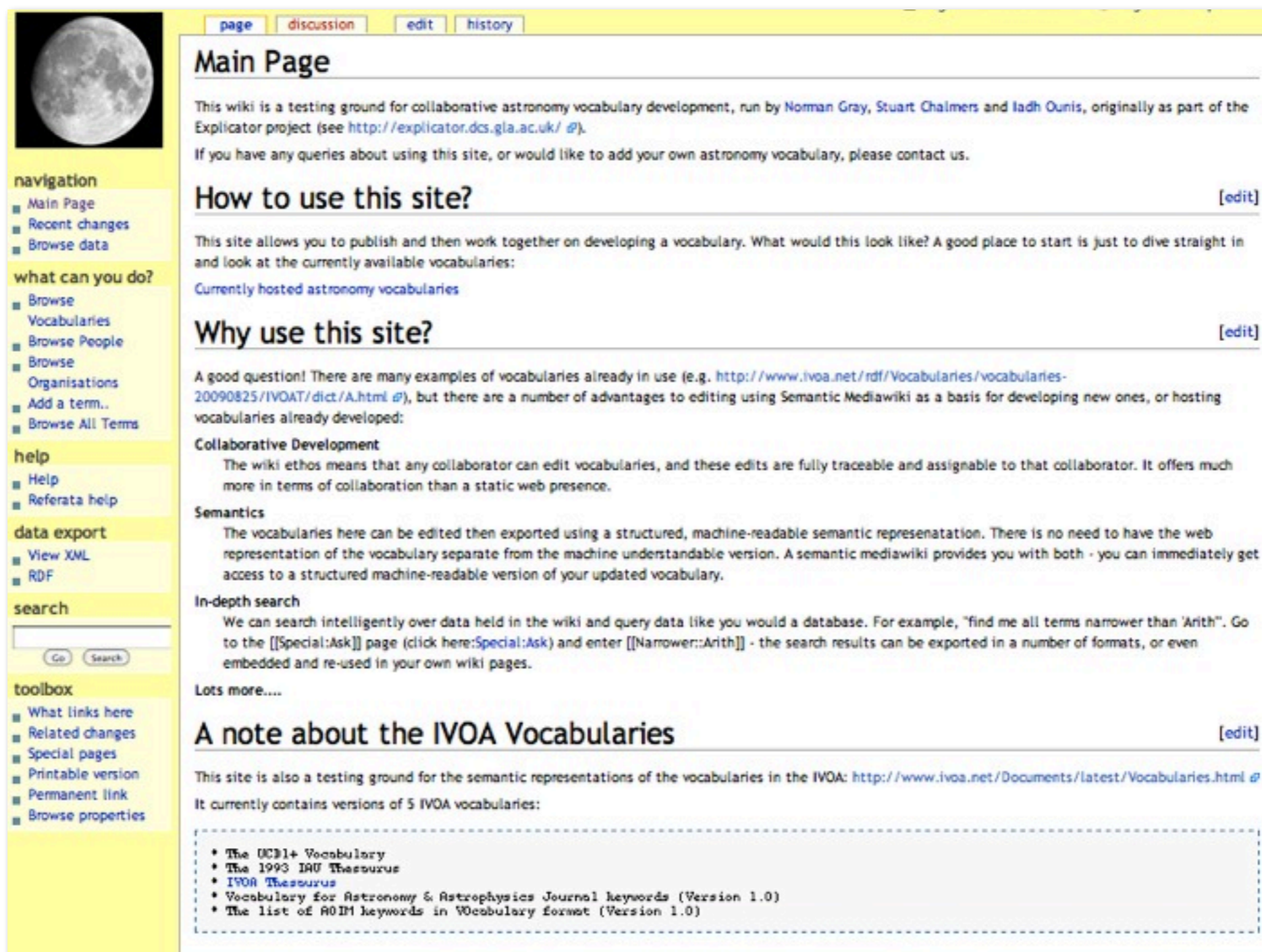
Semantics required for:

- **Astrophysical Objects:** Ex: Galaxy, disk, bulk, Cloud, gas, jets, ...
- **Physical quantities: UCDs ?** Ex: Velocity, Temperature, Temperature of electrons, ...
- **Physical processes** Ex: Gravitation, MHD, hydrodynamics, Radiative transfer
- **Algorithms** Ex: Tree, SPH, Vlasov solver, Monte Carlo,
- **IdentityName** Ex: M31, ...

Development of the vocabularies

A wiki has been set up by Norman Gray and Stuart Chalmers

<http://vocabularies.referata.com/wiki>



The screenshot shows the main page of the IVOA Vocabularies wiki. The page has a yellow header with navigation tabs for 'page', 'discussion', 'edit', and 'history'. The main content area is titled 'Main Page' and contains several sections: 'How to use this site?', 'Why use this site?', and 'A note about the IVOA Vocabularies'. Each section has an '[edit]' link. The left sidebar contains a navigation menu with categories like 'navigation', 'what can you do?', 'help', 'data export', 'search', and 'toolbox'. A search box is located in the 'search' section. The 'A note about the IVOA Vocabularies' section lists five vocabularies: The UC31+ Vocabulary, The 1993 IAU Thesaurus, IVOA Thesaurus, Vocabulary for Astronomy & Astrophysics Journal Keywords (Version 1.0), and The list of A01M keywords in Vocabulary format (Version 1.0).

Main Page

This wiki is a testing ground for collaborative astronomy vocabulary development, run by Norman Gray, Stuart Chalmers and Iadh Ounis, originally as part of the Explicator project (see <http://explicator.dcs.gla.ac.uk/>).

If you have any queries about using this site, or would like to add your own astronomy vocabulary, please contact us.

How to use this site? [edit]

This site allows you to publish and then work together on developing a vocabulary. What would this look like? A good place to start is just to dive straight in and look at the currently available vocabularies:

[Currently hosted astronomy vocabularies](#)

Why use this site? [edit]

A good question! There are many examples of vocabularies already in use (e.g. <http://www.ivoa.net/rdf/Vocabularies/vocabularies-20090825/IVOAT/dict/A.html>), but there are a number of advantages to editing using Semantic Mediawiki as a basis for developing new ones, or hosting vocabularies already developed:

Collaborative Development

The wiki ethos means that any collaborator can edit vocabularies, and these edits are fully traceable and assignable to that collaborator. It offers much more in terms of collaboration than a static web presence.

Semantics

The vocabularies here can be edited then exported using a structured, machine-readable semantic representation. There is no need to have the web representation of the vocabulary separate from the machine understandable version. A semantic mediawiki provides you with both - you can immediately get access to a structured machine-readable version of your updated vocabulary.

In-depth search

We can search intelligently over data held in the wiki and query data like you would a database. For example, "find me all terms narrower than 'Arith'". Go to the [\[\[Special:Ask\]\]](#) page (click here:[Special:Ask](#)) and enter [\[\[Narrower::Arith\]\]](#) - the search results can be exported in a number of formats, or even embedded and re-used in your own wiki pages.

Lots more....

A note about the IVOA Vocabularies [edit]

This site is also a testing ground for the semantic representations of the vocabularies in the IVOA: <http://www.ivoa.net/Documents/latest/Vocabularies.html>

It currently contains versions of 5 IVOA vocabularies:

- [The UC31+ Vocabulary](#)
- [The 1993 IAU Thesaurus](#)
- [IVOA Thesaurus](#)
- [Vocabulary for Astronomy & Astrophysics Journal Keywords \(Version 1.0\)](#)
- [The list of A01M keywords in Vocabulary format \(Version 1.0\)](#)

special page



Browse data

There are no results for this report.

Choose a category:

Astro Term (0)

Concept (4)

IVOA Vocabularies (432)

IVOAT (434)

Organisation (1)

Organization (0)

Person (3)

VOT Algorithm (69)

Vocabulary (1727)

navigation

- [Main Page](#)
- [Recent changes](#)
- [Browse data](#)

what can you do?

- [Browse Vocabularies](#)
- [Browse People](#)
- [Browse Organisations](#)
- [Add a term..](#)
- [Browse All Terms](#)

help

- [Help](#)
- [Referata help](#)

data export

- [View XML](#)
- [RDF](#)

Export in RDF (not fully fonctionnal yet)

IAU thesaurus



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Browse data: IVOA Vocabularies

IVOA Vocabularies

Click on one or more items below to narrow your results.

Subcategory: [UCD \(432\)](#)

Showing below up to 250 results starting with #1.

View (previous 250) (next 250) (20 | 50 | 100 | 250 | 500)

A

- Arith
- Arith.diff
- Arith.factor
- Arith.grad
- Arith.ratio
- Arith.zp

E

- Em
- Em.IR
- Em.IR.15-30um
- Em.IR.3-4um
- Em.IR.30-60um
- Em.IR.4-8um
- Em.IR.60-100um
- Em.IR.8-15um

C

- CALENDARIOGIULIANO:IAUT93

I cont.

- Instr.order
- Instr.param
- Instr.plate
- [Instr.plate.emulsion](#)
- Instr.precision
- Instr.saturation
- Instr.scale
- Instr.sensitivity
- Instr.setup
- Instr.skyLevel
- Instr.skyTemp
- Instr.tel
- Instr.tel.focalLength

M

- [Meta](#)
- DAMPINGCONSTANTS:IAUT93
- DATENERFASSUNG:IAUT93
- DATENREDUKTION:IAUT93
- DECALAGESPECTRAL:IAUT93
- DECELERAZIONE:IAUT93
- DECLINAISON:IAUT93
- DEFORMATION:IAUT93
- DENSIDAD:IAUT93
- DENSITAELETRONICA:IAUT93
- DENSITOMETRIE:IAUT93
- DETECTEURAQUADRANT:IAUT93
- DETERMINATIONDEL EQUATEUR:IAUT93
- DETERMINAZIONEDEL PERIODO:IAUT93
- DEUTERIUM:IAUT93
- DIAGRAMADEHERTZSPRUNGRUSSELL:IAUT93
- DIAGRAMASDEFEYNMAN:IAUT93
- DICHTMATERIE:IAUT93
- DICKERADIOMETERS:IAUT93
- DIFFRAZIONE:IAUT93

P cont.

- Phot.mag.reddFree
- Phot.mag.sb
- Phys
- Phys.SFR
- Phys.absorption.coeff
- Phys.absorption.gal
- Phys.absorption.opticalDepth
- Phys.abund

Choose a category:
Astro Term (0)
Concept (4)
IVOA Vocabularies (432)
IVOAT (434)
Organisation (1)
Organization (0)
Person (3)
VOT Algorithm (69)
Vocabulary (1727)



Category:IAUT93

IAUT93 Thesaurus - Version Fri Feb 22 1

(previous 200) (next 200)

Pages in category "IAUT93"

The following 200 pages are in this cate

A

- ABBONDANZAISOTOPICA:IAUT93
- ABSOLUTETEMPERATURESCALE:IAUT93
- ABSORPTIONSPECTRA:IAUT93
- ACHSEN:IAUT93
- ACIMUT:IAUT93
- ACONDRIITI:IAUT93
- ADAPTACIONALAOBSCURIDAD:IAUT93
- AEQUATORIALEGBIETE/ZONEN:IAUT93
- AGE:IAUT93
- AIREACONCONDICIONADO:IAUT93
- AKTIVEGALAXIEN:IAUT93
- AKTIVEGALAXIENKERNE:IAUT93
- AKTIVEOPTIK:IAUT93
- ALBEDO:IAUT93
- ALONI:IAUT93
- ALPHAPARTICLES:IAUT93
- AMASABELL:IAUT93
- AMMASSIO:IAUT93
- AMORTISSEMENTPARRAYONNEMENT:IAUT93
- AMPLIFICATEURPARAMETRIQUE:IAUT93
- ANALISIDIFREQUENZA:IAUT93
- ANALISIDELAFORMADEONDA:IAUT93
- ANGLEDEREFRACTION:IAUT93
- ANILLOSPLANETARIOS:IAUT93
- ANNEAU:IAUT93

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- What links here
- Related changes
- Special pages
- Printable version
- Permanent link
- Browse properties

UCD vocabulary



category discussion edit history

Category:VOT Algorithm

Pages in category "VOT Algorithm"

The following 69 pages are in this category, out of 69 total.

A

- Accelerated Lambda Iteration
- Adaptive Mesh Refinement
- Advection Upstream Splitting Method
- Alternating direction implicit

B

- Bulirsch-Stoer

C

- Coupled Escaped probability
- Crank-Nicolson

E

- Escape probability
- Euler
- Exact Riemann Solver
- Exact radiative transfer method

F

- Fast-multipole method
- Finite Difference Method
- Finite Element Method
- Finite Volume Method
- Fokker-Planck solver
- Forward-Time Central-Space
- Fourier Technique

G

- Gauss-Seidel
- Gear Method
- Godunov

H

- HLL
- HLLC

H cont.

- HLLC
- Hartree-Fock
- Henryey

I

- Isochrones synthesis
- Iterative method

J

- Jacobi method

K

- Krylov subspace method

L

- Lax-Friedrichs
- Lax-Wendroff
- Leap frog
- Line Velocity Gradient
- Local thermodynamic equilibrium

M

- M1
- MUSCL
- MacCormack
- Monte Carlo
- Multi-domain spectral method
- Multigrid

N

- N-Body

O

- Orbital Elements
- Orthogonal polynomial expansion

P

P cont.

- Particle in cell
- Particle-Mesh
- Particle-Particle
- Piecewise linear method
- Piecewise parabolic method
- Polynomial Expansion

R

- Ray Tracing
- Riemann Solver
- Roe Solver
- Rotated-hybrid Riemann solver
- Runge-Kutta

S

- Self-Consistent Field
- Simplectic integration
- Smoothed Particle Hydrodynamics
- Spectral method
- Stationary iterative method
- Successive overrelaxation

T

- Test-particle
- Tree
- Tree-SPH

V

- Vlasov solver

Z

- Zeeman-Feautrier

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Go Search

toolbox

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SKOS concept has :

- Name
- Definition
- prefLabel
- AltLabel
- Broader term
- Narrower term
- Related term

page discussion edit history	
<h2>Adaptive Mesh Refinement</h2>	
Definition	Adaptive mesh refinements methods
ScopeNote	
prefLabel	AMR
AltLabel	AMR
Broader	Particle-Mesh
Narrower	
Related	

page discussion edit history	
<h2>Particle-Mesh</h2>	
Definition	Fourier method on cartesian grid
ScopeNote	
prefLabel	
AltLabel	PM
Broader	N-Body
Narrower	P3M
Related	

Norman should finish the semantics wiki

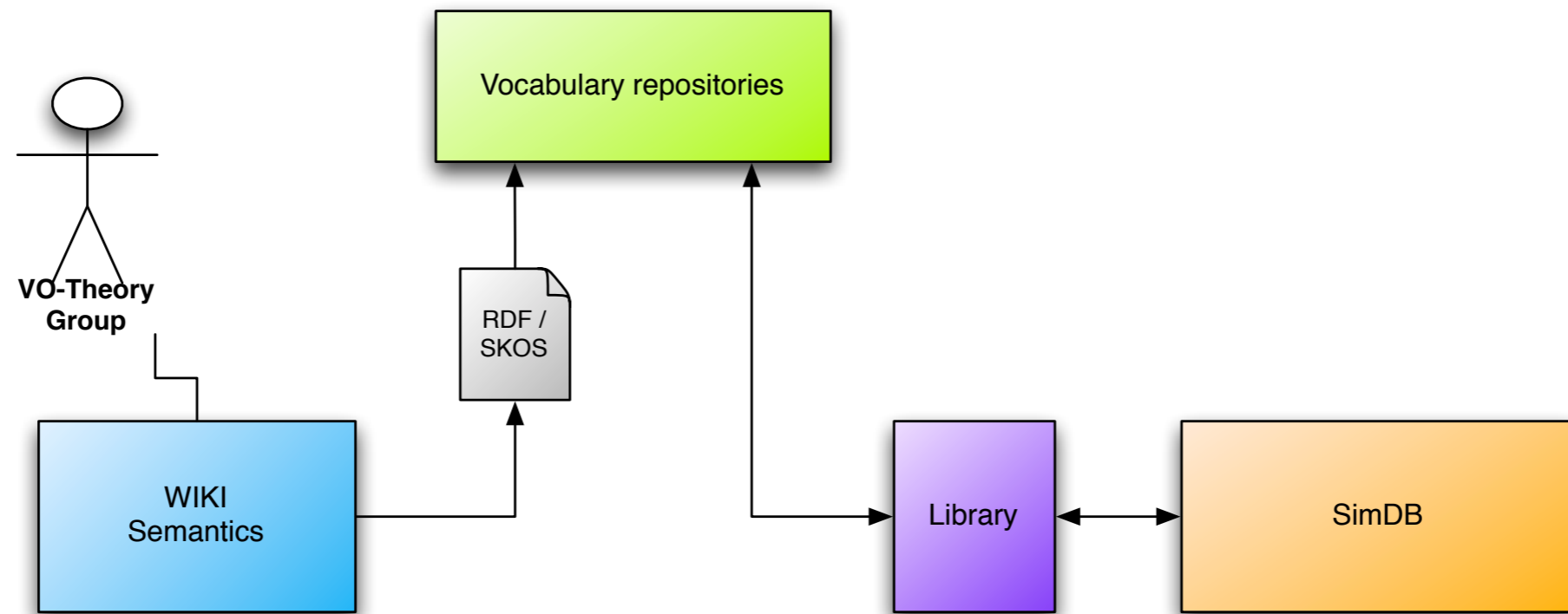
Fabrice began the work but still needs to :

- Need to add new terms
- Need to do the relationships

More participations of the VO-Theory I.G. required

Infrastructure to use the vocabularies

- Wiki semantics : development of the vocabularies
- Vocabulary repository



Should be developed by Sebastien

Conclusions

One of the next efforts should be : Semantics

- Standards have been developed by the Semantics WG
- Collaborative tools have been set up
- Infrastructure to use these vocabularies should be developed

- For theory : beginning of work on Algorithms vocabulary by Fabrice.

BUT :

- It is mandatory to have a largest participation of the members of the VO-Theory IG
Expertise in different fields of astrophysics is mandatory
<http://vocabularies.referata.com/wiki>

We should :

1. Finalize the Algorithm vocabulary
2. Develop the other vocabularies
 - Physical processes (subset of IVOAT + a few missing processes)
 - Astrophysical object (Ontology of astronomical objects + a few other processes)
 - Physical properties (UCDs + vocabulary)