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# GNSS Knowledge Map

Marco-Antonio Dueñas-Esterling

Programa Nacional de Ciencias Básicas

COLCIENCIAS

Seminario Taller Regional GNSS 2008

Medellín-Colombia



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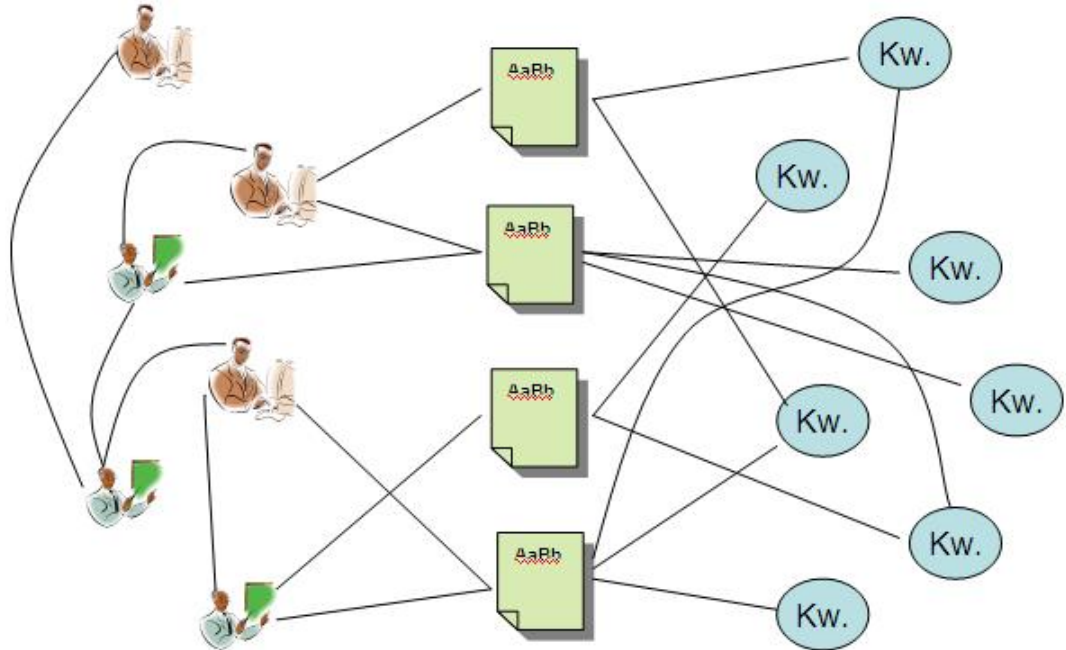
# Scientometrics<sup>1</sup>

- Theoretical Reconstruction: The idea is to use mathematical and computational models that help in the construction of the phenomenological structures.
- What is a knowledge map?
  - Co-word analysis (keywords)
  - Relations among concepts
- Emergence of Research Areas
- Scientometrics as a policy making tool

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<sup>1</sup>Chavalarias D. & Cointet J-P. (2008) Scientometrics Vol. 75 No. 1

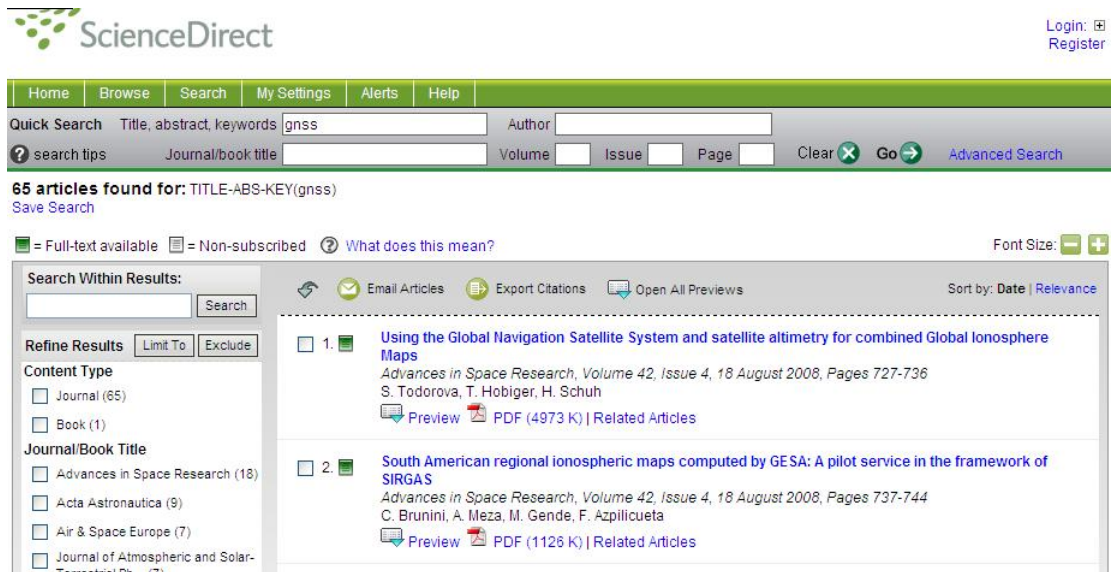
# Makers of scientific activity



Authors → Medium → Knowledge

# Building the data-base

- **RIS Format:** The RIS file format is a tagged format for expressing bibliographic citations. It is supported by a number of reference managers.



The screenshot shows the ScienceDirect search interface. At the top, there is a navigation bar with links for Home, Browse, Search, My Settings, Alerts, and Help. Below this is a search bar with the query 'gns' entered. The search results show 65 articles found for the title 'TITLE-ABS-KEY(gns)'. The first two results are listed:

1. **Using the Global Navigation Satellite System and satellite altimetry for combined Global Ionosphere Maps**  
*Advances in Space Research*, Volume 42, Issue 4, 18 August 2008, Pages 727-736  
 S. Todorova, T. Hobiger, H. Schuh  
[Preview](#) [PDF \(4973 K\)](#) | [Related Articles](#)
2. **South American regional ionospheric maps computed by GESA: A pilot service in the framework of SIRGAS**  
*Advances in Space Research*, Volume 42, Issue 4, 18 August 2008, Pages 737-744  
 C. Brunini, A. Meza, M. Gende, F. Azpilicueta  
[Preview](#) [PDF \(1126 K\)](#) | [Related Articles](#)

On the left side of the search results, there is a 'Search Within Results:' section with a search box and a 'Search' button. Below this, there are 'Refine Results' buttons for 'Limit To' and 'Exclude'. Under 'Content Type', there are checkboxes for 'Journal (65)' and 'Book (1)'. Under 'Journal/Book Title', there are checkboxes for 'Advances in Space Research (18)', 'Acta Astronautica (9)', 'Air & Space Europe (7)', and 'Journal of Atmospheric and Solar-Terrestrial Ph. (7)'. At the top right of the search results area, there are options for 'Email Articles', 'Export Citations', and 'Open All Previews', along with a 'Sort by: Date | Relevance' dropdown menu. A 'Font Size' control is also visible at the top right.



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# GNSS and Related Areas

## Data features

- 45.000 Authors
- 21.000 different titles
- More than 100 journals
- 600 items related to navigation satellite systems (final selection)

# GNSS and Related Areas

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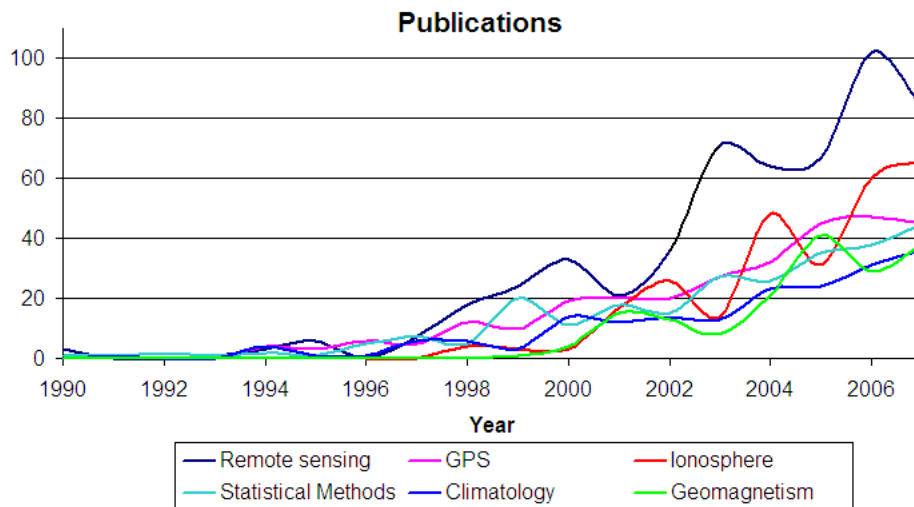
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## Proximity measure<sup>2</sup>

Let  $i$  and  $j$  be two keywords, then:

- $n_i$  = number of articles mentioning  $i$
- $n_{i,j}$  number of articles mentioning  $i$  and  $j$

The proximity measure must fulfill:

- $P(i, j) = 0$  iff  $n_{i,j} = 0$
- $\lim_{\frac{n_{i,j}}{n_i} \rightarrow 0} P(i, j) = 0$ , general topics
- $P(i, j) = 1$
- $D_{n_{i,j}} P(i, j) > 0$  and  $D_{n_i} P(i, j) < 0$

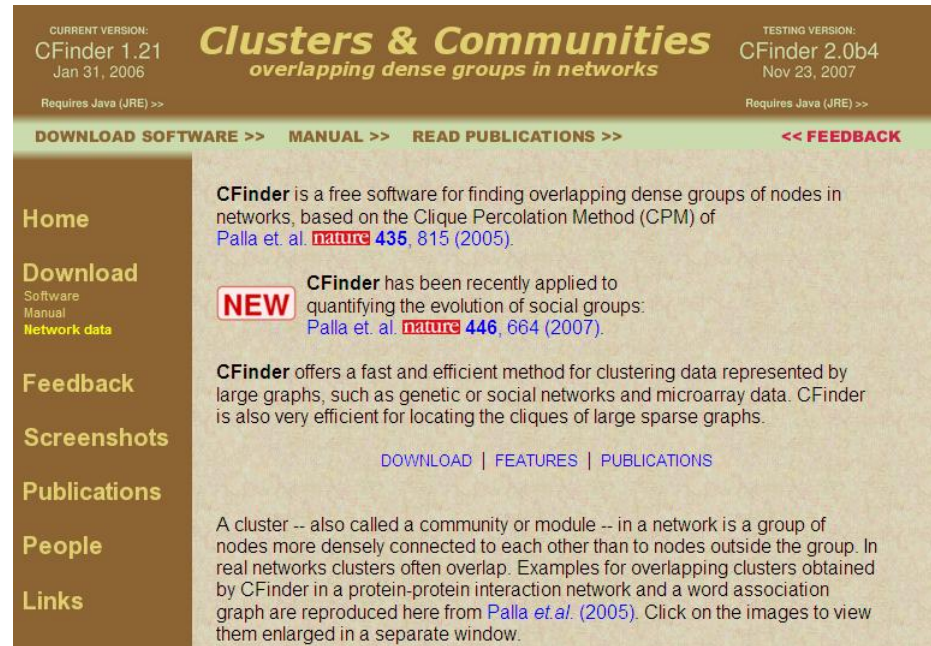
Then,

$$P(i, j) = \frac{n_{i,j}^2}{n_i n_j} \quad (1)$$

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<sup>2</sup>Chavalarias D. & Cointet J-P. (2008) *Scientometrics* Vol. 75 No. 1

# Clustering - K-clique percolation<sup>3</sup>



The screenshot shows the website for 'Clusters & Communities: overlapping dense groups in networks'. The page features a navigation menu with links for 'DOWNLOAD SOFTWARE >>', 'MANUAL >>', 'READ PUBLICATIONS >>', and '<< FEEDBACK'. The main content area is divided into a left sidebar and a main text area. The sidebar contains links for 'Home', 'Download' (with sub-links for 'Software', 'Manual', and 'Network data'), 'Feedback', 'Screenshots', 'Publications', 'People', and 'Links'. The main text area contains the following information:

**CURRENT VERSION:**  
CFinder 1.21  
Jan 31, 2006  
Requires Java (JRE) >>

**TESTING VERSION:**  
CFinder 2.0b4  
Nov 23, 2007  
Requires Java (JRE) >>

**CFinder** is a free software for finding overlapping dense groups of nodes in networks, based on the Clique Percolation Method (CPM) of Palla et. al. [nature](#) **435**, 815 (2005).

**NEW** **CFinder** has been recently applied to quantifying the evolution of social groups: Palla et. al. [nature](#) **446**, 664 (2007).

**CFinder** offers a fast and efficient method for clustering data represented by large graphs, such as genetic or social networks and microarray data. CFinder is also very efficient for locating the cliques of large sparse graphs.

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A cluster -- also called a community or module -- in a network is a group of nodes more densely connected to each other than to nodes outside the group. In real networks clusters often overlap. Examples for overlapping clusters obtained by CFinder in a protein-protein interaction network and a word association graph are reproduced here from [Palla et al. \(2005\)](#). Click on the images to view them enlarged in a separate window.

<sup>3</sup>Palla, G., Derenyi, I., Farkas, I., Vicsek, T. (2005), Uncovering the overlapping community structure of complex networks in nature and society, *Nature*, 435:814.





# Clusters

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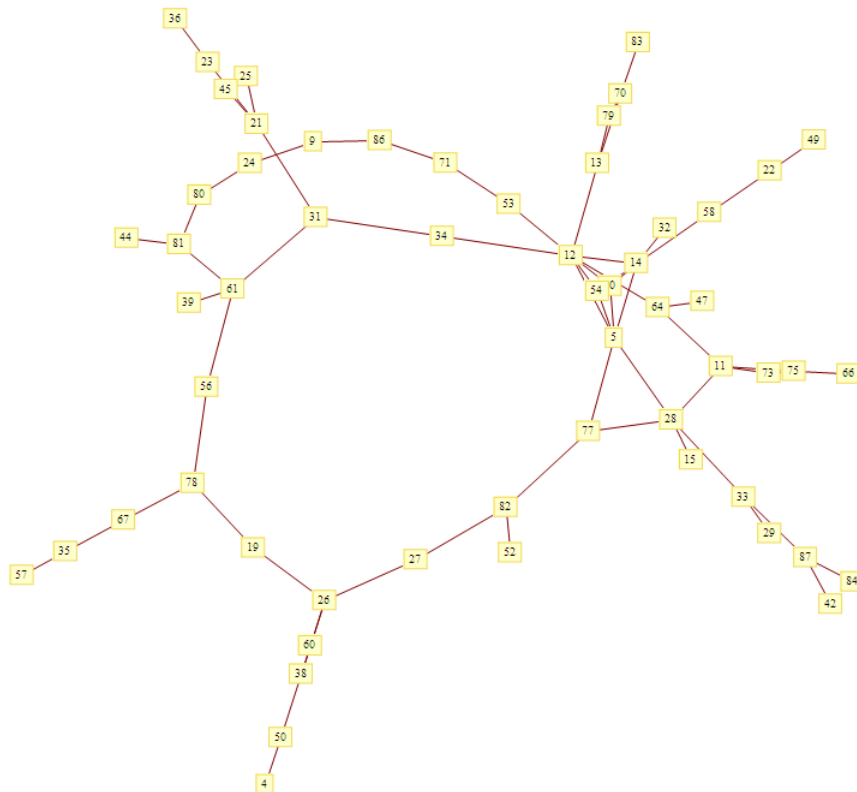
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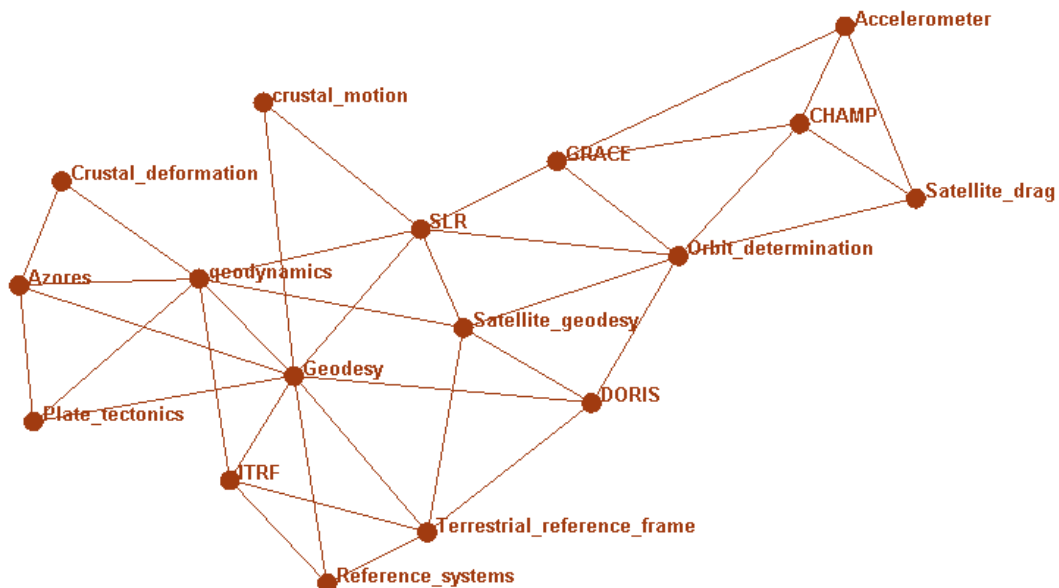
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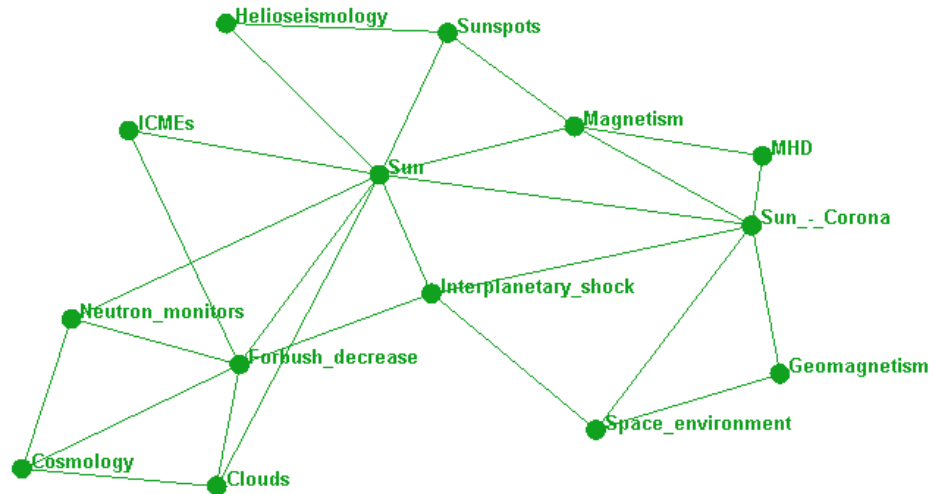
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# C14 - Aeronomy



# C23 - Astro-Imagery

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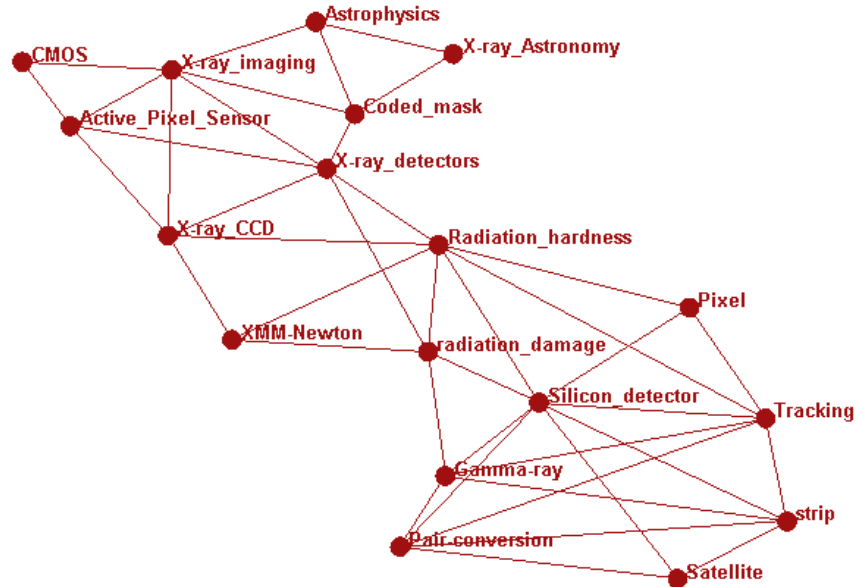
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# C26 - Oceanography



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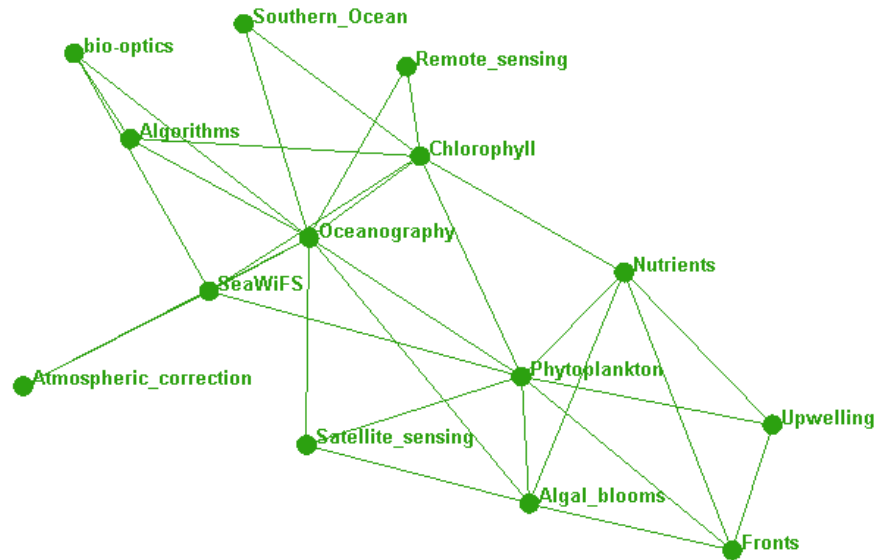
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# C28 - Astronomy

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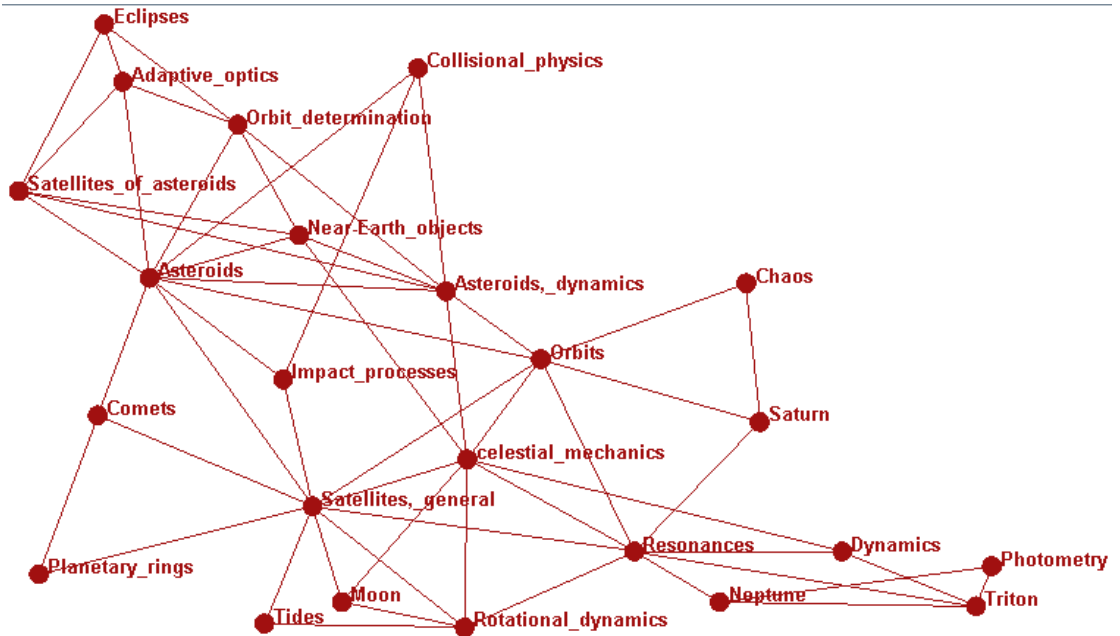
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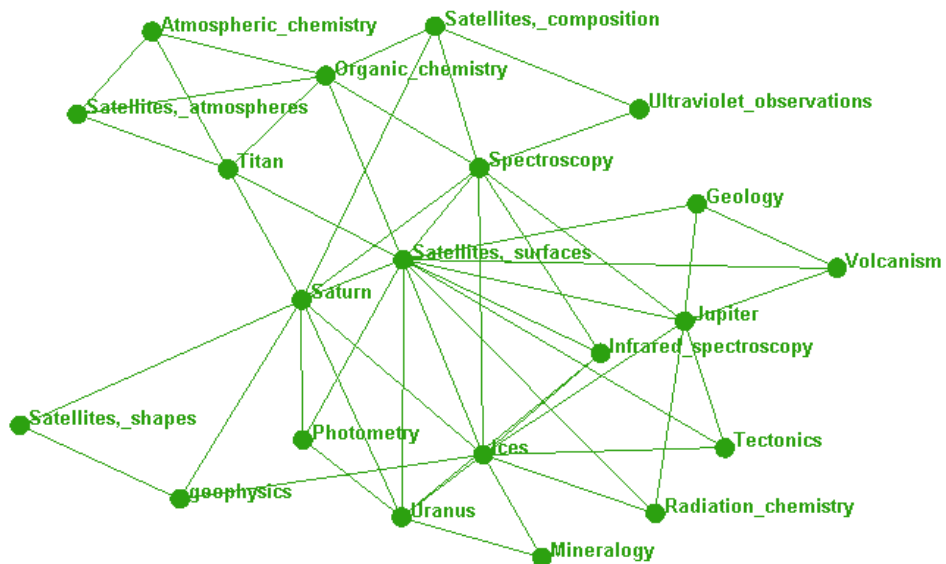
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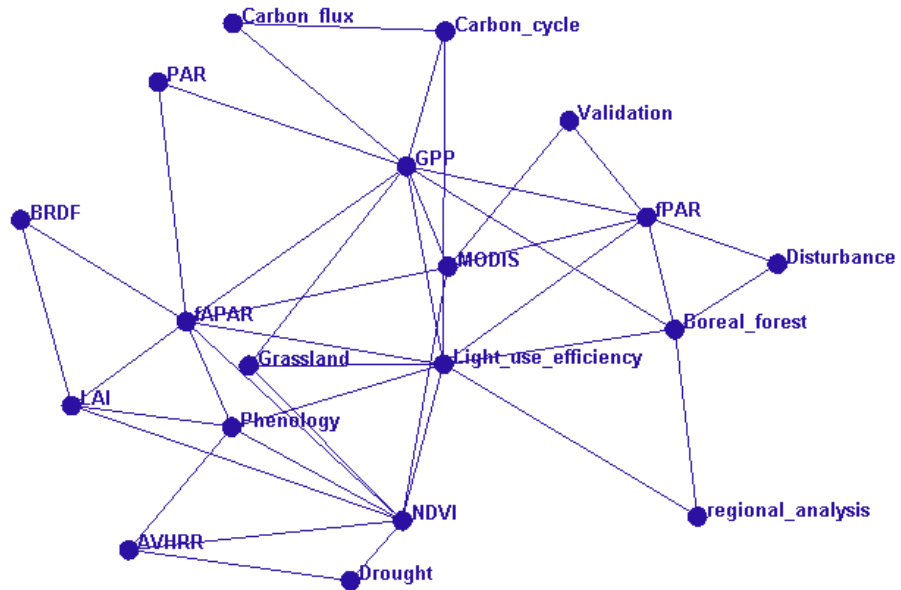
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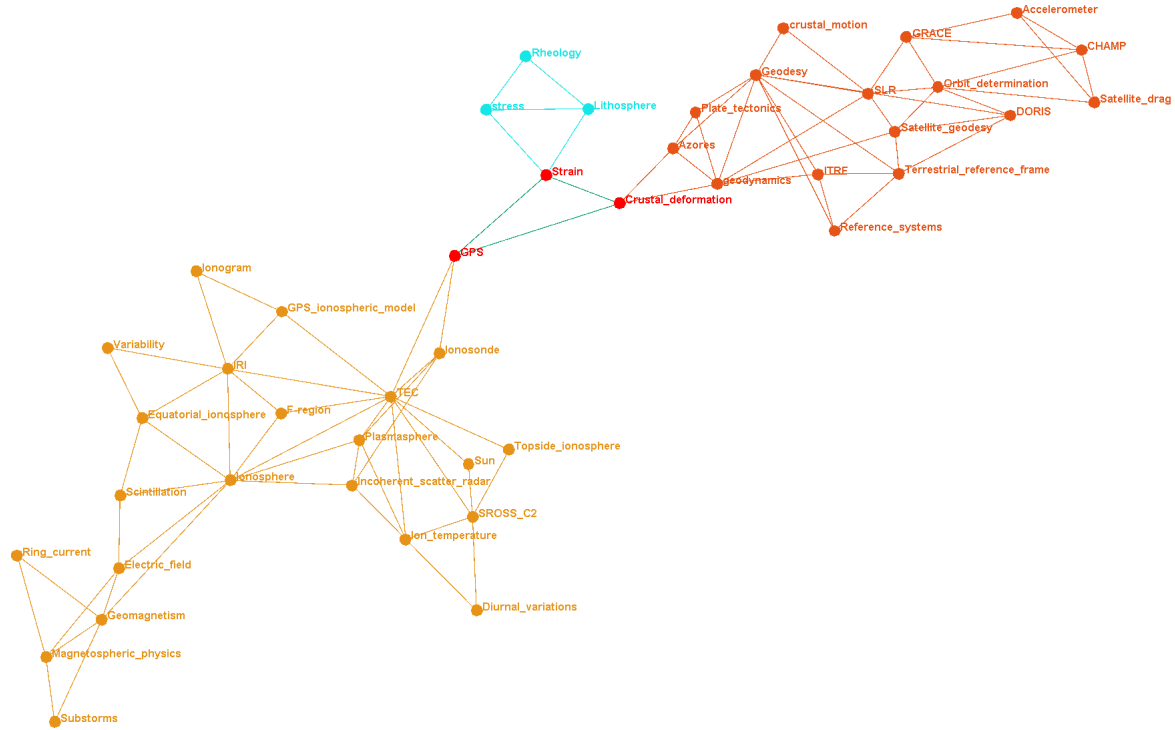
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## Conclusion

- It is possible reconstruct how scientific fields are articulated around gns applications

## Perspectives

- Early detection of emergent scientific fields
- Prediction of terms dynamics
- Localization of scientific themes to make a development policy



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## References

- [1] Chavalarias D. & Cointet J-P. (2008) Scientometrics Vol. 75 No. 1
- [2] Palla, G., Derenyi, I., Farkas, I., Vicsek, T. (2005), Uncovering the overlapping community structure of complex networks in nature and society, Nature, 435:814.

Thank you  
maduenase@colciencias.gov.co