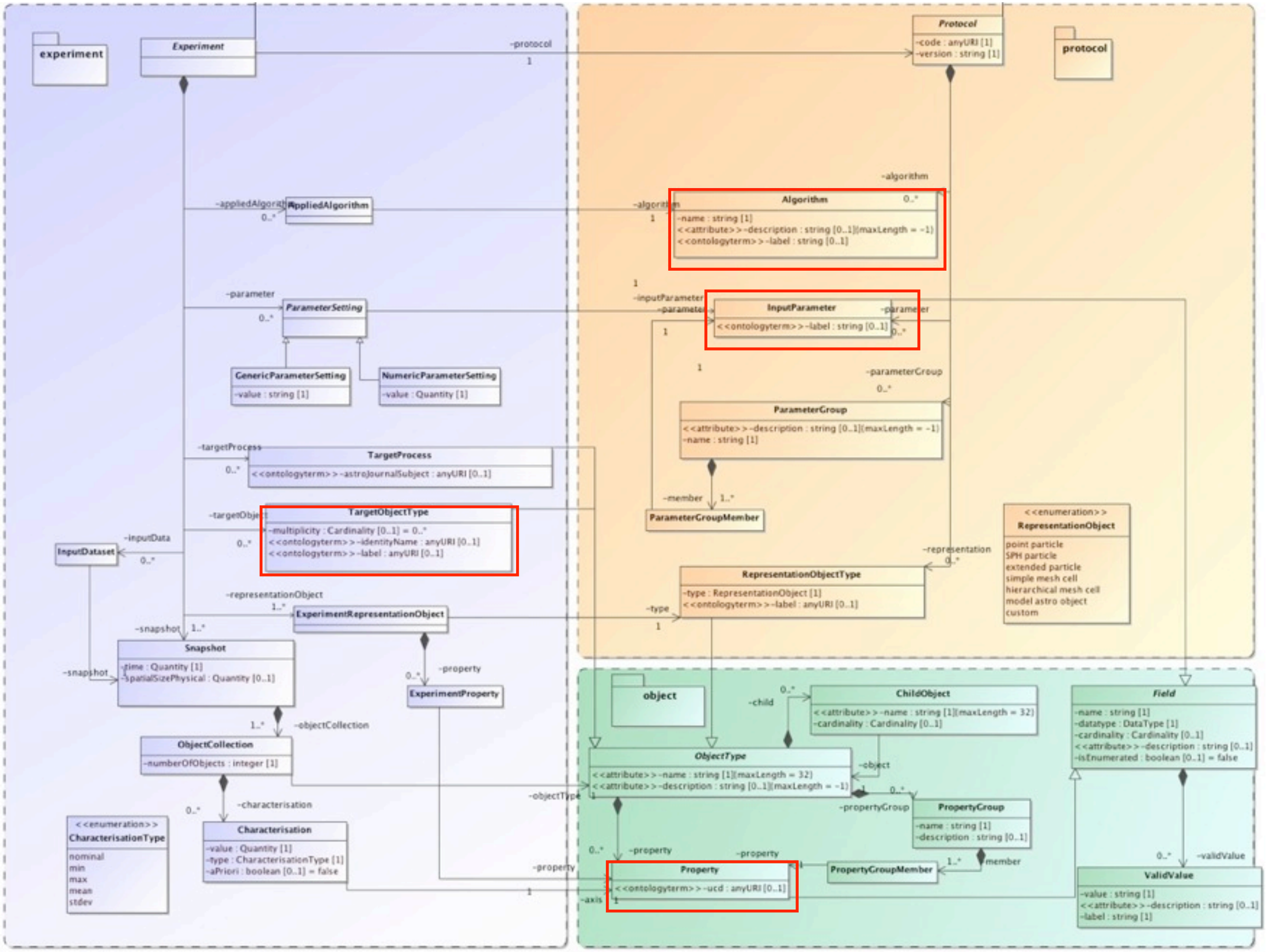
VO-Theory

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**

1. Ontology of Astronomical Objects

International

Virtual

Observatory

Alliance

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):

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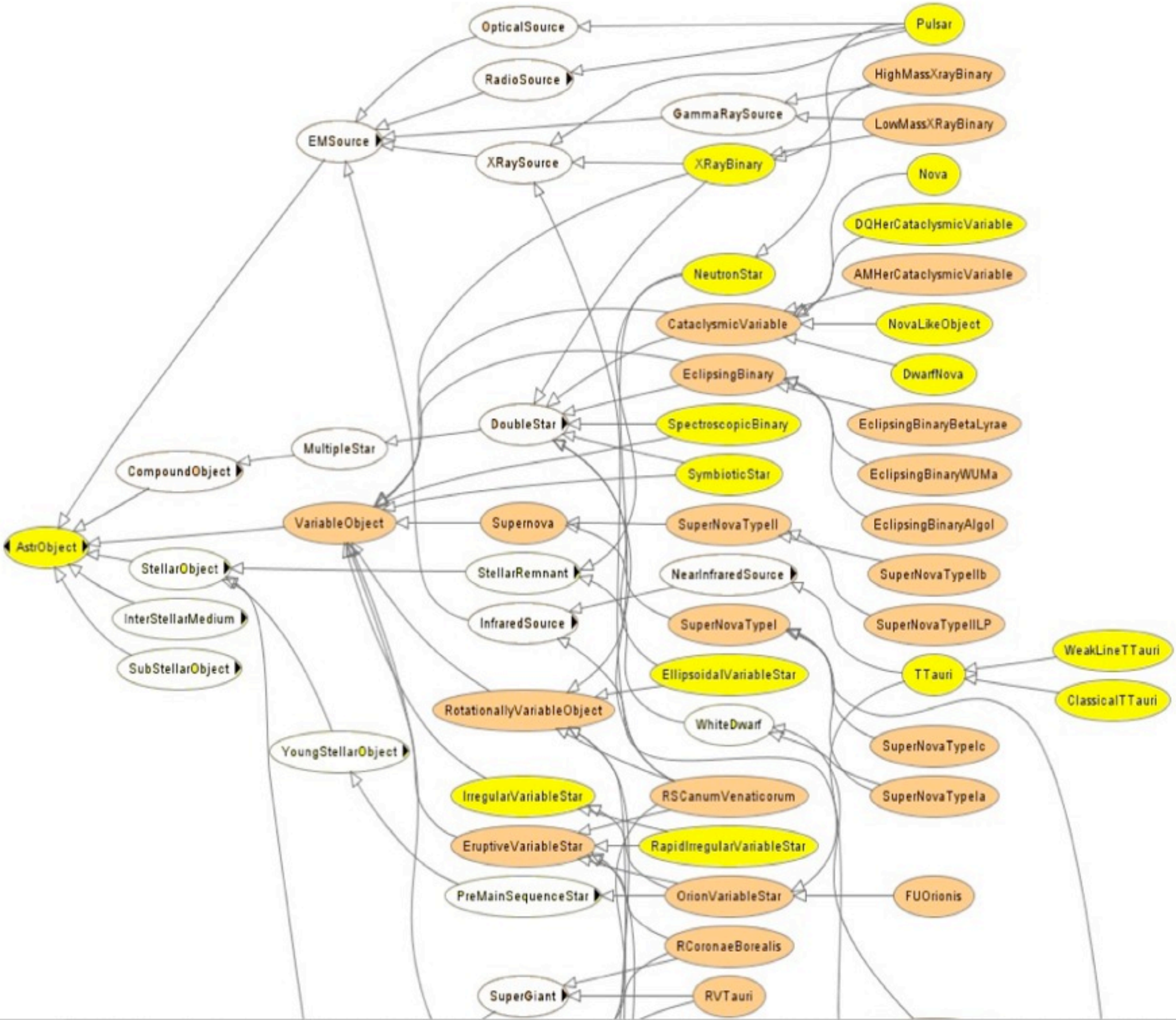
Good starting point but should add some terms

Examples :
- Simulations can model very specific regions of AstroObjects:

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

Need to separate :
- stellar interior
- photosphere
- Stellar wind
- Sollar wind
- Jets
- **...**


OpticalSource
Pulsar
RadioSource
HighMassXrayBinary
GammaRaySource
LowMassXRayBinary
EMSource
XRaySource
XRayBinary
Nova
DQHerCataclysmicVariable
NeutronStar
AMHerCataclysmicVariable
CataclysmicVariable
NovaLikeObject
EclipsingBinary
DwarfNova
DoubleStar
SpectroscopicBinary
EclipsingBinaryBetaLyrae
MultipleStar
CompoundObject
SymbioticStar
EclipsingBinaryWUMa
VariableObject
Supernova
SuperNovaTypeII
EclipsingBinaryAlgol
AstrObject
StellarObject
StellarRemnant
NearInfraredSource
SuperNovaTypeIIb
InterStellarMedium
InfraredSource
SuperNovaTypeI
SuperNovaTypeIILP
WeakLineTTauri
SubStellarObject
EllipsoidalVariableStar
TTauri
ClassicalTTauri
RotationallyVariableObject
WhiteDwarf
SuperNovaTypeIc
YoungStellarObject
IrregularVariableStar
RSCanumVenaticorum
SuperNovaTypeIa
EruptiveVariableStar
RapidIrregularVariableStar
PreMainSequenceStar
OrionVariableStar
FUOrionis
RCoronaeBorealis
SuperGiant
RVTauri

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/REC/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
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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 fullfill 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
Absorption		#Absorption
Acceleration of particles	#AccelerationOfParticles	#ParticleAccretion
Accretion	#Accretion	
Astrochemistry	#Astrochemistry	#astrochemistry
Advection		
Atomic Processes	#AtomicProcesses	#AtomicProcesses
Bremsstrahlung		#Bremsstrahlung
Chaos	#Chaos	None
Collision		#Collisions
Collisional excitation		#CollisionalExcitation
Collisional plasma		*#CollisionalPlasmas*
Collisional broadening		#CollisionBroadening
Collisonal processes		#CollisionProcesses
Compton effect		#ComptonEffect
Compton scattering		*#ComptonScattering*
Conduction	#Conduction	#Conduction
Convection	#Convection	#Convection
		#CosmicElectrodynamics
Cosmochemistry / Primordial chemistry		#Cosmochemistry
Diffusion / Scattering	#Diffusion / #Scattering	#Diffusion / #Scattering
		#EnergyTransfer
Electrodynamics		#Electrodynamics
Equation of state	#EquationOfState	
Fluorescence		#Fluorescence
Gravitation	#Gravitation	#Gravitation
Hydrodynamics	#Hydrodynamics	#Hydrodynamics
Inverse Compton scattering		#InverseComptonScattering
Line broadening		#LineBroadening

Keyword	A&A vocabulary	IAU93 vocabulary
Magnetohydrodynamics	MHD	#Magnetohydrodynamics
MHD Hall		
Mie scattering		#MieScattering
Molecular processes		#MolecularProcesses
		#NewtonianGravitation
		#MolecularBands
Nuclear reaction		#NuclearReaction
		#Nucleosynthesis
Photoelectric effect		
Photoionization		#Photodissociation
Photodissociation		#Photoionization
Plasma physics		#PlasmaPhysics
Polarization	#Polarization	#Many narrower
Radiative transfer		#RadiativeTransfer
		#RadiativeBraking
		#RadiationScattering
		#radiativeCapture
		#RadiativeEquilibrium
		#RadiativeRecombination
		#RamanScattering
		#RayleighScattering
Surface reactions	*None*	*None*
		#Reddening
Scattering / diffusion		#Scattering
Sunyaev-Zeldovitch effect		
Synchrotron radiation		#SynchrotronRadiation
		#ThermalConductivity
		#ThomsonScattering
Turbulence	#Turbulence	None

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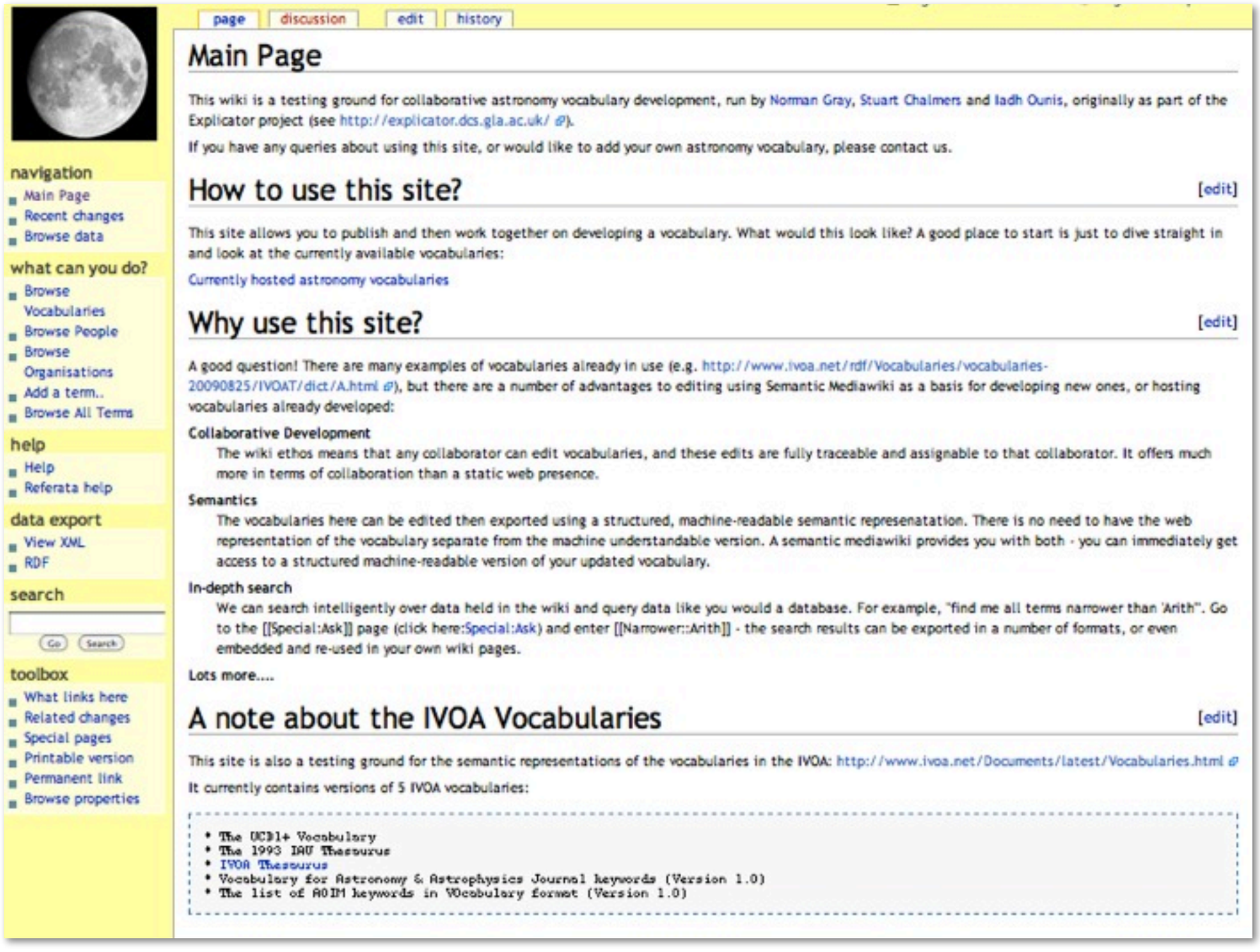
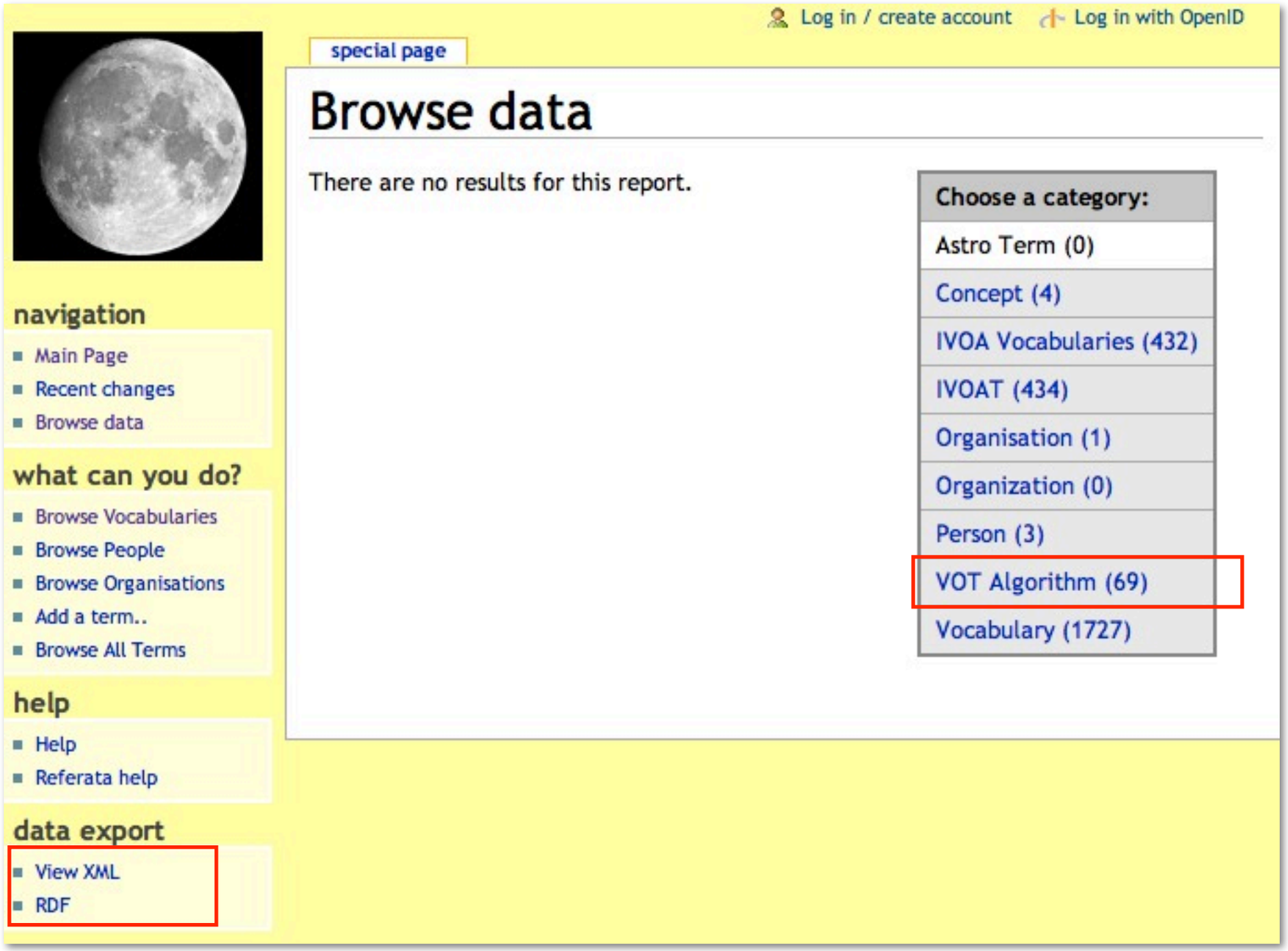
- **Physical processes** Ex: Gravitation, MHD, hydrodynamics, Radiative transfer
- **Algorithms** Ex: Tree, SPH, Vlasov solver, Monte Carlo,

- **IdentityName** Ex: M31, ...

Development of the vocabularies

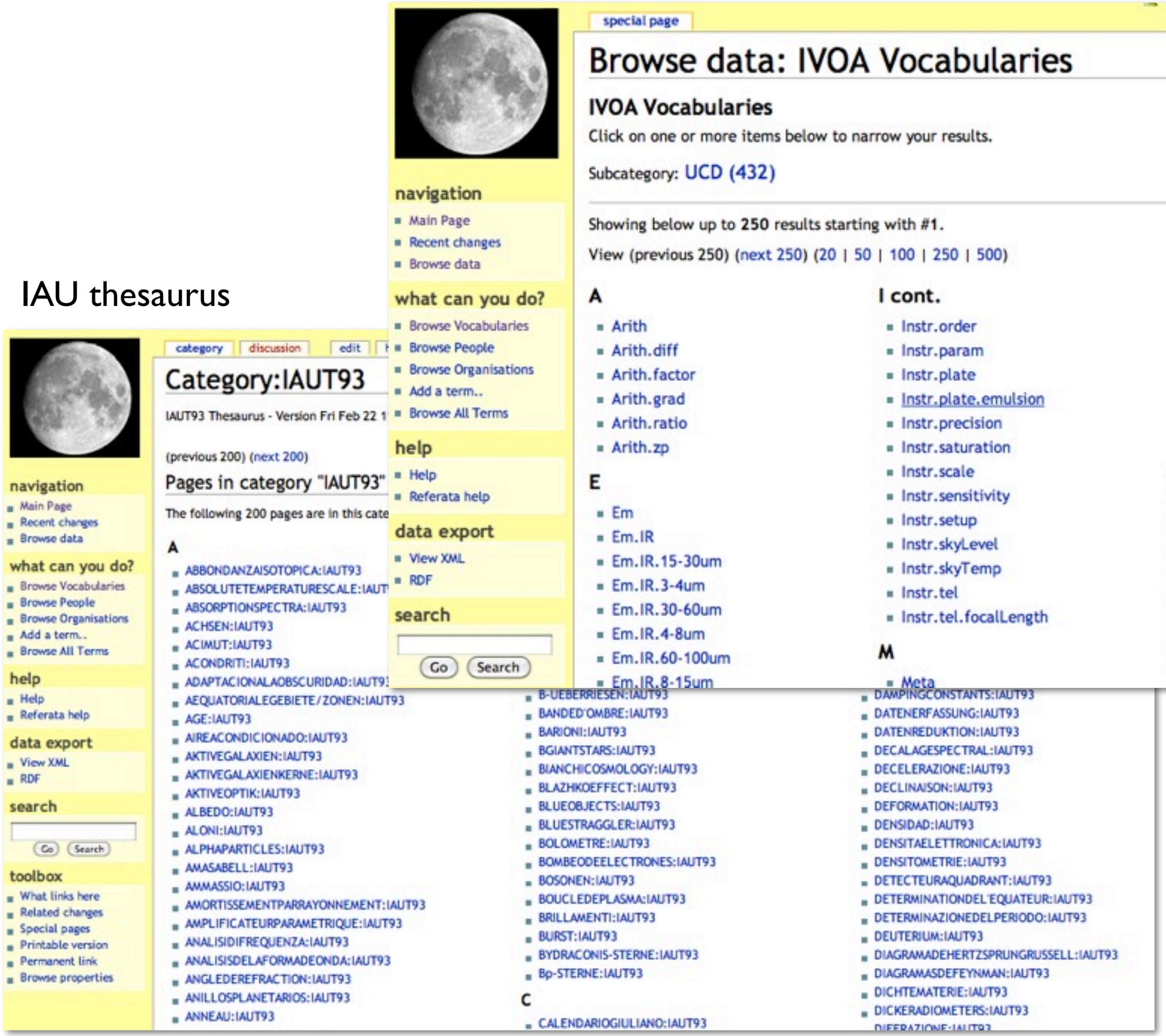
A wiki has been set up by Norman Gray and Stuart Chalmers
http://vocabularies.referata.com/wiki





Export in RDF (not fully functionnal yet)

IAU thesaurus



UCD vocabulary

Semantics for Algorithms / Algorithms parameters
Fabrice Roy

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

search

Go Search

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

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.
- HLLE
- Hartree-Fock
- Henyey

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

SKOS concept has :

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

page | discussion | edit | history

Adaptive Mesh Refinement

Definition	Adaptive mesh refinements methods
ScopeNote	
prefLabel	AMR
AltLabel	AMR
Broader	Particle-Mesh
Narrower	
Related	

page | discussion | edit | history

Particle-Mesh

Definition	Fourier method on cartesian grid
ScopeNote	
prefLabel	
AltLabel	PM
Broader	N-Body
Narrower	P3M
Related	

Norman should finish the semantics wiki

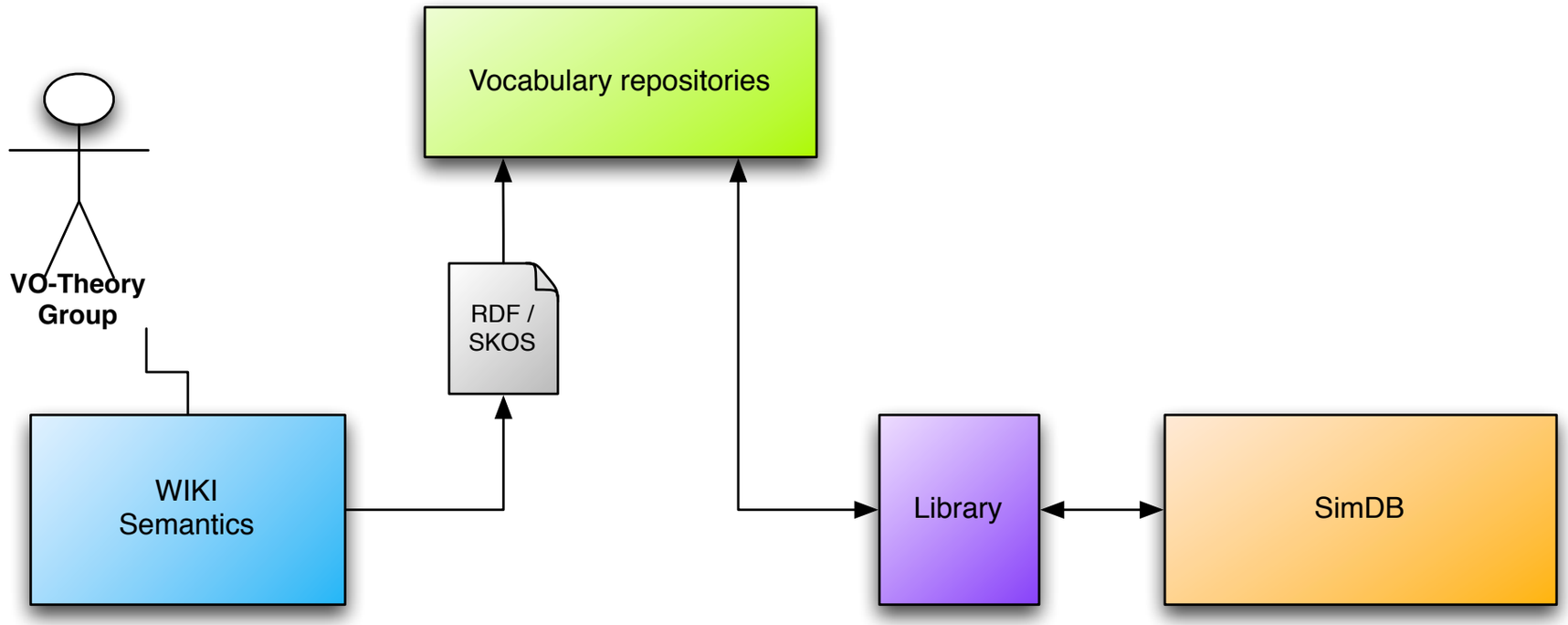
Fabrice began the work but still needs to :

- 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)