Introduction to Topic Selection

AI Hub -Academy and Research (2)

GEC Academy
Jiayi Zhu

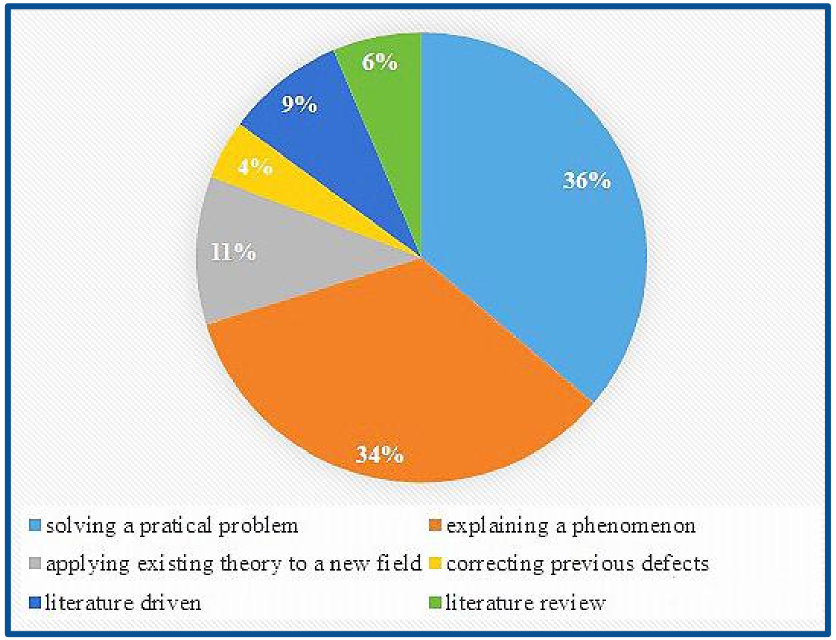
Today

- Introduction: Topic Selection
- Email: zhujiayi1130@yale.edu

Intro Topics

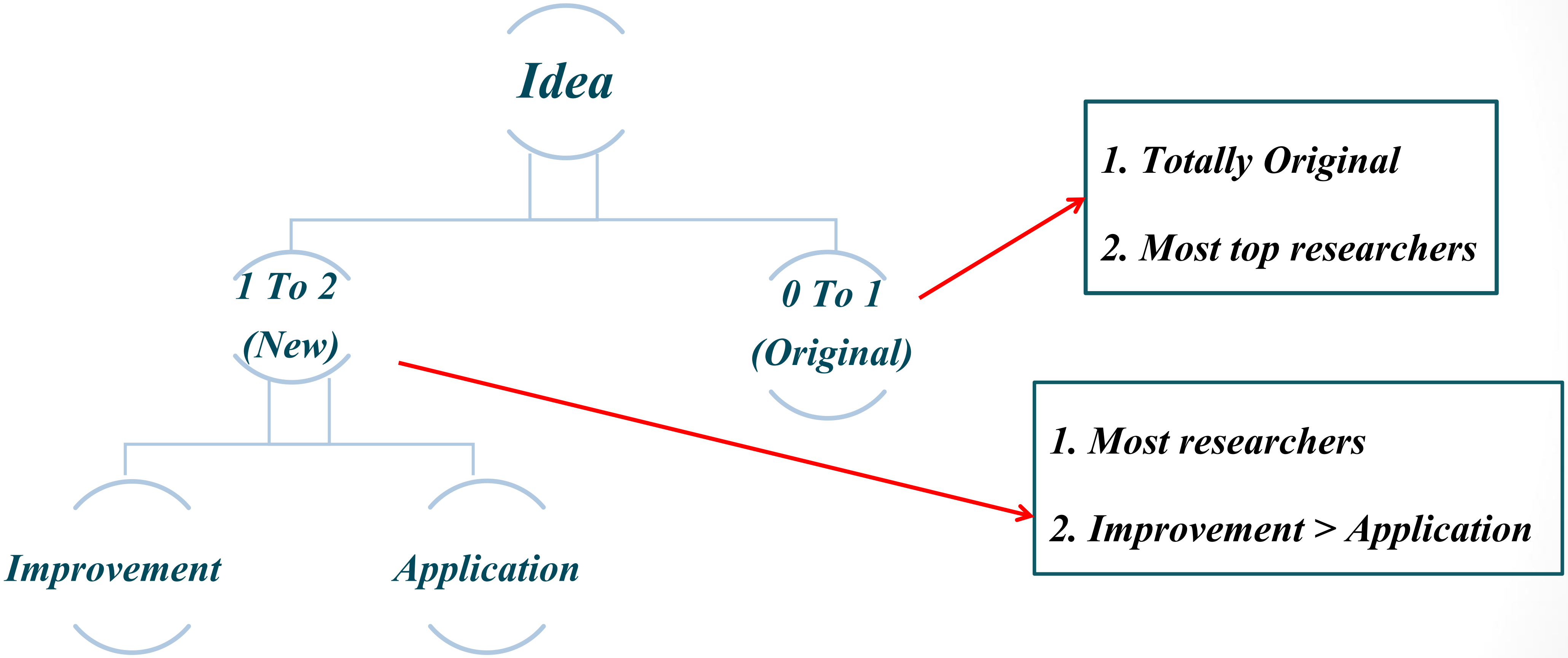
- Important Points in Topic Selection
- About Novelty/Originality
- Quickly Step into an Unfamiliar Field
- Start from a Research Paper

- Important Points in Topic Selection--Purpose



- ***Solve a pratical problem***
- ***Explain a phenomenon***
- ***Apply existing theory to a new field***
- ***Correct previous defects***
- ***Literature driven***
- ***Literature review***

- Important Points in Topic Selection-Innovation



• Important Points in Topic Selection

0 to 1: Original

Improvement

1 to 2: New

Application

Table 2: Researches about Capital Asset Pricing Model (CAPM)

Author(Year)	Model	Country	Sample Period
	Advanced		
Sharpe (1964)	CAPM	-	-
Merton (1973)	Intertemporal CAPM (ICAPM)	-	-
Black(1976)	wealth CAPM	-	-
Lucas (1978)	consumption CAPM (CCAPM)	-	-
	Intermediate		
Fama and French (1993)	3-factor CAPM	U.S.	1962-1989
Chen et.al.(2012)	CAPM-GARCH	U.S.	2001:1-2010:3
Gultekin and Rogalski (1985)	APT and CAPM	U.S.	1960-1979
Ziegler et.al. (2008)	CAPM and Multifactor Model	Europe	1996:1-2001:8
Los Rios and Garcia (2011)	CAPM and SDF	Europe and U.S.	1994:1-2008:6
Jin(2012)	CAPM-AEPD	China and U.S.	2006:1-2010:12
	Primary		
Chen and Sun (2000)	CAPM	China	1994:9-1998:10
Söderlind (2006)	CCAPM	U.S.	1947:1-1956:4
Grossman and Shiller (1981)	CCAPM	U.S.	1890-1979
Wu and Xu (2004)	CAPM and 3-factor model	China	1995:2- 2002:6
Hodgseon and Seçkin (2012)	CAPM	Canada	1968-2008
Zhang et.al. (2012)	CAPM	China	2007-2011
Li and Yang(2012)	CAPM-AEPD	Hongkong	2006:1-2010:12

- About New/Originality

  - ***If nobody has done it before, why you should do it?***

    Originality

    No previous literature

  - ***If everybody has done it before, why you should do it?***

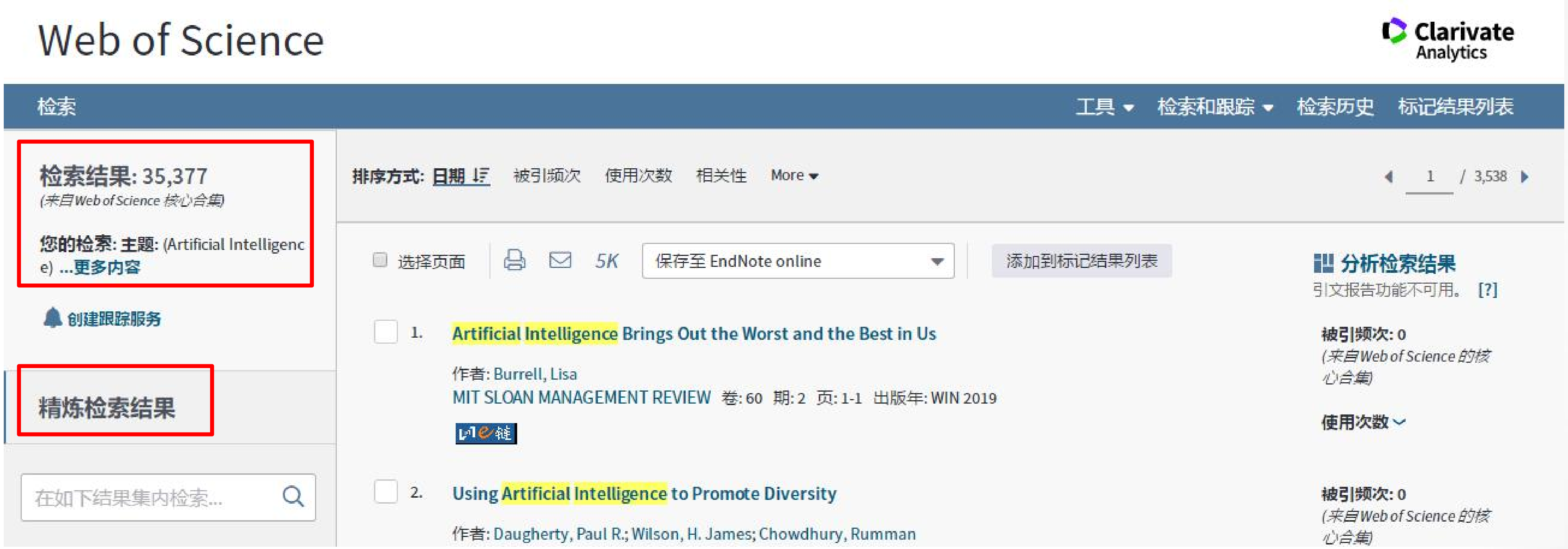
    New

    Literature review

- Quickly Step into an Unfamiliar Field

Start from a Keyword

• Quickly Step into an Unfamiliar Field

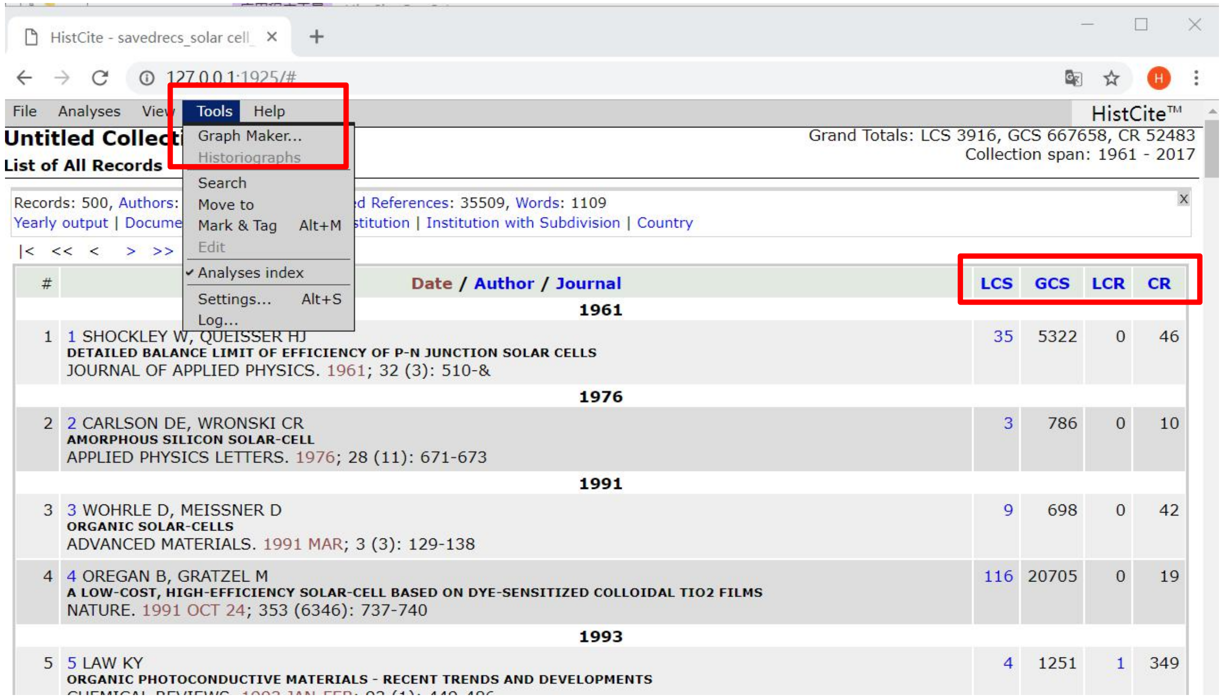


Too many results, which is important?

- # Quickly Step into an Unfamiliar Field

Which article is more important?

Quick Step into an Unfamiliar Field



Histcite

- ***GCS = global citation score***

总引用频次，它表示这篇文章被整个*wos*数据库中所有文献引用的次数。

- ***LCS = local citation score***

本地引用次数，它表示这篇文章在当前数据集中被引用的次数。

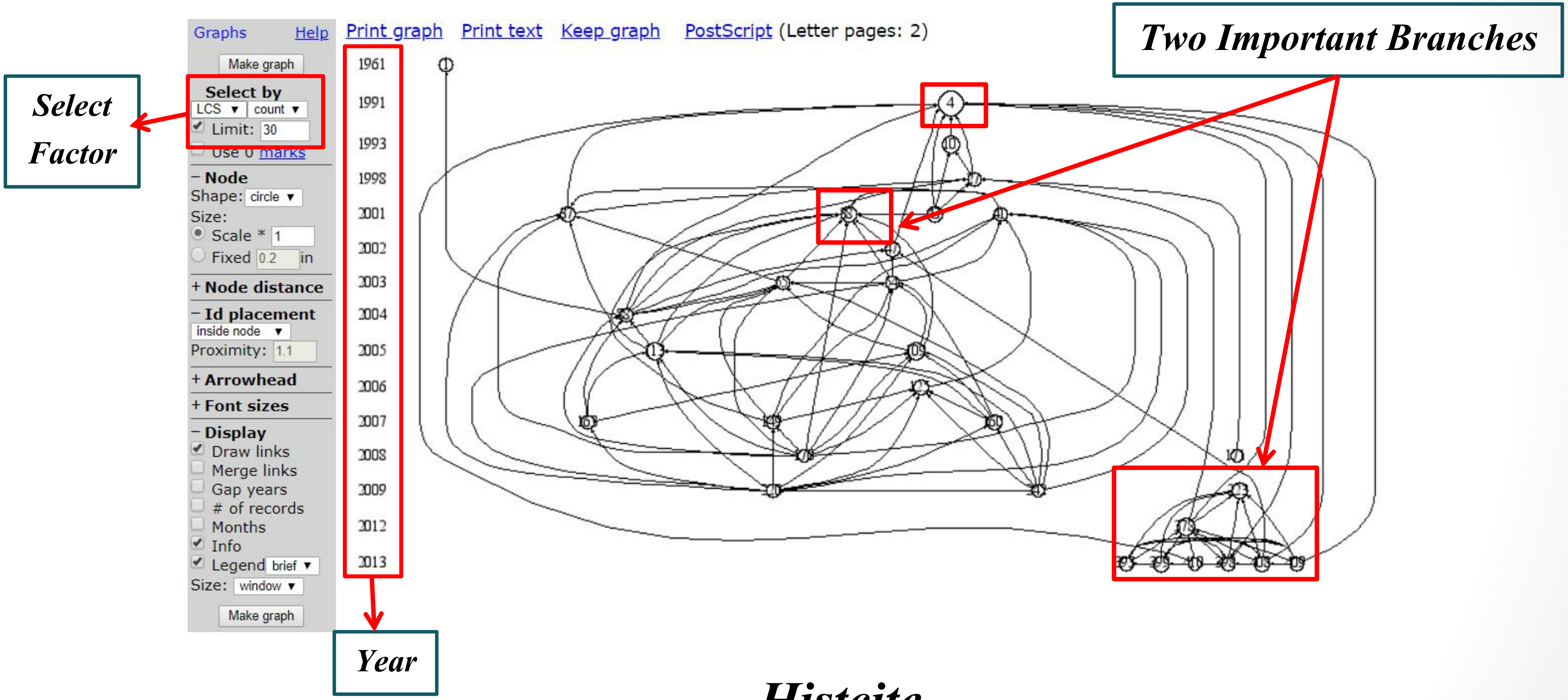
- ***LCR = local cited references***

本地参考文献数，它表示这篇文献的参考文献在当前数据集中的数量，即这篇文献引用别人的情况。

- ***CR = cited references***

参考文献数，它表示这篇文章的参考文献在整个 *wos* 数据库中的数量。

• Quick Step into an Unfamiliar Field



Histcite

• Quick Step into an Unfamiliar Field

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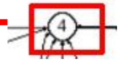

Author(s): OREGAN B (OREGAN, B); GRATZEL M (GRATZEL, M)

Title: A LOW-COST, HIGH-EFFICIENCY SOLAR-CELL BASED ON DYE-SENSITIZED COLLOIDAL TIO2 FILMS

Source: NATURE 353 (6346): 737-740

Date: 1991 OCT 24

Document Type: Journal : Article

DOI: 10.1038/353737a0

Language: English

LCR: 0 **CR**: 19 **LCS**: 116 **GCS**: 20705 **OCS**:

Comment:

Address: SWISS FED INST TECHNOL, INST PHYS CHEM, CH-1015 LAUSANNE, SWITZERLAND.

Reprint:

E-mail:

Author Keywords:

KeyWords Plus: PHOTOELECTROCHEMICAL CONVERSION; ELECTROCHEMISTRY; COMPLEXES; LIGHT; PHOTOCHEMISTRY; ELECTRICITY; ELECTRODES

Abstract: THE large-scale use of photovoltaic devices for electricity generation is prohibitively expensive at present: generation from existing commercial devices costs about ten times more than conventional methods 1. Here we describe a photovoltaic cell, created from low-to medium-purity materials through low-cost processes, which exhibits a commercially realistic energy-conversion efficiency. The device is based on a 10-mu-m-thick, optically transparent film of titanium dioxide particles a few nanometres in size, coated with a monolayer of a charge-transfer dye to sensitize the film for light harvesting. Because of the high surface area of the semiconductor film and the ideal spectral characteristics of the dye, the device harvests a high proportion of the incident solar energy flux (46%) and shows exceptionally high efficiencies for the conversion of incident photons to electrical current (more than 80%). The overall light-to-electric energy conversion yield is 7.1-7.9% in simulated solar light and 12% in diffuse daylight. The large current densities (greater than 12 mA cm-2) and exceptional stability (sustaining at least five million turnovers without decomposition), as well as the low cost, make practical applications feasible.

Detail informatoin for each paper

Title Key words Abstract

- # Start from a Research Paper

Title

- ***Be short, accurate, and unambiguous***
- ***Give your paper a distinct personality***

Journal

PNAS PNAS PNAS PNAS

Array atomic force microscopy for real-time multiparametric analysis

Qingqing Yang[a,1], Qian Ma[b,1], Kate M. Herum[c,2], Chonghe Wang[d], Nirav Patel[c], Joon Lee[a,3], Shanshan Wang[e,f], Tony M. Yen[c], Jun Wang[c], Hanmei Tang[d], Yu-Hwa Lo[b], Brian P. Head[e,f], Farooq Azam[g], Sheng Xu[a,d], Gert Cauwenberghs[c], Andrew D. McCulloch[c,h], Scott John[i], Zhaowei Liu[a,b,4], and Ratnesh Lal[a,c,j,k,4]

[a]Materials Science and Engineering, University of California, San Diego, La Jolla, CA 92093; [b]Department of Electrical and Computer Engineering, University of California, San Diego, La Jolla, CA 92093; [c]Department of Bioengineering, University of California, San Diego, La Jolla, CA 92093; [d]Department of Nanoengineering, University of California, San Diego, La Jolla, CA 92093; [e]Department of Anesthesiology, University of California, San Diego, La Jolla, CA 92093; [f]Department of Anesthesia, Veterans Affairs San Diego Healthcare System, San Diego, CA 92161; [g]Marine Biology Research Division, Scripps Institution of Oceanography, University of California, San Diego, La Jolla, CA 92093; [h]Department of Medicine, University of California, San Diego, La Jolla, CA 92093; [i]Cardiovascular Research Laboratory, University of California, Los Angeles, CA 90095; [j]Department of Mechanical and Aerospace Engineering, University of California, San Diego, La Jolla, CA 92093; and [k]Institute of Engineering in Medicine, University of California, San Diego, La Jolla, CA 92093

Edited by David A. Weitz, Harvard University, Cambridge, MA, and approved February 11, 2019 (received for review August 6, 2018)

Nanoscale multipoint structure–function analysis is essential fo deciphering the complexity of multiscale biological and physica systems. Atomic force microscopy (AFM) allows nanoscale struc ture–function imaging in various operating environments and car be integrated seamlessly with disparate probe-based sensing anc manipulation technologies. Conventional AFMs only permit sequen tial single-point analysis; widespread adoption of array AFMs fo simultaneous multipoint study is challenging owing to the intrinsi limitations of existing technological approaches. Here, we describe a prototype dispersive optics-based array AFM capable of simulta neously monitoring multiple probe–sample interactions. A single supercontinuum laser beam is utilized to spatially and spectrally map multiple cantilevers, to isolate and record beam deflection from individual cantilevers using distinct wavelength selection. This design provides a remarkably simplified yet effective solution to overcome the optical cross-talk while maintaining subnanometer sensitivity and compatibility with probe-based sensors. We demonstrate the versatility and robustness of our system on parallel multiparametri imaging at multiscale levels ranging from surface morphology to hydrophobicity and electric potential mapping in both air and liquid mechanical wave propagation in polymeric films, and the dynamic of living cells. This multiparametric, multiscale approach provide opportunities for studying the emergent properties of atomic scale mechanical and physicochemical interactions in a wide range of physical and biological networks.

atomic force microscopy | dispersive optics | multiparametric analysis | nanobiosensing | nanoimaging

Dynamic multiscale systems ranging from nanoheterostructured materials (1), surface and intersurface sciences (2), and intricate biological networks (3) to sensors and devices (4) have unique emergent properties owing to the complex coordination of structure and function among their constituent units. Our understanding of these multiscale interactions has been limited by the paucity of appropriate tools allowing real-time and simultaneous nanoscale structure–function investigation of multiple sub-

measuring various physicochemical properties including thermal energy (14), chemical force (15), conductance (16), and magnetism (17). The current AFM technology limits these multiparametric studies to single, one-time-point applications (18, 19). To overcome such limitations, array AFM platforms that can achieve high-resolution multipoint simultaneous imaging and mapping physicochemical properties are expected to have wide applicability in investigating the cooperative and coordinated activities of various biological and physical systems.

AFM works by measuring a cantilever deflection proportional to sample–probe interaction force. Among all of the available array

Significance

High-resolution multipoint simultaneous structure–function analysis is becoming of great interest in a broad spectrum of fields for deciphering multiscale dynamics, especially in biophysics and materials science. However, current techniques are limited in terms of versatility, resolution, throughput, and biocompatibility. Here, a multifunctional imaging platform is introduced that shows high sensitivity, minimum cross-talk, and a variety of probe-based sensing. This is demonstrated by parallel multiparametric studies in air and liquid, including mechanical wave propagation in a soft polymer film, imaging of live neurons, and cooperative activities of living coupled cardiac muscle cells. As an experimental demonstration of array atomic force microscopy for multiparametric analysis in dynamic systems this work sheds light on the study of emergent properties in wide-ranging fields.

Author contributions: Q.Y., Q.M., Z.L., and R.L. designed research; Q.Y., Q.M., K.M.H., C.W., N.P., J.L., S.W., T.M.Y., and J.W. performed research; Q.Y., Q.M., K.M.H., N.P., J.L., J.W., H.T., Y.-H.L., B.P.H., F.A., S.X., G.C., A.D.M., S.J., Z.L., and R.L. analyzed data; and Q.Y. wrote the paper.

Conflict of interest statement: A.D.M. is a cofounder of Insilicomed and Vektor Medical, and serves on the scientific advisory boards. He has an equity interest in Insilicomed. His research grants, including those acknowledged here, have been identified for conflict of interest management by the University of California, San Diego based on the overall scope of the research and its potential benefit to these entities. B.P.H. is scientific founder

Author

Abstract

Introduction

- ***What is known***
- ***What is not known***
- ***Why we did this study***

- Start from a Research Paper

sensitivity and scalability. To demonstrate the SEA-AFM platform's versatility and robustness we have applied our newly designed array to multiple physical and biological systems for simultaneous structure–function analysis.

Results and Discussion

System Design. The general design and working principle of the SEA-AFM are shown in Fig. 1 and *SI Appendix*, Figs. S1 and S2. The system consists of a supercontinuum laser with associated optics, a customized MultiMode AFM equipped with a Nanoscope controller III (Bruker) and quadrant photodetectors (QPDs). Broadband light beam from a supercontinuum laser is reflected by a dispersive grating and the stretched beam is projected onto an

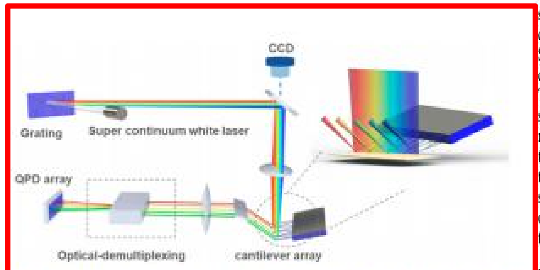

Fig. 1. SEA-AFM system. A supercontinuum laser, reflected by a grating (groove 300 mm^{-1}), transmits through a focusing lens and projects a spectral gradient onto a cantilever array. Each cantilever is illuminated by light with a distinct wavelength. The beams deflected by the array of cantilevers are monitored by a QPD array following an optical frequency demultiplexing component, such as a series of dichroic beam splitters and filters.

cantilever and the operational condition will also affect the number of cantilevers that can be packed in the system. Notably, this method can be adapted to illuminate a 2D AFM array with a larger number of tips via slight modification of the optics.

In general, optical readouts eliminate most of the electronic and thermal cross-talk that hinders the high-density array (32–34). As we mentioned earlier, single-frequency optical readouts are typically challenging for large-scale closely packed array AFM (22, 25). In the case of SEA-AFM, the spectral information represents an additional degree of freedom, leading to the cantilever packing density close to the optical diffraction limit without substantial cross-talk.

Since SEA-AFM has the same detection principle as conventional OBD (20), the theoretical limit of the detection sensitivity obtained by SEA-AFM should be almost identical to conventional OBD. We tested the noise power spectrum of our SEA-AFM using a silicon cantilever (Bruker MPP-21100, spring constant k = 3 N/m) (*SI Appendix*, section 2 and Figs. S4–S6). Through adjusting the laser power and optimizing the beam shape, the deflection noise density floor of our current setup reaches around 350 fm/$\sqrt{\text{Hz}}$. Importantly, most of the conventionally reported techniques which have been applied to improve the signal-to-noise ratio of the OBD method are equally well-suited to SEA-AFM (35–40). Thus, we speculate that by further optimizing the system the noise level of SEA-AFM will be close to that of commercially available AFMs.

Parallel Topography Imaging. We evaluated the feasibility of the array AFM system for parallel topography imaging. Two different areas on the calibration grating (Fig. 2*A*) were imaged simultaneously in constant height mode with our customized silicon nitride cantilever array (*SI Appendix*, Fig. S7; the two probes have similar cantilever length of ~200 μm with ~388 μm

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Results and Discussion

- *Sample characteristics*
- *State what you found*
- *Discuss the relevance to current literature*

Figure and Table

- *No more than six tables or figures*
- *Use Table 1 for sample characteristics*
- *Put most important findings in a figure*

Article Information

- # Start from a Research Paper

Conclusion

In summary, a SEA-AFM platform was developed to achieve simultaneous multipoint, multiscale structure–function analysis both in air and in liquid. The main advantage of the SEA-AFM over other existing array AFM is its ability to optically address closely packed probe–sample interaction signals without cross-talk or further complicating the system. We have demonstrated the versatility and robustness of the SEA-AFM system for multipoint morphology imaging, surface hydrophobicity, and electric potential mapping. In addition, taking advantage of its high sensitivity and biological compatibility, we recorded dynamic mechanical wave propagation in polymer film and intercellular activities of cardiomyocytes in real time. A number of innovative implementations can be envisioned from this array AFM platform, providing new perspectives in a wide range of fields, including multipoint manipulations/fabrications, multifunctional sensing, and robotic cantilever arrays.

Methods

Array AFM Setup. The array AFM system is adapted from a MultiMode AFM (Bruker) with Nanoscope III controller by customizing both illumination and deflection beam paths. A supercontinuum laser (Extreme; NKT Photonics. Inc.) is used to illuminate cantilever arrays through a dispersive grating and an objective lens. The AFM head is customized to have a top opening for illumination and side opening for deflection beam detection. Two QPDs (Skyhunt)

1 to 2: New

Conclusion

- ***Outline your implications with a clear "So what?" and "Where now?"***
- ***Outline the strengths and limitations of the study***

Methods

- ***Participants***
- ***Measurements***
- ***Outcomes and explanatory variables***
- ***Statistical methods***

• Start from a Research Paper

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Reference

- ***All citations must be accurate***
- ***Include only the most important, most rigorous, and most recent literature***
- ***Quote only published journal articles or books***
- ***Never quote "second hand"***
- ***Cite only 20-35 references***

• Start from a Research Paper

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