

Jiří Nádvorník

Czech Technical University in Prague

Petr Škoda

Astronomical Institute, Czech Academy of Sciences Ondřejov

> IVOA TDIG Group IVOA DM Group

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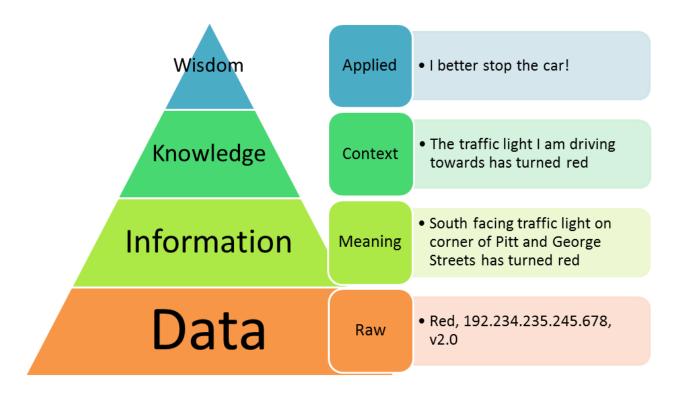


Outline

- 1. What is TS cube
- 2. Time Series Cube structure
- 3. Discovering TS Cube
- 4. Cutouting TS Cube
- 5. Open Questions



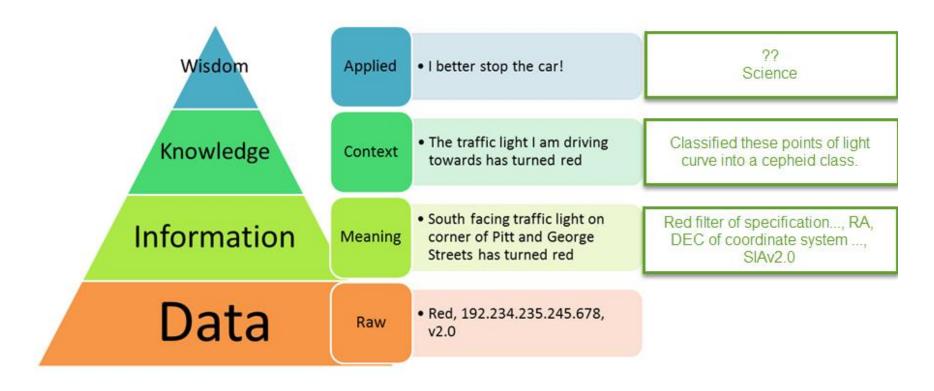
Separation of Data vs. Information



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Separation of Data vs. Information



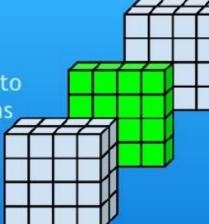
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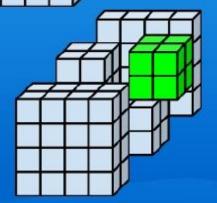
What is a data cube

OLAP Cubes - operations

 Slice = choose values corresponding to ONE value on one or more dimensions



 Dice = choose values corresponding to one slice or a number of consecutive slices on more than 2 dimensions of the cube



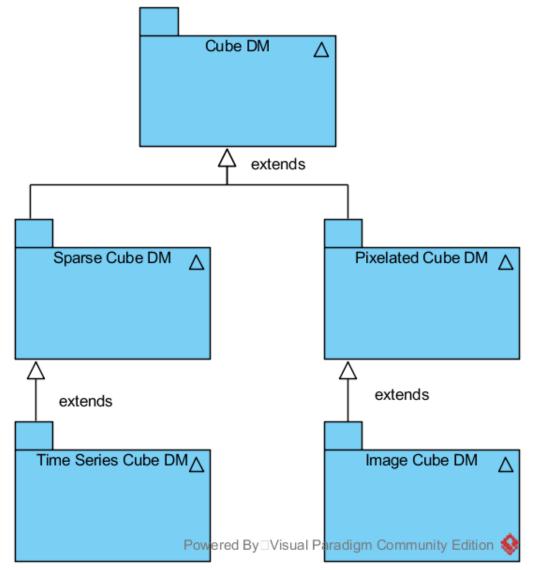


Sparse Cube DM

- Can describe any time series axes.
- Is flexible
- Is extensible



Time Series Cube DM





Data + Information in Time Series Cube DM



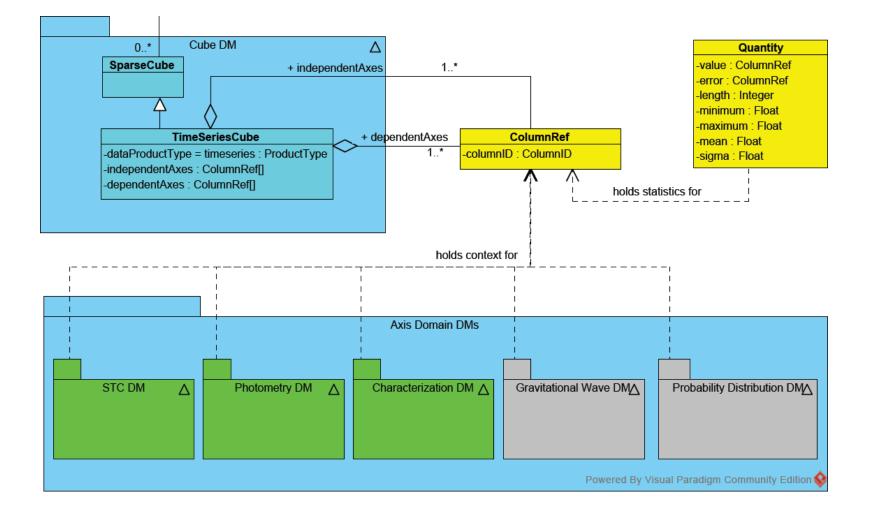


Separation of Data vs. Information

- Describing meaning (information layer) for any possible data in the Cube DM will create a god object
- Cube DM can still describe information about its axes (data layer) without needing to know every physical domain model
- Changes to physical domain models (STC, Phot DM, Provenance) won't require Cube DM to change



Time Series Cube UML





Time Series Cube UML

- Through Time Series Cube class I can find the axes (data) of the cube
- In the Quantity class, I store statistical metadata about my data
- Axis domain DMs (frame) metadata of already existing models (STC, Phot DM) or potential new models. If these change, it doesn't matter to the Cube DM.



Advantages of Cube

- Adding new filters during the survey
- Adding new data sources (instruments) to the survey

-> No change to the VOTable



Advantage of Time Series Cube

- Time Series Cube DM does not wait for STC v2.0, Phot DM, Gravitation wave DM, ...
- Domain-specific clients (Spectral, Photometry, etc.) can still use cube without change. Cube is just adding metadata about the data
- Discovery of "pure" cube metadata -> Time Series Cube can cutout itself without knowing about physical meaning of the data, just statistical distributions
- Ability to partially describe non-standardized frames (gravitational waves, hardness ratio, etc.) without the need to understand everything that can be stored within Cube DM



Science use Cases for Time Series

- Use cases (2012-10-20, Enrique Solano)
- 3 groups of requirements
 - Group A: Combine photometry and light curves of a given object/list of objects in the same photometric band
 - Group B: Combine photometry and light curves of a given object/list of objects in different photometric bands
 - Group C: Time series **other** than light curves



ObsCore discovery

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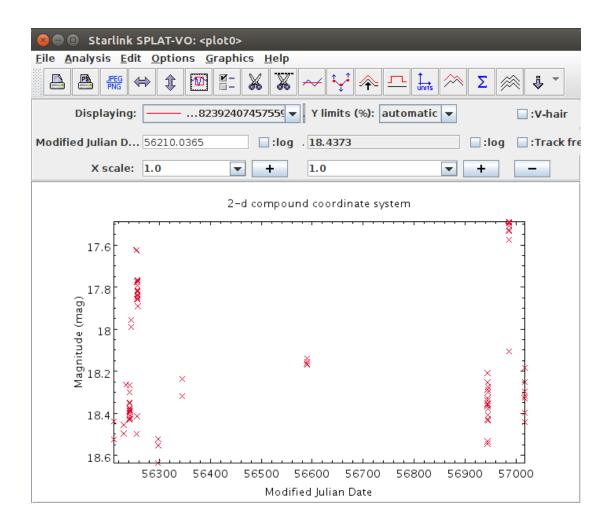


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Light curve





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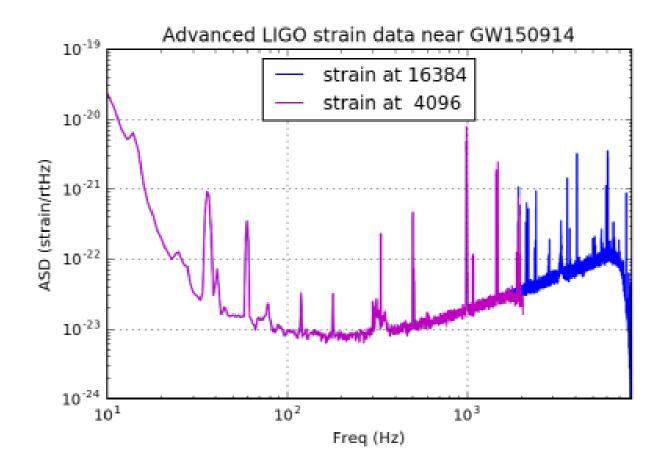


Light curves (Group A, Group B)

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Gravitational wave data (Group C)





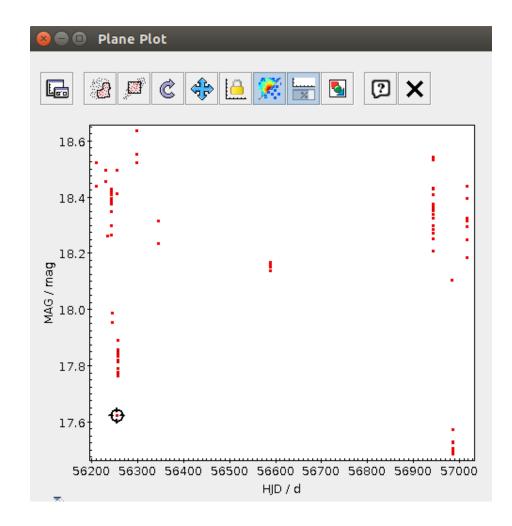
Obscore discovery

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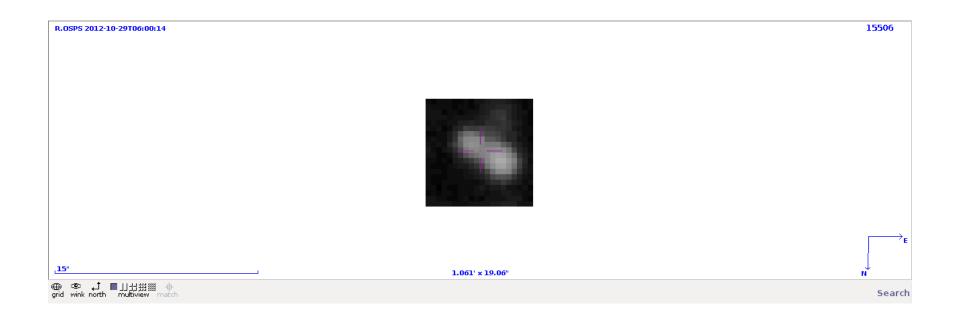


Topcat plotting + action function





Clicking point leads to cutout in Aladin





Other use cases

- Plot light curves from multiple data sources
- Looking for stars with more than N photometric points
 5 sigma higher than the mean value.
- Fermi has detected a flaring blazar. It has a certain error ellipse, say a few arc-minutes. An optical counterpart is not known. How can one get light curves for all objects in the error-ellipse to look for variability and thus possible counterparts to the blazar?
- Retrieve all catalogues which have measurements for a given date (e.g., date of a Gaia observation)



Open Questions

- Add datalink to ObsCore
- What to put into Quantity DM
 - Underlying statistical distribution of values beneath each axis of the cube
 - Underlying statistical distribution of each point in the cube
- Two kinds of models
 - Real world model for data cubes
 - Application data model used for publishing the data (view on the real world model)
- What do I need to discover about the data cube
- Datalink for cutouts of cubes (time series) seems like the best option
- Use cases!



Join us!

- IVOA note on volute repository
- voevent@ivoa.net
- dm@ivoa.net

