

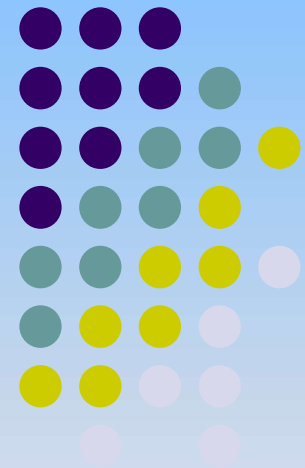
**An Exploration on the Frontier of Energy Industries:
A Perspective of Scientific-Innovation**

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Leiden, Netherlands



Research Question

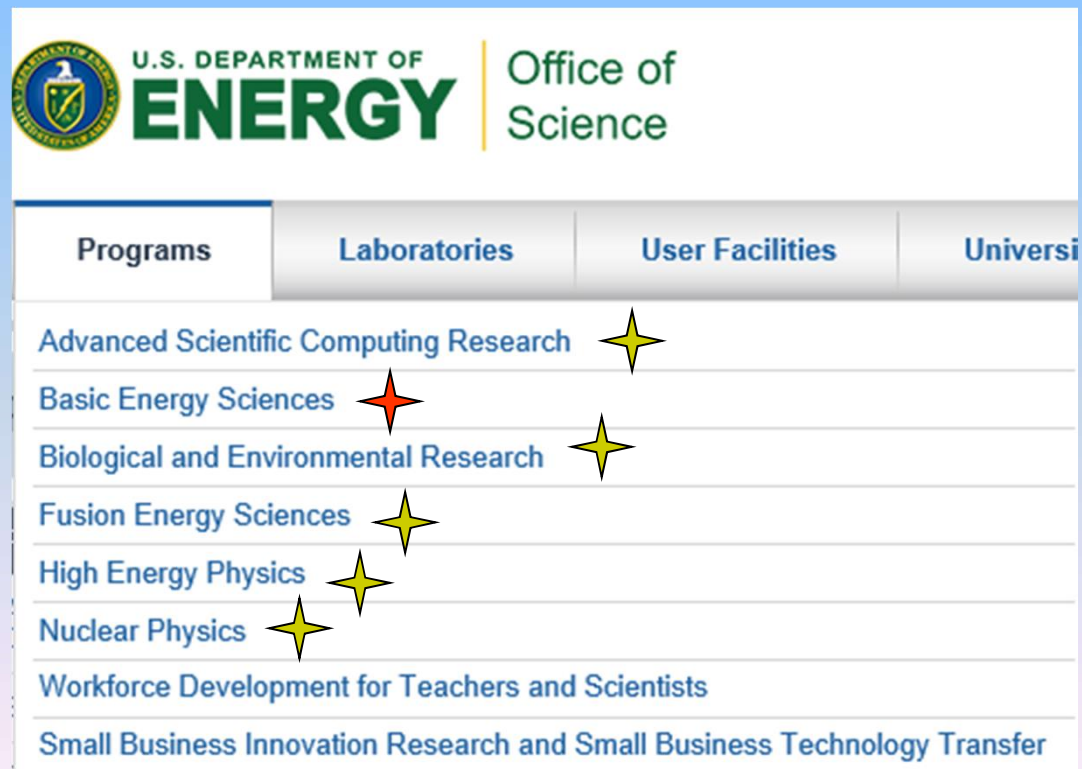


- **May we detect technology/ industry frontiers via using new data?**
- *Publications of patent, paper*
- **Data of Projects being fostered by DOE**

Data source

- Data of **projects** being cultivated in **user facility** is retrieved from the official website of *U.S. DOE, Department of Energy*. <https://science.energy.gov/user-facilities/user-statistics/data-archive/>

- **BES**
- **27881 Projects**
- **2016**



The screenshot shows the U.S. Department of Energy Office of Science website. The header includes the U.S. Department of Energy logo and the text "U.S. DEPARTMENT OF ENERGY | Office of Science". Below the header is a navigation menu with four tabs: "Programs", "Laboratories", "User Facilities", and "Universi". The "Programs" tab is selected, and a list of programs is displayed below it. Each program name is followed by a yellow star icon. The programs listed are: Advanced Scientific Computing Research, Basic Energy Sciences, Biological and Environmental Research, Fusion Energy Sciences, High Energy Physics, Nuclear Physics, Workforce Development for Teachers and Scientists, and Small Business Innovation Research and Small Business Technology Transfer.

Programs	Laboratories	User Facilities	Universi
Advanced Scientific Computing Research			
Basic Energy Sciences			
Biological and Environmental Research			
Fusion Energy Sciences			
High Energy Physics			
Nuclear Physics			
Workforce Development for Teachers and Scientists			
Small Business Innovation Research and Small Business Technology Transfer			

Facility	User Facility Full Name	User Facility Host Institution Acronym	User Facility Host Institution Name	Project/Experiment
	Argonne Leadership Computing Facility	ANL	Argonne National Laboratory	Computational Design o
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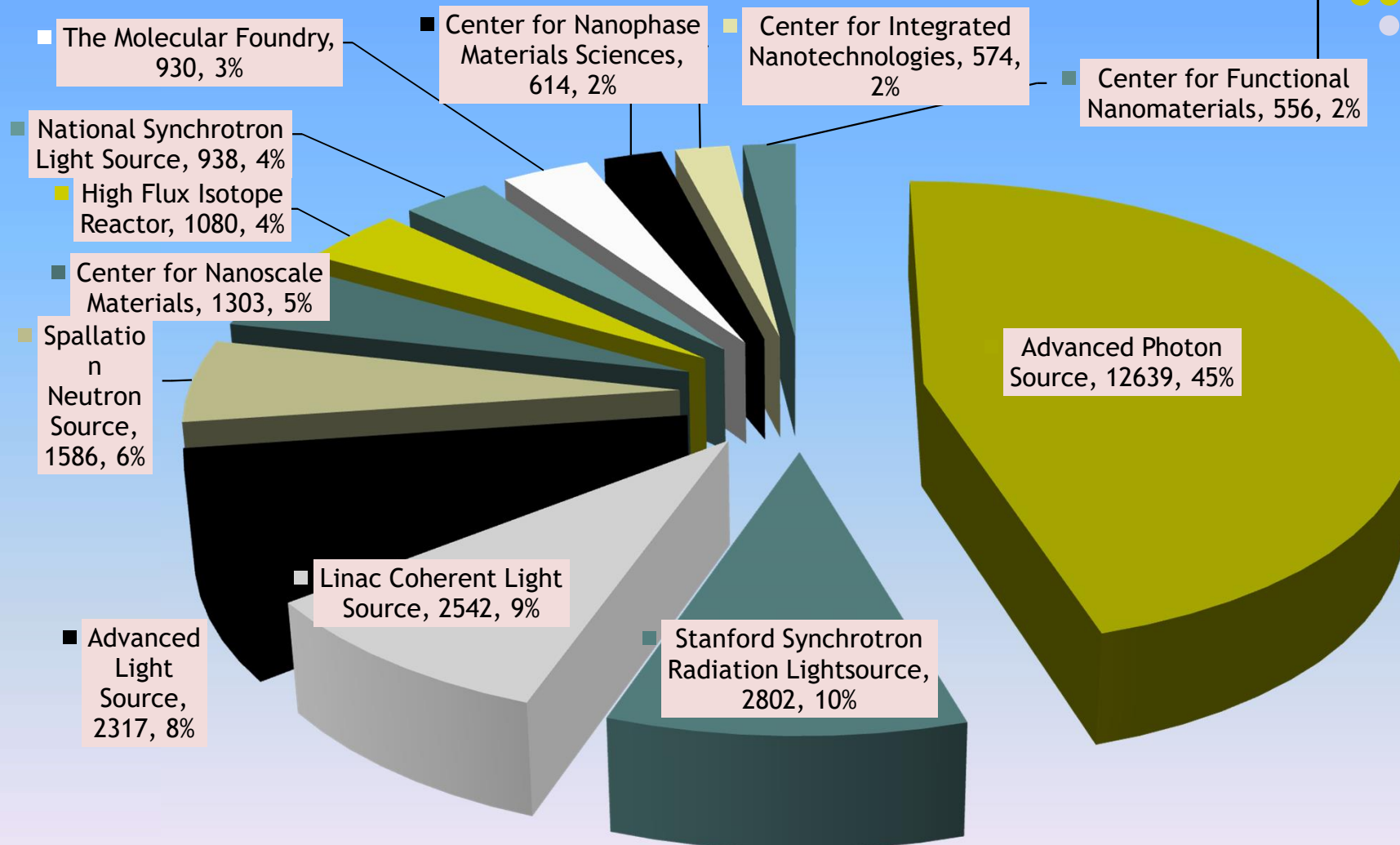
Columns of Data

- **Program Acronym**
- **Program Full Name**
- **User Facility Acronym**
- **User Facility Full Name**
- **User Facility Host Institution Acronym**
- **User Facility Host Institution Name**
- **Project/Experiment Title**
- **Project Type**
- **Primary Source(s) of Project Support**
- **User Name**
- **User Type**
- **User Employment Level**
- **Home Institution Name**
- **Home Institution Street Address**
- **Home Institution City**
- **Home Institution State/Territory/Province**
- **Home Institution Postal Code/Zip**
- **Home Institution Country**
- **Congressional District**
- **Institution Type**

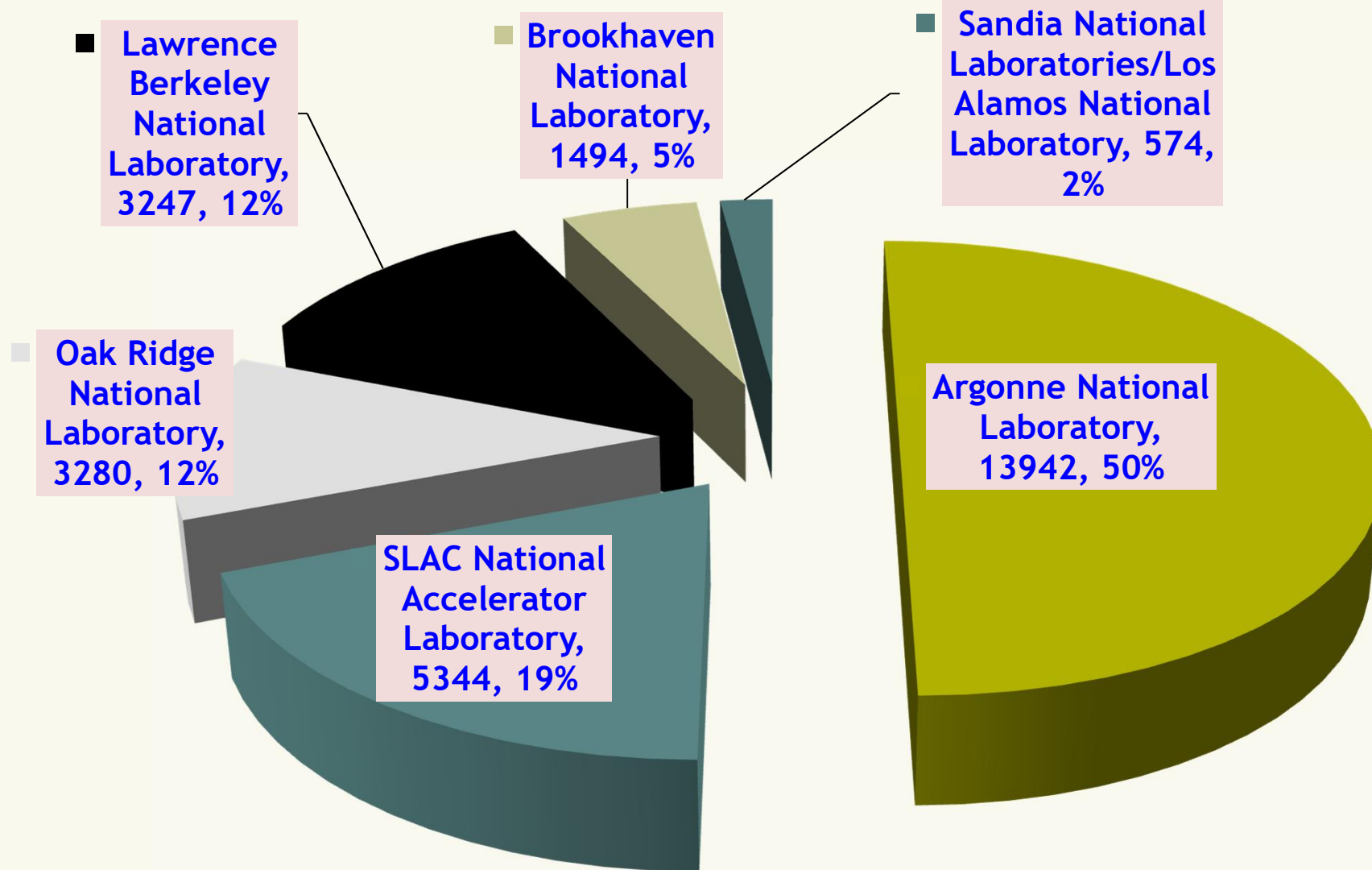
Analysis & Results



Leading User Facilities, Where



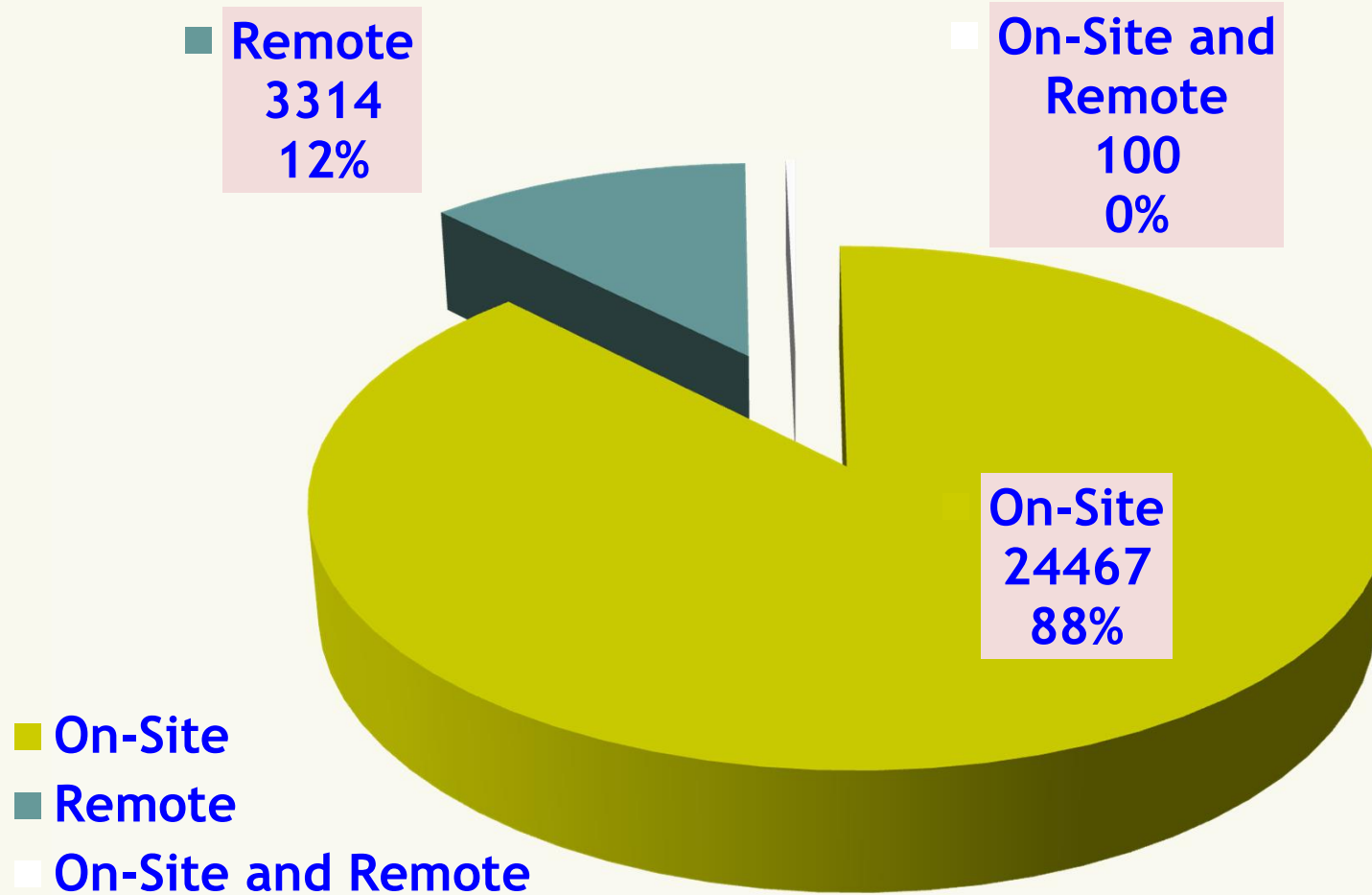
User Facility host institution



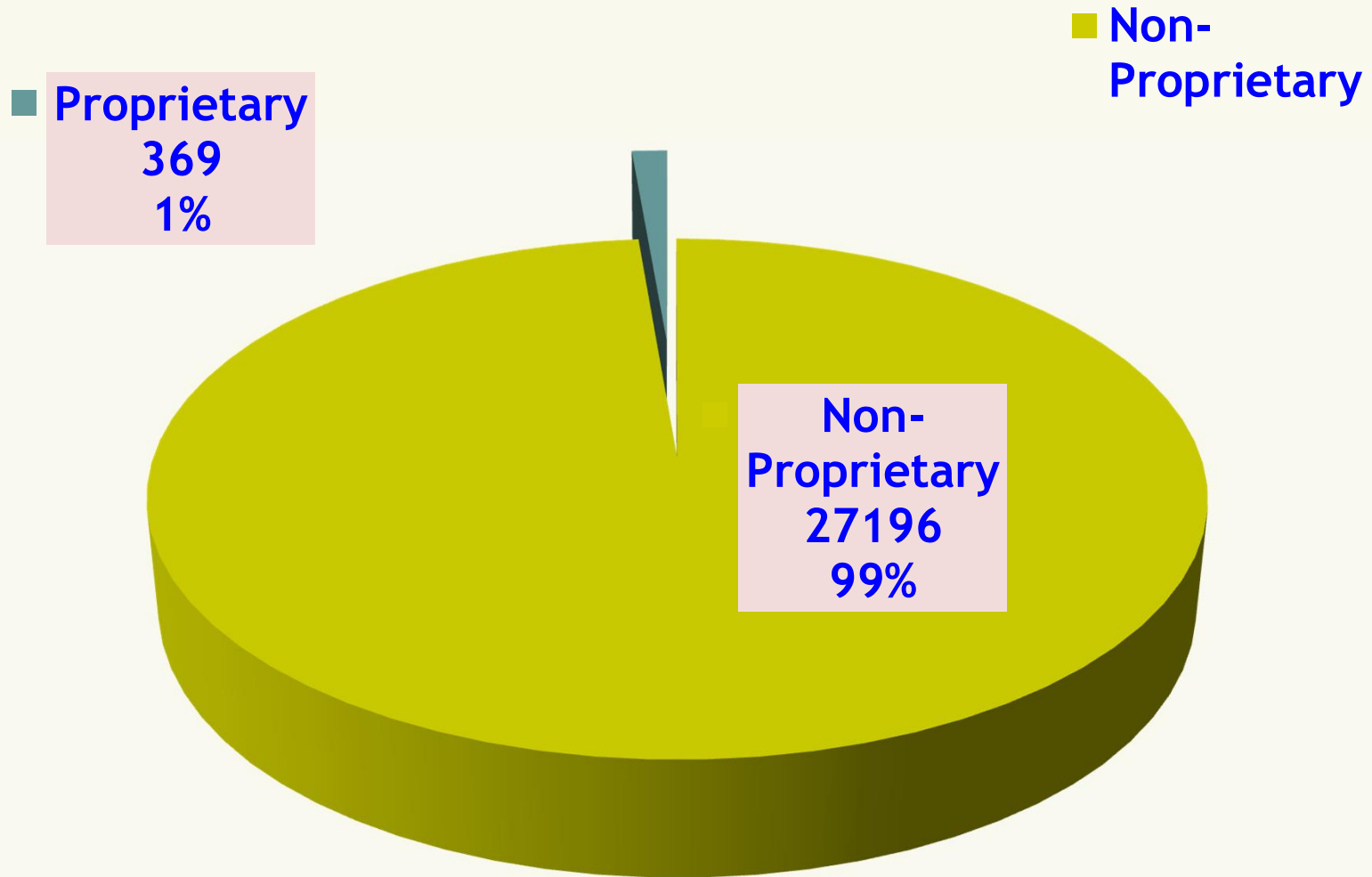
Home Institute: **Leading innovators-Who**

Rank	Home Institute	Count	Prop.
1	Argonne National Laboratory (ANL)	3058	10.97%
2	Oak Ridge National Laboratory (ORNL)	1232	4.42%
3	SLAC National Accelerator Laboratory	1056	3.79%
4	Lawrence Berkeley National Laboratory	884	3.17%
5	University of Chicago	834	2.99%
6	Stanford University	818	2.93%
7	Brookhaven National Laboratory (BNL)	781	2.80%
8	Northwestern University	720	2.58%
9	University of California - Berkeley	551	1.98%
10	Stony Brook University, SUNY	356	1.28%
11	Los Alamos National Laboratory (LANL)	353	1.27%
12	Carnegie Institute of Washington	348	1.25%
13	Arizona State University	343	1.23%
14	University of Tennessee	340	1.22%
15	Deutsches Elektronen-Synchrotron (DESY)	316	1.13%

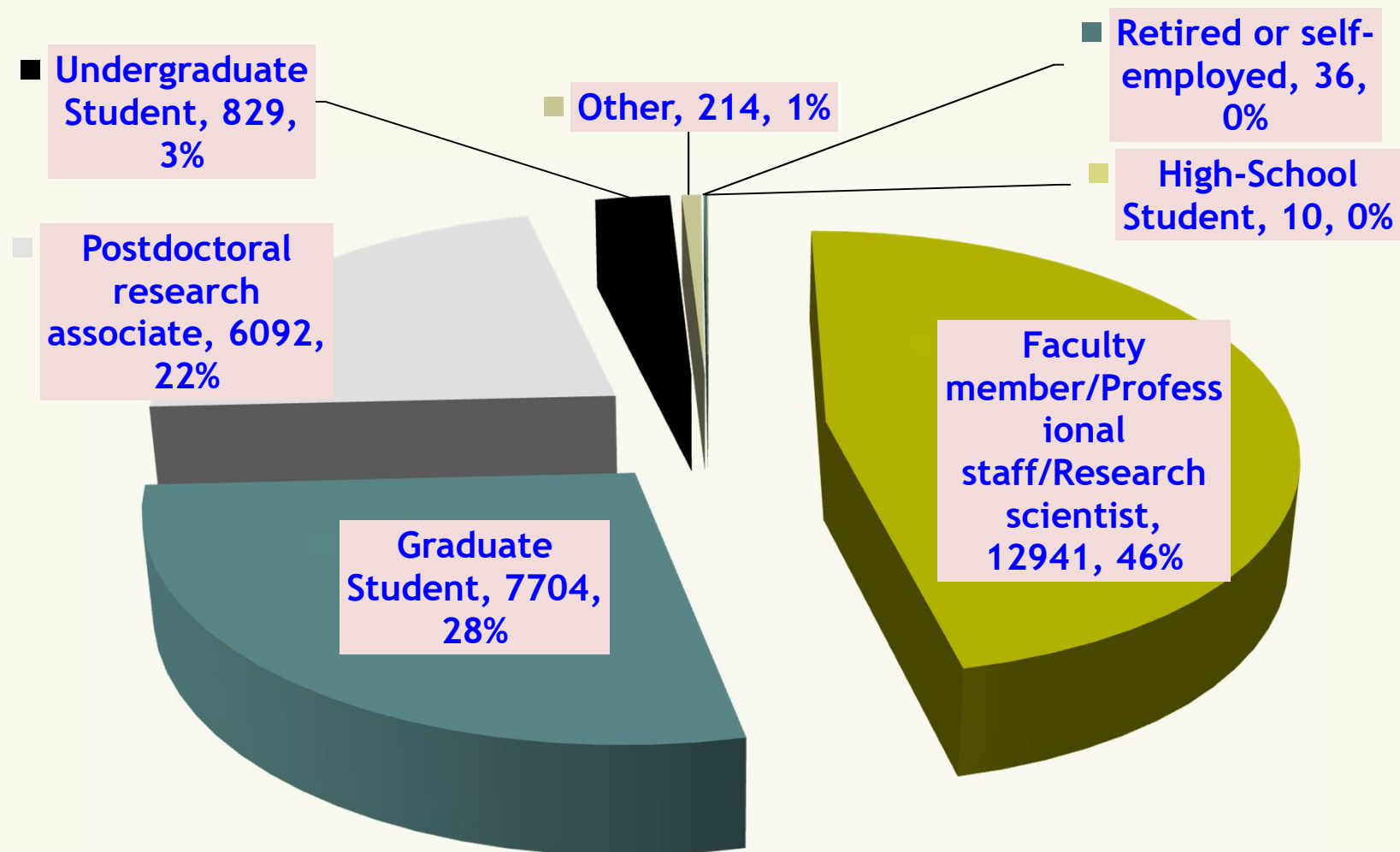
USER TYPE



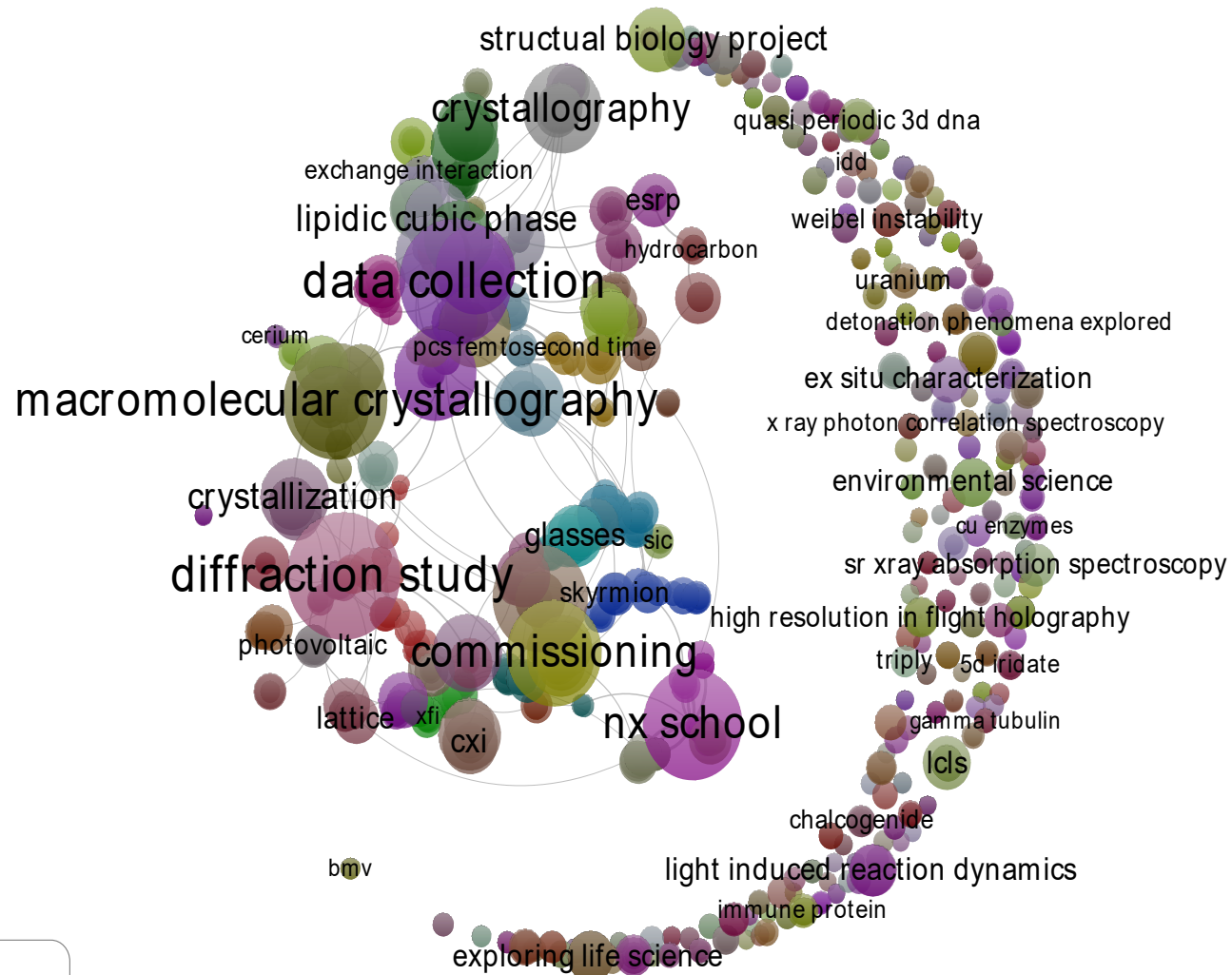
Project type



User employment level



Topic term of energy industry



Topic term of BES (≥ 100)



Rank	Topic term	Freq.
1	diffraction study	359
2	data collection	352
3	macromolecular crystallography	301
4	NX school (National School on Neutron and X-ray Scattering)	274
5	Commissioning	253
6	Beamline	249
7	Biology	186
8	Receptor	176
9	Crystallography	174
10	LS CAT (Life Sciences Collaborative Access Team)	165
11	SFX (Serial Femtosecond Crystallography)	147
12	G protein	139
13	Crystallization	135
14	femtosecond crystallography	133
15	photosystem II	132
16	lipidic cubic phase	128
17	Alignment	127
18	x ray imaging	117
19	single particle initiative run	112
20	structural dynamic	103

Conclusions and discussions



- **Science- technology- innovation**
- **New path: innovation fostered from
technology, science, idea, concept**
- **Government role in fostering innovation**
- **The role of User Facility**

Acknowledgments

I do appreciate **U.S. DOE** for the data they provided publicly. This work was supported by NSFC under Grant 71774020/71473028.

Thank you very much !

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