LCPD 2013

From Linked Data to Concept Networks

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Agenda

- Motivation
- Concept network
- Example
- Benefits
- LYR platform
- Future work

Citations have no precise meaning

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Time-of-arrival states

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(Received 17 July 1998)

Although one can show formally that a time-of-arrival operator cannot exist, one can modify the low-momentum behavior of the operator slightly so that it is self-adjoint. We show that such a modification results in the difficulty that the eigenstates are drastically altered. In an eigenstate of the modified time-of-arrival operator, the particle, at the predicted time of arrival, is found far away from the point of arrival with probability 1/2. [S1050-2947(99)03403-4]

PACS number(s): 03.65.−w

I. INTRODUCTION

In quantum mechanics, observables like position and momentum are represented by operators at a fixed time t. However, there is no operator associated with the time it takes for …

… the possibility of localizing these states at the location of arrival at the time-of-arrival. Our results for the "unmodified" part of the time-of-arrival state seem to agree with those of Muga, Leavens, and Palao, who have studied these states independently [7]. Our central result is contained in …

1050-2947/99/59(3)/1804(5)/$15.00 PRA 59 1804 ©1999 The American Physical Society

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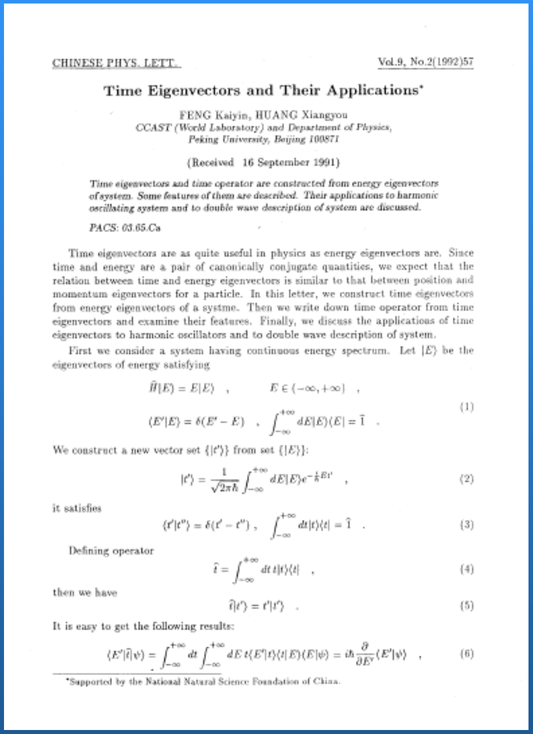
cites



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Time Eigenvectors and Their Applications*

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(Received 16 September 1991)

Time eigenvectors and time operator are constructed from energy eigenvectors of system. Some features of them are described. Their applications to harmonic oscillating system and to double wave description of system are discussed.

PACS: 03.65.Ca

Time eigenvectors are as quite useful in physics as energy eigenvectors are. Since time and energy are a pair of canonically conjugate quantities, we expect that the relation between time and energy eigenvectors is similar to that between position and momentum eigenvectors for a particle. In this letter, we construct time eigenvectors from energy eigenvectors of a systme. Then we write down time operator from time eigenvectors and examine their features. Finally, we discuss the applications of time eigenvectors to harmonic oscillators and to double wave description of system.

First we consider a system having continuous energy spectrum. Let $|E\rangle$ be the eigenvectors of energy satisfying

$$\hat{H}|E\rangle = E|E\rangle \quad , \qquad E \in (-\infty, +\infty) \quad ,$$
$$\langle E'|E\rangle = \delta(E'-E) \quad , \quad \int_{-\infty}^{+\infty} dE|E\rangle\langle E| = \hat{1} \quad . \qquad (1)$$

*Supported by the National Natural Science Foundation of China.

Article A cites Article B

Citations have no precise meaning

There are many reasons why authors cite the work of others*:

1. Paying homage to pioneers.
2. Giving credit for related work.
3. Identifying methodology, equipment, etc.
4. Providing background reading.
5. Correcting one's own work.
6. Correcting the work of others.
7. Criticising the work of others.
8. Substantiating claims.
9. Alerting researchers to forthcoming work.
10. Providing leads to poorly disseminated, poorly indexed, or uncited work.
11. Authenticating data and classes of fact-physical constants, etc.
12. Identifying original publications in which an idea or concept was discussed.
13. Identifying the original publication describing an eponymic concept or term such as, e.g. Hodgkin's disease ...
14. Disclaiming work or ideas of others.
15. Disputing priority claims of others.

*Weinstock M. (1971), Citation index. Encyclopedia of Library and Information Science, 5, 16-40.

Citation network

struct an operator which is conjugate to the Hamiltonian if **H** is bounded from above or below [3].

One might try to modify **T** in order to make it self-adjoint [6]. Consider the operator

$$\mathbf{T}_\epsilon(k) = -im\sqrt{f_\epsilon(k)}\frac{d}{dk}\sqrt{f_\epsilon(k)}, \qquad (5)$$

where $f_\epsilon(k)$ is some smooth function which differs from $1/k$ only near $k=0$. Since $u(k)$ and $v(k)$ could diverge at the origin at a rate approaching $1/\sqrt{k}$ and still remain square integrable, if $f_\epsilon(k)$ goes to zero at least as fast as k, then $\mathbf{T}_\epsilon$ will be self-adjoint and defined over all square-integrable functions. However, as we show in Sec. IV, these eigenstates do not behave as one would expect a time-of-arrival eigenstate to behave.

It can be verified that $\mathbf{T}_\epsilon$ has a degenerate set of eigenstates $|t_A,+\rangle$ for $k>0$ and $|t_A,-\rangle$ for $k<0$, given by

$g^{\pm}_{t_A}(k) = \langle k|t_A,\pm\rangle$

the $t_A=0$ state, (8) can be integrated to give

$${}_\epsilon\tilde{g}^+(x)_{t_A} = \frac{\epsilon}{\sqrt{2xim}}\Phi(\sqrt{i\epsilon x}), \qquad (9)$$

where Φ is the probability integral. For large x, ${}_\epsilon\tilde{g}^+(x)_{t_A}$ goes as $1/\sqrt{x}$ and the quantity $\int dx'|{}_\epsilon\tilde{g}^+_{t_A}(x')|^2 \sim \ln x$ diverges as $x\to\infty$. For small x, ${}_\epsilon\tilde{g}^+_{t_A}(x)$ is proportional to $e^{-i\epsilon x}$. Its modulus squared vanishes when integrated around a small neighborhood of $x=0$. ${}_\epsilon\tilde{g}^+(x)_{t_A}$, then, is not localized around the point of arrival, at the time of arrival. This will also be verified in Sec. III where we examine normalizable states. Although ${}_\epsilon\tilde{g}^+(x)_{t_A}$ is not localized around the point of arrival at the time of arrival, one might hope that this part of the state does not contribute significantly in time-of-arrival measurements when $\epsilon\to 0$. However, we will see that for coherent superpositions of these eigenstates, half the

Our aim is to specify such citations more precisely and to represent them in machine-processable way.

Towards concept network

URI assignment

For instance, we may choose

$$f_\epsilon(k)=\begin{cases}\dfrac{1}{k} & \text{for } |k|>\epsilon\\ \epsilon^{-2}k & \text{for } |k|<\epsilon.\end{cases} \tag{36}$$

Using this, we define the regulated time-of-arrival operator as

$$\hat{T}_\epsilon=-i\frac{m}{\hbar}\sqrt{f_\epsilon(k)}\frac{d}{dk}\sqrt{f_\epsilon(k)}, \tag{37}$$

to be compared with the unregulated operator (27). Notice that on any state with support on $|k|>\epsilon$ the operators $\hat{T}_\epsilon$ and $\hat{T}$ are equal. Their action differs only on the component of a state with arbitrary low momentum. As we shall see, the probability distribution for the time of arrival $\pi(T)$ com-

struct an operator which is conjugate to the Hamiltonian if **H** is bounded from above or below [3].

One might try to modify **T** in order to make it self-adjoint [6]. Consider the operator

$$\mathbf{T}_\epsilon(k)=-im\sqrt{f_\epsilon(k)}\frac{d}{dk}\sqrt{f_\epsilon(k)}, \tag{5}$$

where $f_\epsilon(k)$ is some smooth function which differs from $1/k$ only near $k=0$. Since $u(k)$ and $v(k)$ could diverge at the origin at a rate approaching $1/\sqrt{k}$ and still remain square integrable, if $f_\epsilon(k)$ goes to zero at least as fast as k, then $\mathbf{T}_\epsilon$ will be self-adjoint and defined over all square-integrable functions. However, as we show in Sec. IV, these eigenstates do not behave as one would expect a time-of-arrival eigenstate to behave.

It can be verified that $\mathbf{T}_\epsilon$ has a degenerate set of eigenstates $|t_A,+\rangle$ for $k>0$ and $|t_A,-\rangle$ for $k<0$, given by

$$g^{\pm}_{t_A}(k)=\langle k|t_A,\pm\rangle$$

http://link.aps.org/doi/10.1103/PhysRevA.54.4676#37

http://link.aps.org/doi/10.1103/PhysRevA.59.1804#5

Towards concept network

Using terms from ontologies we can name the relation between the two concepts e.g.

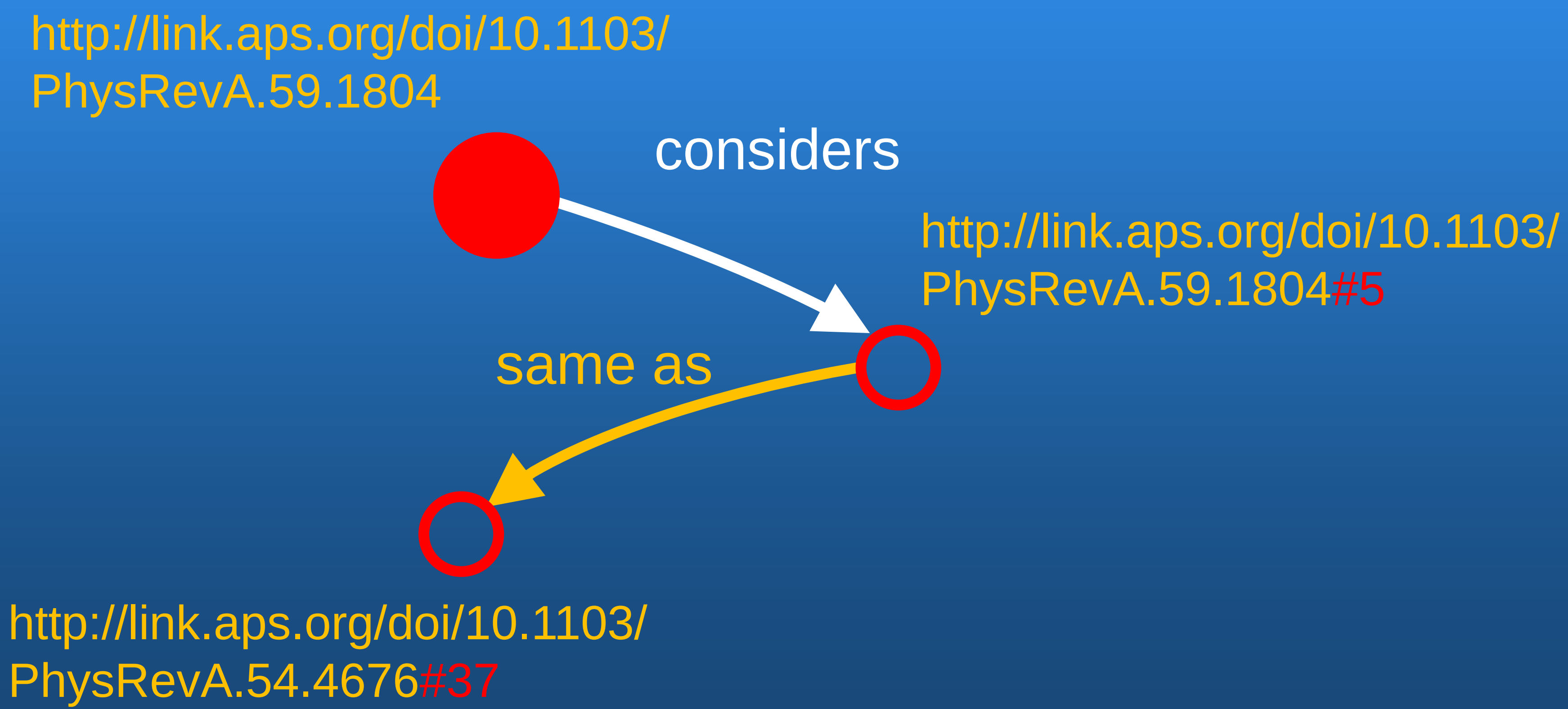
http://link.aps.org/doi/10.1103/PhysRevA.59.1804#5

http://link.aps.org/doi/10.1103/PhysRevA.54.4676#37

In this case we simply identify the two concepts.

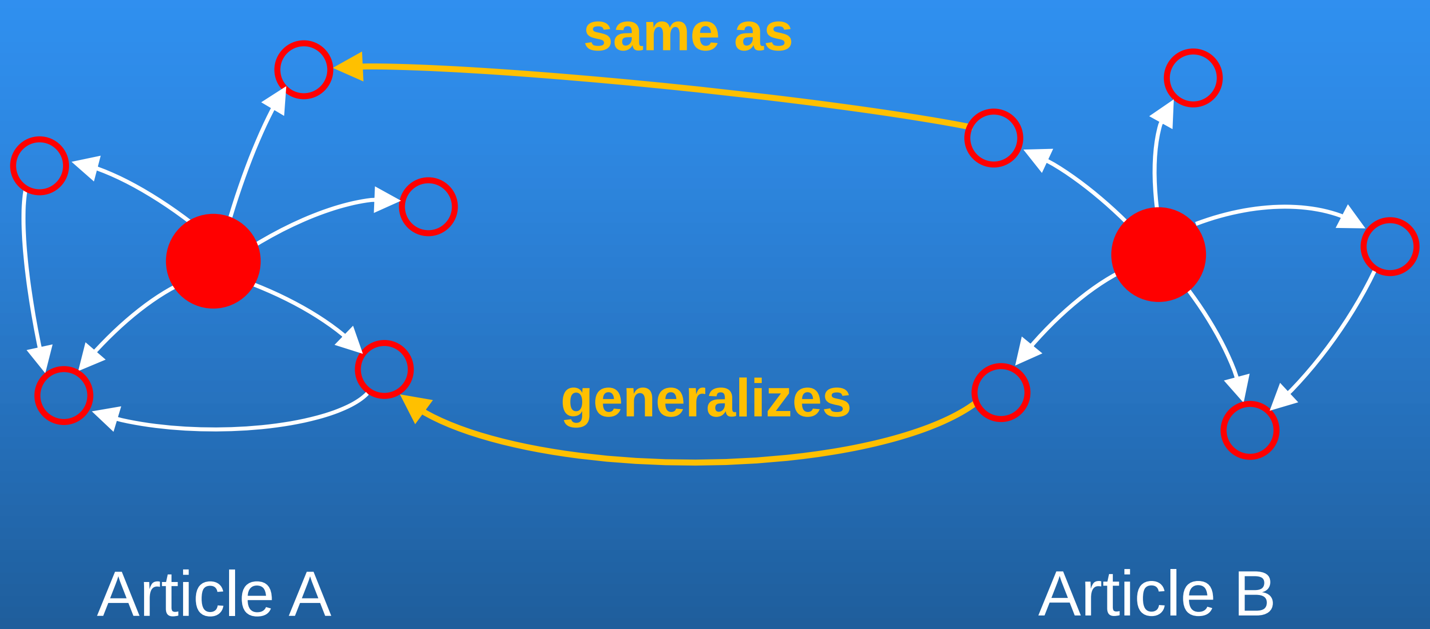
Towards concept network

We also want to define more precisely (using terms from ontologies) the relationship between each article and the concepts discussed (considered etc.) in it e.g.



Concept network

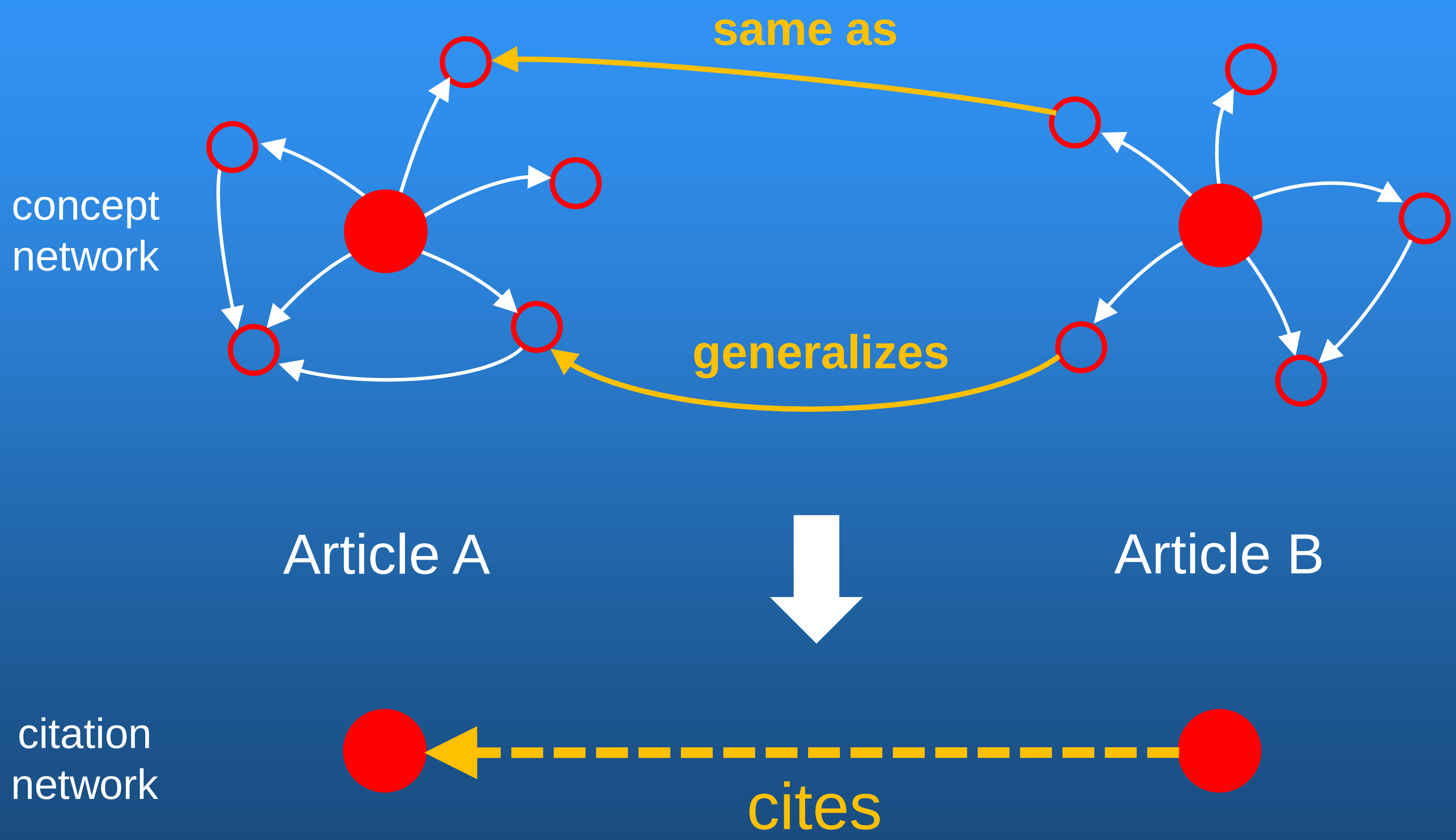
In this way we obtain a network which we call a *concept network*.



- articles - concepts

A *concept network* can be represented as linked data.

Concept network and citation network



Concept network – an example

In our example we use the following ontologies:

SACO (Scientific Article Content Ontology) - an ontology containing a set of object properties enabling description of what is done/used in a research publication.

In such publication something (e.g. some element of the theory, entity, resource) is *analyzed, described* etc.

Concept network – an example

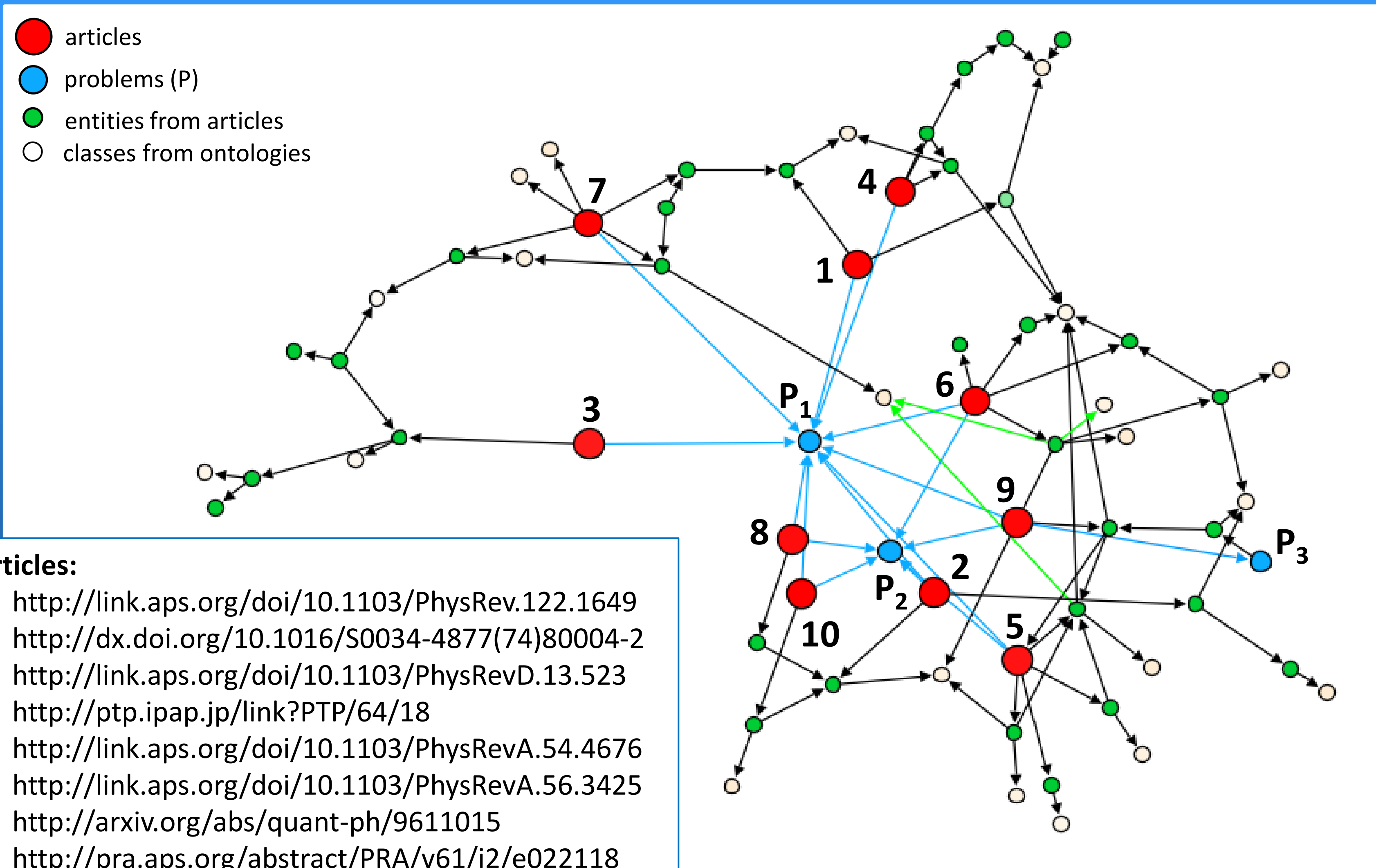
PHYSO (Physical Sciences Ontology) - an ontology describing main concepts (e.g. *principle, problem, assumption)* and relations *(e.g. has property, consequence of)* of *physical sciences.*

quONTOm

quONTOm – an ontology describing main concepts (e.g. *observable, Hamiltonian)* and relations (e.g. *commutator, orthogonality)* of *quantum mechanics.*

Remark: these ontologies are at the moment incomplete and are gradually developed towards more complete forms.

Concept network – an example



Articles:

1. http://link.aps.org/doi/10.1103/PhysRev.122.1649
2. http://dx.doi.org/10.1016/S0034-4877(74)80004-2
3. http://link.aps.org/doi/10.1103/PhysRevD.13.523
4. http://ptp.ipap.jp/link?PTP/64/18
5. http://link.aps.org/doi/10.1103/PhysRevA.54.4676
6. http://link.aps.org/doi/10.1103/PhysRevA.56.3425
7. http://arxiv.org/abs/quant-ph/9611015
8. http://pra.aps.org/abstract/PRA/v61/i2/e022118
9. http://link.aps.org/doi/10.1103/PhysRevA.59.1804
10. http://arxiv.org/abs/quant-ph/0102005

*labels are omitted for simplicity

Benefits

- Scientific articles are no longer only human-readable data islands
- They become machine-understandable (at least in some parts)
- There are precise (machine-understandable) relationships between articles (and concepts considered in them)
- Machines are able to process relationships between articles and concepts

LYR platform

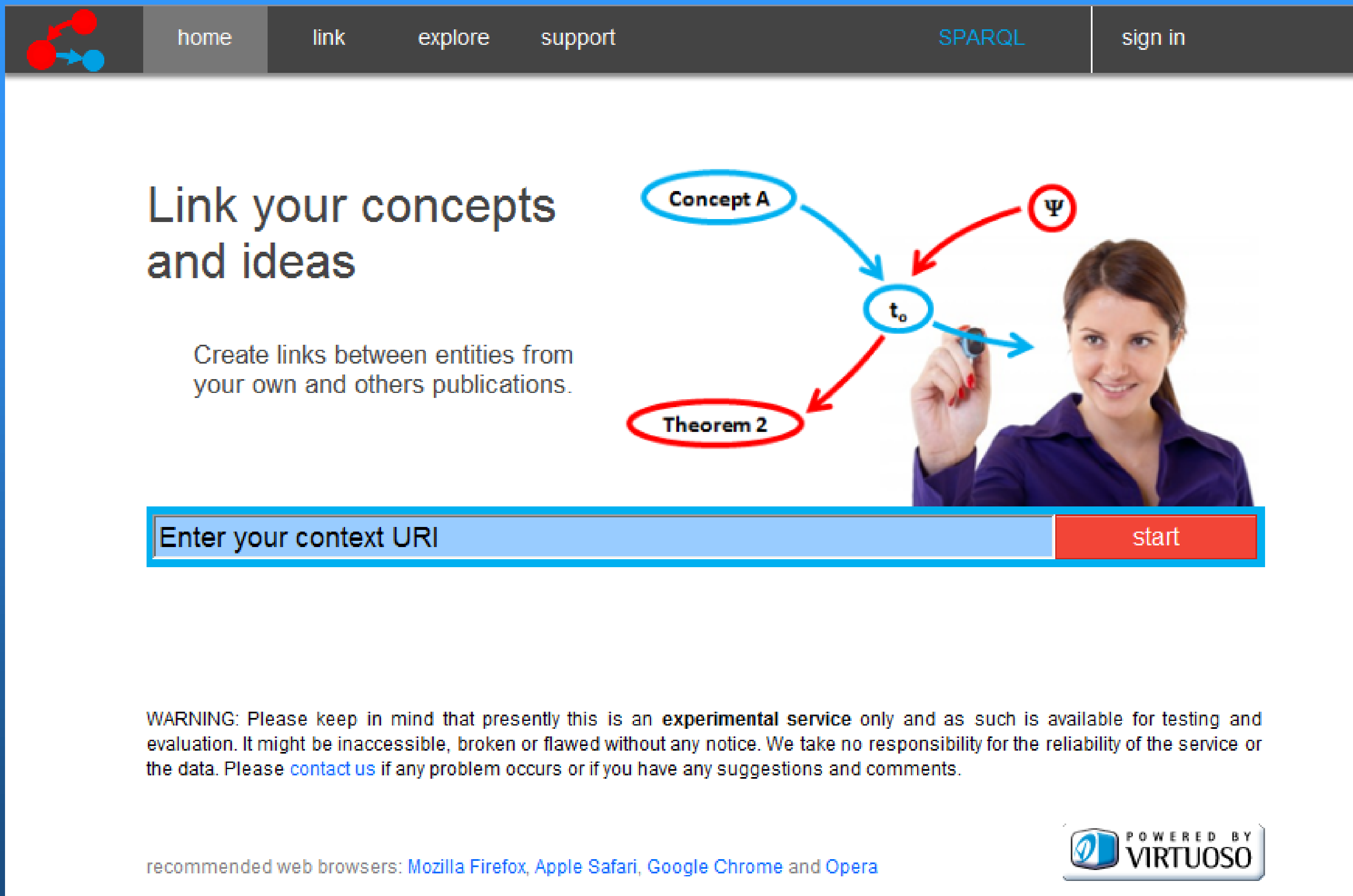
Automatic creation of valuable and precise concept networks seems to be very difficult.

However, one can imagine manual creation by authors and research community with the help of special tools.

LYR (Link Your Research) is a web platform supporting creation of concept networks (RDF links) for scientific articles*.

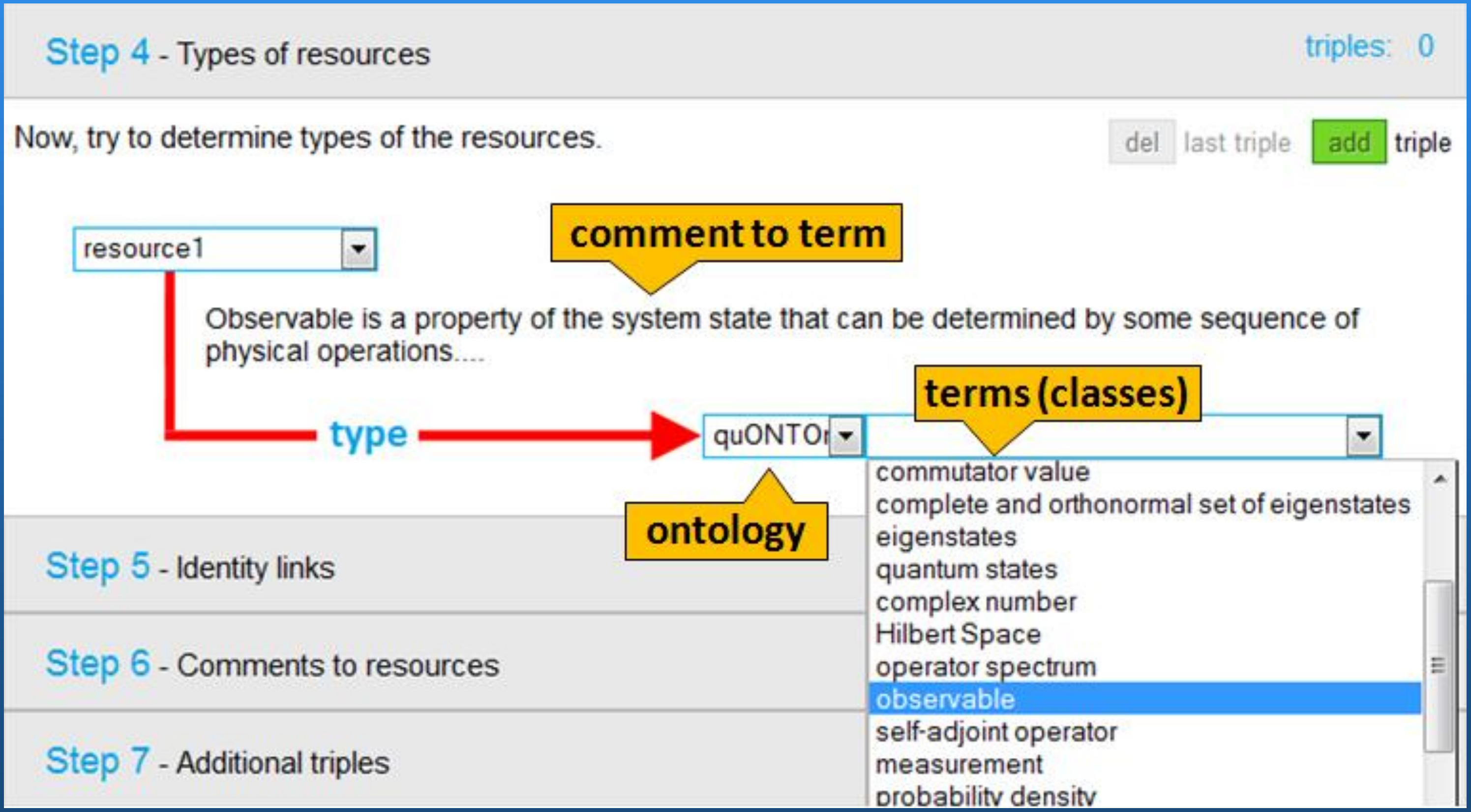
*Additional information can be found online at http://www.linkyourresearch.org

LYR platform



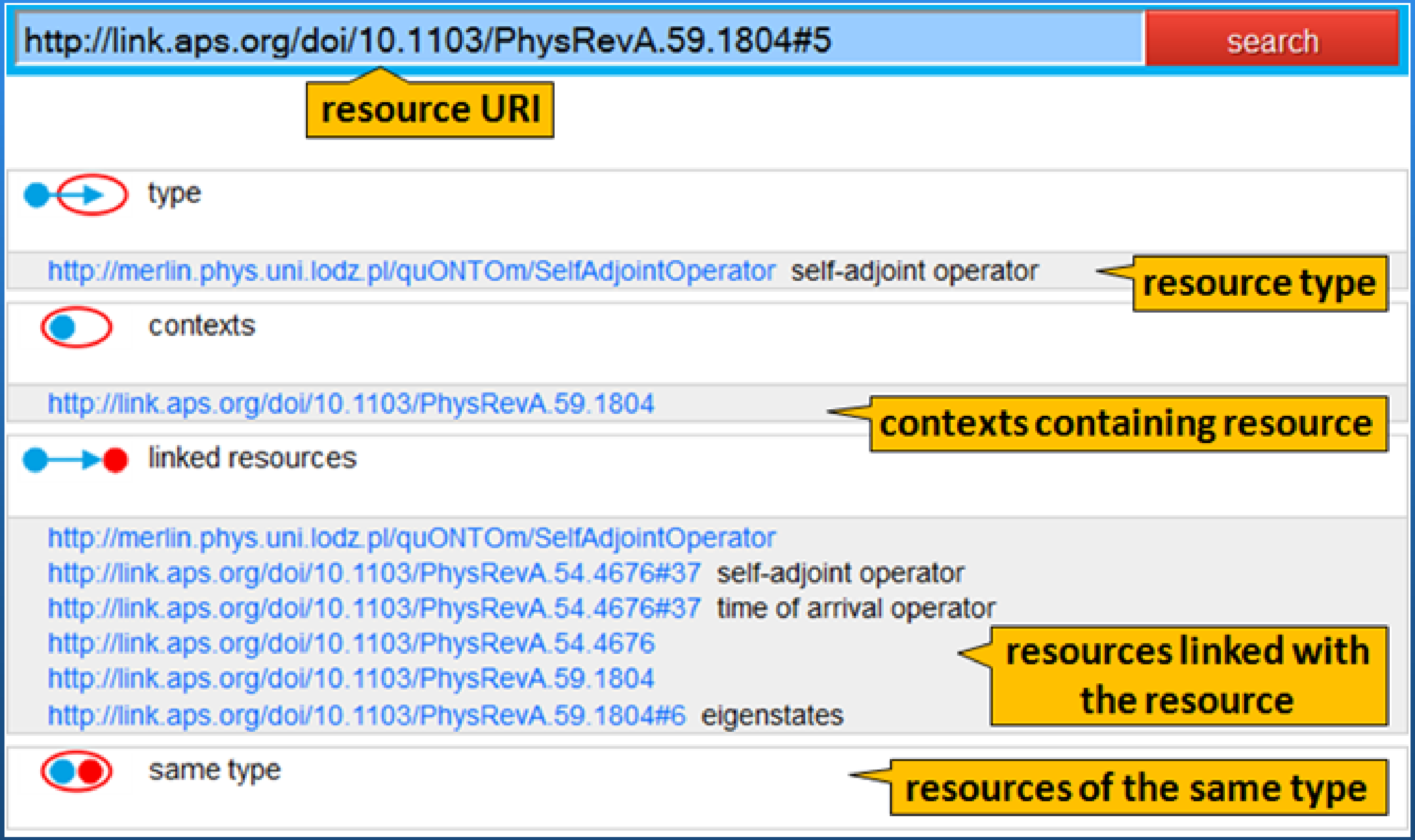
LYR platform

The process of adding new links has a few steps and consists of filling in a form available on the website. Knowlegde of an RDF syntax is not required.



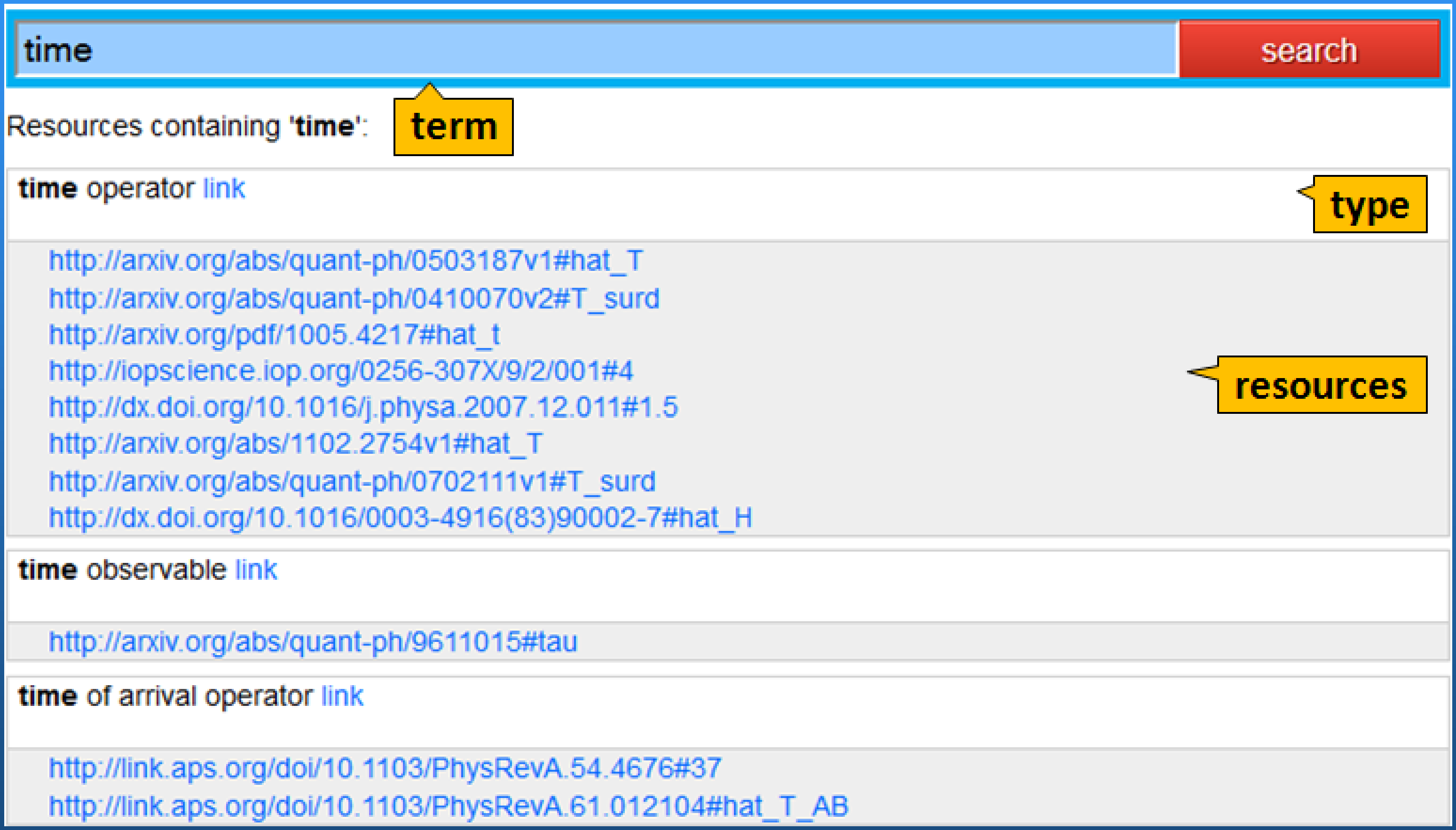
LYR platform

All links generated using the LYR tool are stored in RDF Triple Store. The LYR tool enables an easy search and exploration of the dataset.



LYR platform

Searching for some term:



LYR platform

It is possible to retrieve links forming concept networks using SPARQL queries.

SPARQL

```
PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
PREFIX rdfs: <http://www.w3.org/TR/rdf-schema/#>

SELECT DISTINCT * WHERE
        { GRAPH ?article { ?concept ?relatedBy ?toSpecifier . }} LIMIT 100
```

submit

Future

- General hints on how to create concept networks for publications in various disciplines
- Further development of LYR platform
- Development and harmonization of used ontologies

Future

Perhaps one day, in addition to putting references in scientific publications, authors will create concept networks.

That will bring us closer to the semantic science.