

# Organizational and Business Perspectives on Open Access to Information

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# Presentation Outline

- arXiv Overview
- Sustainability Initiative
- Principles for Sustainability
- Q&A





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## The warm gas atmosphere of the HD 100546 disk seen by Herschel\*

### Evidence of a gas-rich, carbon-poor atmosphere?

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#### ABSTRACT

**Context.** With the Herschel Space Observatory, lines of simple molecules ( $C^+$ , O, and high- $J$  lines of CO,  $J_{up} \geq 14$ ) have been observed in the atmosphere of protoplanetary disks. When combined with ground-based data on [C I], all principal forms of carbon can be studied. These data allow us to test model predictions for the main carbon-bearing species and verify the presence of a warm surface layer. The absence of neutral carbon [C I], which is predicted by models to be strong, can then be interpreted together with ionized carbon [C II] and carbon monoxide.

**Aims.** We study the gas temperature, excitation, and chemical abundance of the simple carbon-bearing species  $C^+$ ,  $C^+$ , and CO, as well as O by the method of chemical-physical modeling. Using the models, we explore the sensitivity of the lines to the entering parameters and constrain the region from which the line radiation emerges.

**Methods.** Numerical models of the radiative transfer in the lines and dust are used together with a chemical network simulation and a calculation of the gas energetics to obtain the gas temperature. We present our new model, which is based on our previous models but includes several improvements that we report in detail, together with the results of benchmark tests.

**Results.** A model of the disk around the Herbig Be star HD 100546 is able to reproduce the CO ladder together with the atomic fine-structure lines of [O I] and either [C I] or [C II]. We find that the high- $J$  lines of CO can only be reproduced by a warm atmosphere with  $T_{rot} \gg T_{dust}$ . The low- $J$  lines of CO, observable from the ground, are dominated by the outer disk with a radius of several 100 AU, while the high- $J$  CO observable with Herschel-PACS are dominated from regions within some tens of AU. The spectral profiles of high- $J$  lines of CO are predicted to be broader than those of the low- $J$  lines. We study the effect of several parameters including the size of the disk, the gas mass of the disk, the PAH abundance and distribution, and the amount of carbon in the gas phase.

**Conclusions.** The main conclusions of our work are (i) only a warm atmosphere with  $T_{rot} \gg T_{dust}$  can reproduce the CO ladder; (ii) the CO ladder together with [O I] and the upper limit to [C I] can be reproduced by models with a high gas/dust ratio and a low abundance of volatile carbon. These models however produce too small amounts of [C II]. Models with a low gas/dust ratio and more volatile carbon also reproduce CO and [O I], are in closer agreement with observations of [C II], but overproduce [C I]. Owing to the uncertain origin of the [C II] emission, we prefer the high gas/dust ratio models, indicating a low abundance of volatile carbon.

**Key words.** Protoplanetary disks – Stars: formation – Astrochemistry – Methods: numerical

#### 1. Introduction

At an important phase of a young low-mass star's life, the natal envelope has dispersed, but the star is still surrounded by an optically thick protoplanetary disk, which is thought to be the location of planet formation (see [Dallemond & Monnier 2010](#) and [Suzanne 2010](#) for recent reviews). Our own solar system contains both gaseous giants and rocky planets. It is thus evident that both the dust and the gas content of the disk need to be studied in order to understand planet formation. The feedback of the forming star onto the disk can help decide the disk's fate. The star irradiates the disk, heating both the gas and dust and changing the chemical composition of the gas by high-energy ultra-

violet (UV) radiation and X-rays. Through heating of the disk's upper atmosphere, a disk-wind is driven, which may eventually disperse the disk ([Alexander et al. 2006](#); [Ercolano et al. 2008](#); [Sohn & Hollenbach 2009](#)). The most abundant species tracing the ionizing radiation and warm temperature of a few 100 K are (ionized) atomic carbon ( $C^+$ ), atomic oxygen (O), and high- $J$  lines of CO (with  $J_{up} \geq 14$ ). Apart from neutral carbon, which is accessible to ground-based telescopes, these species can now be observed using the PACS instrument ([Opitich et al. 2010](#)) onboard the Herschel Space Observatory ([Pilbratt et al. 2010](#)).

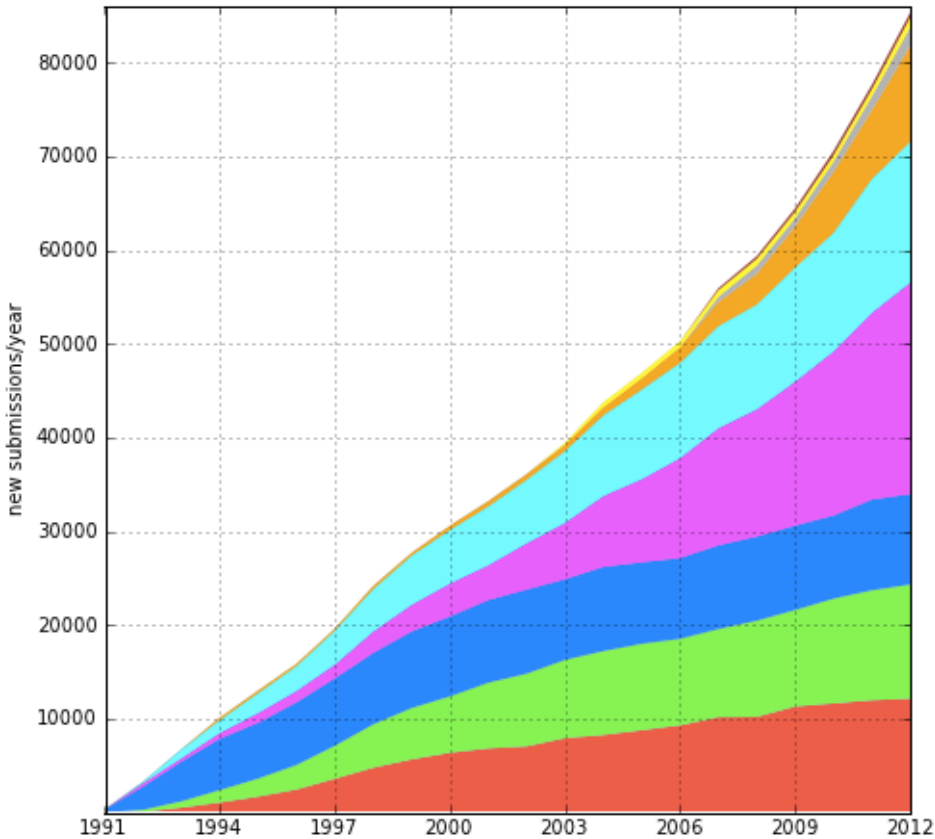
The main forms of carbon ( $C^+$ ,  $C^+$ , and CO) can thus be observed for the first time and through high- $J$  CO lines also in warm regions. This allows us to probe the carbon chemistry and the physical structure of planet- and comet-forming zones, which were previously inaccessible to us. The carbon budget is important for planet formation, since the terrestrial planets in the inner Solar System are known to have a deficit in carbon of three orders of magnitude relative to the solar abundance

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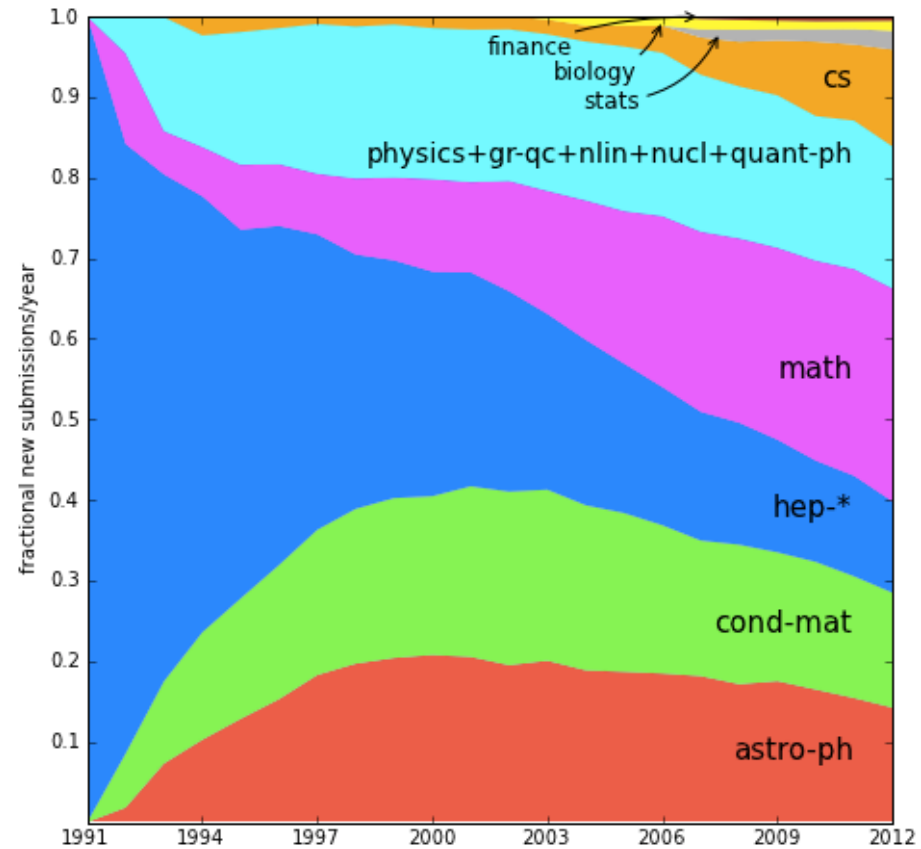
\* *Herschel* is an ESA space observatory with science instruments provided by European-led Principal Investigator consortia and with important participation from NASA.

- established in 1991 by Paul Ginsparg
- has been hosted at Cornell since 2001
- includes 814,000 e-prints
- 2012
  - 84,603 new submissions
  - ~50 million downloads

# arXiv Growth (1991-2012)



arXiv Annual Submissions



arXiv New Submission Rate

## 2012 Submission Rates by Fields

- Math (22565): 26.7%
- Condensed Matter (12184): 14.4%
- Astrophysics (12121): 14.3%
- Computer Science (10236): 12.1%
- High Energy Physics (9636): 11.3%
- Physics (6545): 7.7%
- Quantum Physics (3767): 4.5%
- General Relativity & Quantum Cosmology (2057): 2.4%
- Nuclear Experiment & Theory (1829): 2.2%
- Statistics (1284): 1.5%
- Qualitative Biology (1057): 1.2%
- Nonlinear Sciences (839): 1.0%
- Quantitative Finance (483): 0.6%

# Projected Expenses (2013-2017)

Expense <sup>1</sup>	Description	2013	2014	2015	2016	2017
<b>Staff</b>						
	User support (staff)	228,405	236,400	244,680	295,453	305,795
	User support (student)	8,500	8,500	8,500	8,500	8,800
	Programming & system maintenance	238,669	164,685	170,453	176,415	182,590
	Management & administration	61,835	64,000	66,240	68,558	70,955
	<i>Subtotal Staff Costs</i>	537,409	473,585	489,873	548,925	568,140
<b>Other Direct Costs</b>						
	Server costs <sup>2</sup>	41,700	43,160	44,670	46,235	47,855
	Network bandwidth & telephony	1,550	1,605	1,660	1,720	1,780
	Staff computers, software & supplies	1,865	1,930	2,000	2,070	2,140
	Staff travel	8,280	8,570	8,870	9,180	9,500
	Advisory group travel support	20,700	21,425	22,175	22,950	23,755
	<i>Subtotal Direct Costs</i>	74,095	76,690	79,375	82,155	85,030
<b>Indirect Costs</b>						
	Facilities <sup>3</sup>	67,265	60,530	62,617	69,419	71,849
	Department administration & staff support <sup>4</sup>	158,991	143,072	148,004	164,081	169,824
	<i>Subtotal Indirect Costs</i>	226,256	203,602	210,622	233,500	241,673
	<b>Total Expenses</b>	<b>837,760</b>	<b>753,877</b>	<b>779,869</b>	<b>864,580</b>	<b>894,843</b>



# arXiv Organizational Chart

## Kenney, University Librarian \*

- Resolve disputes between CUL, MAB, SAB as they relate to CUL's responsibilities
- Determine termination and need for transition strategy

## Rieger, Program Director (15-20%) \*

- Oversee the arXiv program (user support, IT, and membership)
- Foster a transparent and open communication strategy
- Identify and develop policies relevant to arXiv operation, preservation, and sustainability
- Take the lead in business planning



## Warner, IT Lead (30%)

- Operate arXiv's technical infrastructure  
Provide interfaces and data access to support open reuse of arXiv data;
- Implement archiving strategies
- Establish and maintain partnership with related initiatives
- STAFF – Shawn Bower, Peter Halliday, Martin Lessmeister (25%)



## Porciello, Membership Program Lead \* (10%)

- Manage the arXiv membership program
- Maintain and communicate information about sustainability program
- Participate in other fund raising efforts to diversify arXiv's revenues



## Ruddy, User Support Lead (20%)

- Oversee arXiv's user-support, moderation, and administration processes
- Working with SAB in developing new policies and procedures
- Oversee the moderation process, including resolving problem cases
- STAFF – Don Beyer, Laura Jones, Jake Weiskoff



## arXiv Sustainability Initiative

In January 2010, Cornell University Library (CUL) undertook a three-year planning effort to establish a long-term sustainable support model for arXiv, one that reduced arXiv's financial burden and dependence on a single institution and transitioned it to a collaboratively governed, community-supported resource. This new model is based on voluntary institutional pledges and contributions from libraries and research laboratories worldwide that represent arXiv's heaviest institutional users. arXiv's new long-term business and management plan will take effect in January 2013. Please see the resources below for more information about this plan.

- [arXiv Membership Program - FAQ](#)
- [Principles](#)
- [Business Model](#)
- [Scientific Advisory Board](#)
- [Interim Member Advisory Board](#)
- [Organizational Structure](#)
- [Initial Five-Year Support Pledges](#)
- [Additional Information](#)

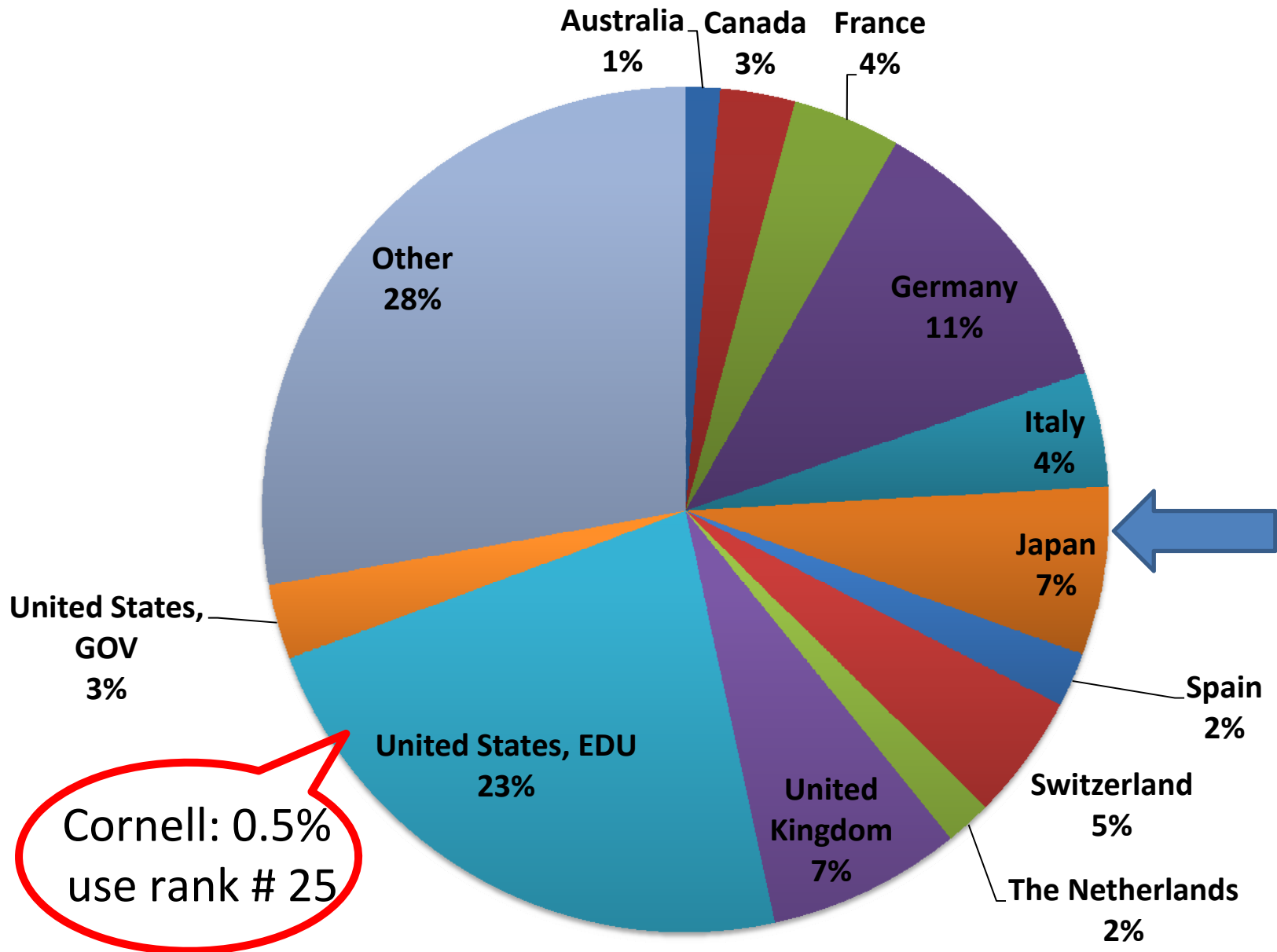
# Membership Program

- Engage libraries and research laboratories worldwide that represent arXiv's heaviest institutional users in arXiv's support and governance
- Each member institution pledges a five-year initial funding commitment to support arXiv

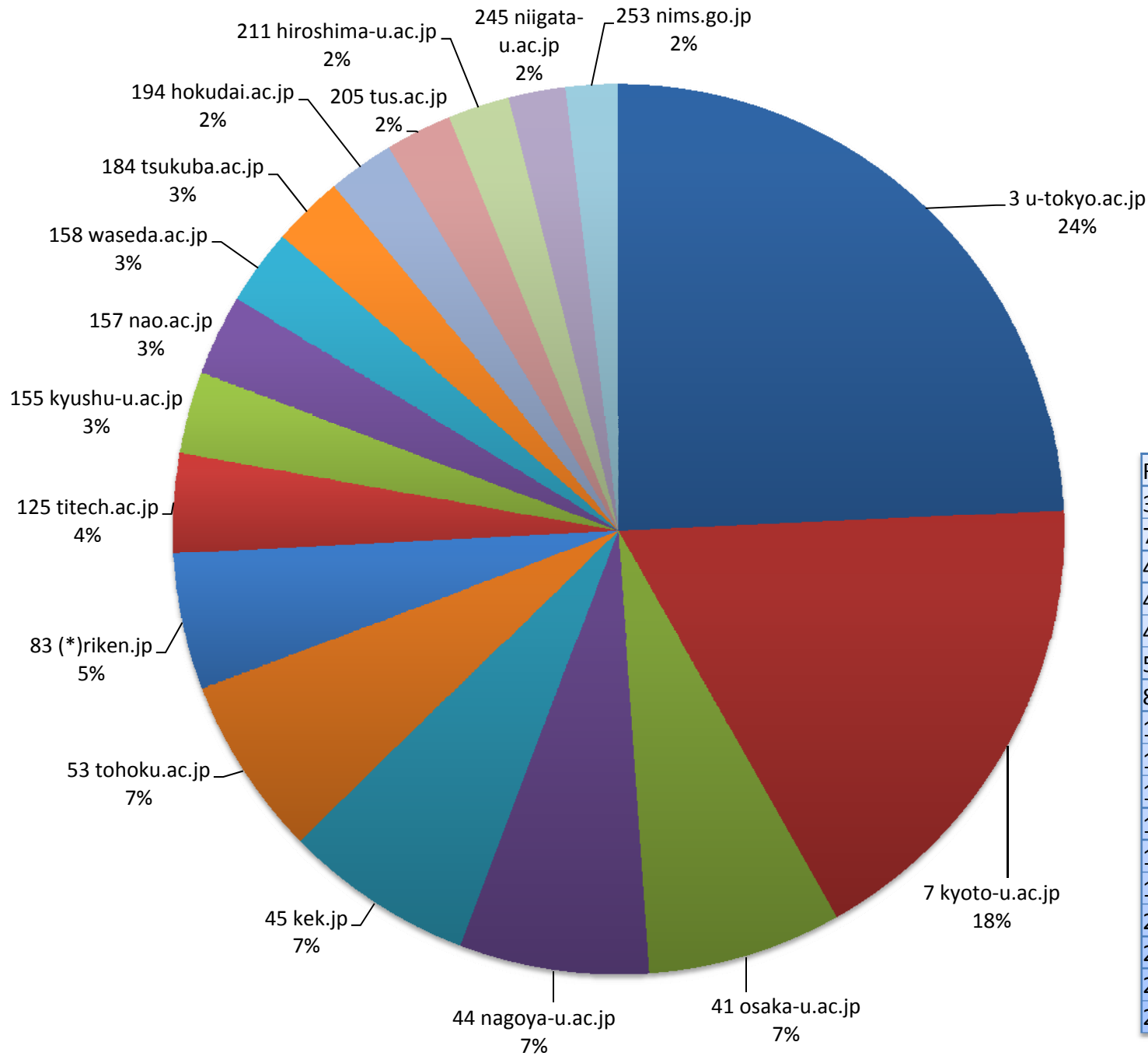
# Business Model, 2013-2017

- Cornell University Library
  - \$75,000 per year in support of operational costs
  - in-kind contribution of all indirect costs (37%)
- Simons Foundation
  - \$50,000 per year
  - \$300,000 per year matching grant
- Member Institution
  - annual fees within \$1,500-3,000 range (based on usage ranking)

# 2012 Institutional Use Distribution

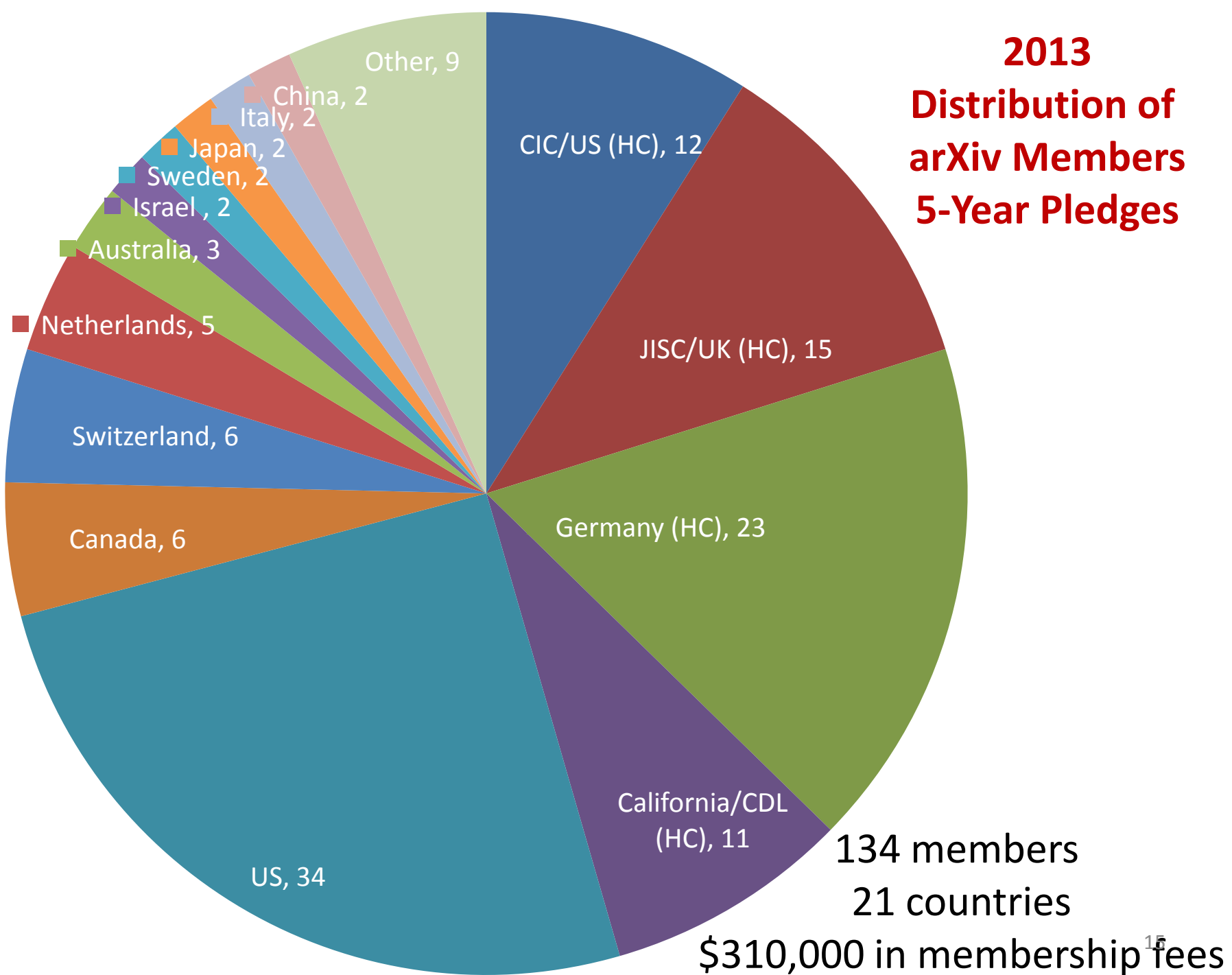


# Japanese Institutional Use by Domain, 2012



Rank	Domain
3	u-tokyo.ac.jp
7	kyoto-u.ac.jp
41	osaka-u.ac.jp
44	nagoya-u.ac.jp
45	kek.jp
53	tohoku.ac.jp
83	(*)riken.jp
125	titech.ac.jp
155	kyushu-u.ac.jp
157	nao.ac.jp
158	waseda.ac.jp
184	tsukuba.ac.jp
194	hokudai.ac.jp
205	tus.ac.jp
211	hiroshima-u.ac.jp
245	niigata-u.ac.jp
253	nims.go.jp

**2013  
Distribution of  
arXiv Members  
5-Year Pledges**



# Cornell University Library

- **Manages the moderation of submissions and user support;**
- **Operates arXiv's technical infrastructure;**
- **Ensures long-term access and maintains arXiv mirror sites.**
- **Establishes and maintains partnerships with related initiatives;**
- **Assumes financial responsibility for running arXiv;**
- **Maintains transparent and open communication;**
- **Provides legal protection.**

## Scientific Advisory Board

- **Provide advice and guidance pertaining to the intellectual oversight of arXiv**
- **Oversee arXiv's moderation system.**
- **Review the criteria and standards for deposit in arXiv**
- **Propose new subject or discipline domains**

## Member Advisory Board

- **Advise CUL on issues related to:**
  - **repository management and development,**
  - **standards implementation, interoperability,**
  - **development priorities,**
  - **business planning**
  - **outreach and advocacy.**





## **Principles for Sustainability**

# Principles for Sustainability

1. Deep integration into academic community and scholarly processes
2. Clearly defined mandate & governance structure
3. Technology platform stability and innovation
4. Systematic development of content policies
5. Reliance on business planning strategies

# 1. Deep Integration into Academic Community & Scholarly Processes

- Factor in research, communication, and collaboration practices & values of scientists
- Balance IT aspects with sociocultural needs
- Implement user-based strategies & feedback cycles

## 2. Clearly Defined Mandate & Governance Structure

- Ensure that an organization has the means to:
  - envision its future
  - implement the vision
  - sustain the process over time
- Tenets:
  - Participatory, accountable, transparent, responsive, equitable, and inclusive

### 3. Technology Platform Stability and Innovation

- Repository ecology:
  - interoperability with other repositories
  - discovery & access: increasing relevance
  - features in support of supplementary information objects (data, images, etc.)
  - preservation strategies

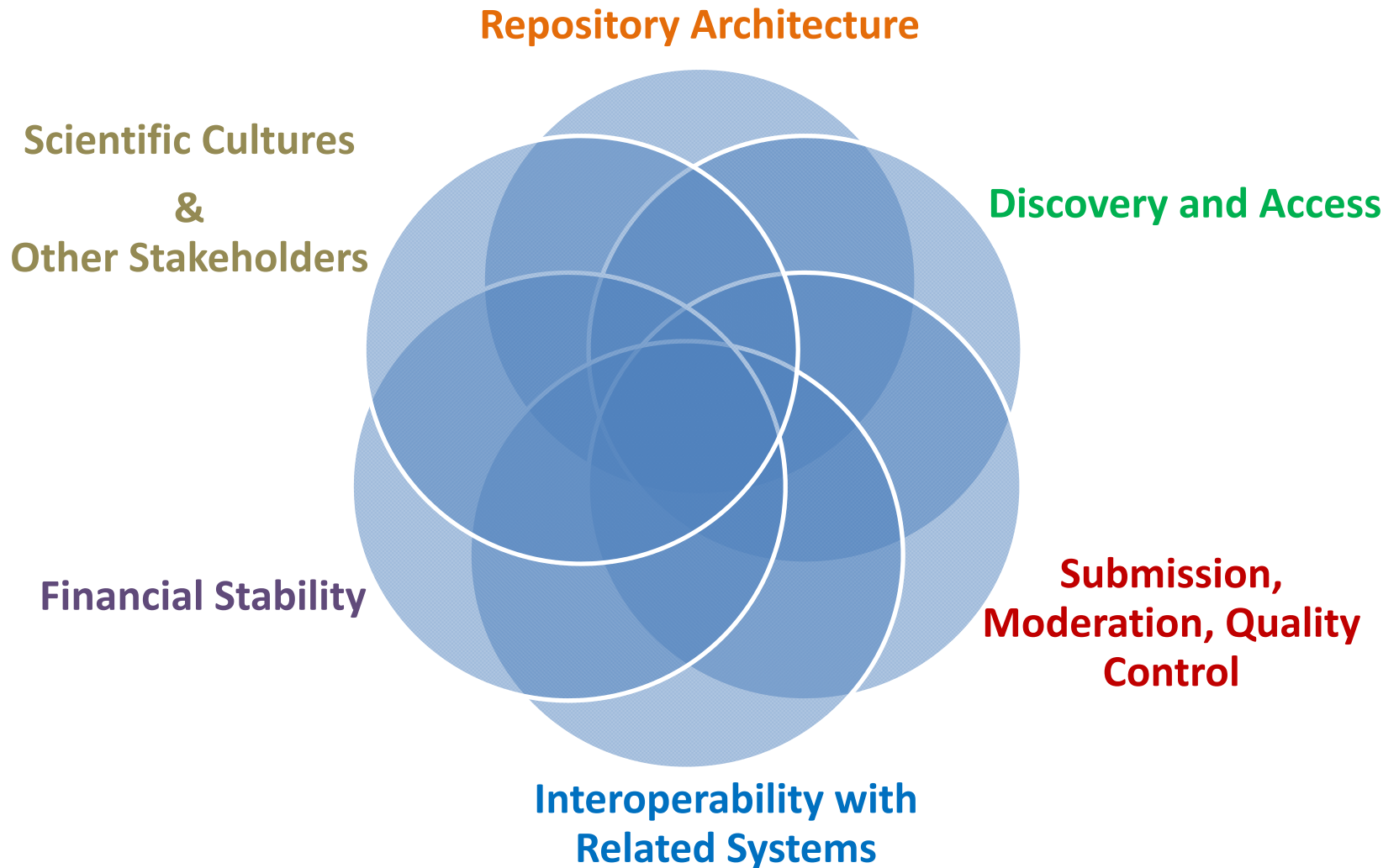
## 4. Systematic Development of Content Policies

- Clearly defined collection policies and submission guidelines
- Quality control
- Version control and maintaining the scholarly communication chain
  - Pre-print, post-print, published version, underlying data and audiovisual materials

## 5. Reliance on Business Planning Strategies

- Key elements of a business planning
  - Value proposition
  - Stakeholders' perspectives
  - Financial planning – costs & revenues
  - Communication plan

# SUSTAINABILITY





**WE WOULD LIKE TO THANK OUR JAPANESE  
COLLEAGUES FOR THEIR FINANCIAL SUPPORT  
2010-2012**

KEK High Energy Accelerator Research Organization

Kyushu University

Hiroshima University

Nagoya University (pledged 5-year membership for 2013-2017)

National Astronomical Observatory of Japan

Kyoto University (pledged 5-year membership for 2013-2017)

Osaka University

University of Tokyo (pledged 5-year membership for 2013-2017)

University of Tsukuba

Tohoku University

Tokyo Institute of Technology

Waseda University