

Impact of US Research Security Policies

US Security and the Benefits of Open Science and International Collaborations



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Overview

The pace of scientific discovery and the translation of those discoveries into usable technologies has greatly accelerated in the past decades, resulting in a highly competitive world where nations are now challenging the United States' leadership in science, technology, and innovation. To remain competitive, the United States must continue to capitalize on two of its key advantages—(1) providing an environment that encourages openness and the free exchange of information and (2) being a destination of choice for the world's best and brightest students and scholars to study and/or work. Unfortunately, the results from a September 2021 survey of APS members reveal that the US federal government's current response to research security concerns is putting both advantages in jeopardy.

The quantitative survey results demonstrate direct impacts of current US research security policies on the US research enterprise. These policies are having a chilling effect on US-based researchers' involvement in international collaborations, which bring new ideas, techniques, and scholars to the US research and development (R&D) ecosystem. Moreover, these policies are causing a growing unease among talented international graduate students and early career scholars that is driving them to consider pursuing their careers in countries other than the United States. In response to these impacts, we offer a series of policy recommendations aimed at reformulating current research security policies, recommitting the United States to open science and collaboration, and increasing our ability to attract and retain international talent.

Introduction

For decades, the US R&D ecosystem greatly benefited from its long-standing commitment to open science, which both promotes collaborations and attracts the world's top talent. This commitment is articulated in President Reagan's National Security Decision Directive 189 (NSDD-189), which states that the products of fundamental research should remain unrestricted "to the maximum extent possible," and that the mechanism for control, when necessary, is classification.

In many fields, including materials science and high-energy physics, leading-edge research occurs in laboratories and institutions outside the United States. Therefore, US-based researchers can directly benefit from being reliable partners in shared ventures with their counterparts abroad. International collaborations provide US researchers access to world-class, international facilities, yield more impactful research results [1], and, perhaps most importantly, help the US institutions, labs, and companies recruit talented international students and scientists.

These international students and scholars are a key component of the country's STEM talent pipeline. While the United States must continue to make concerted efforts to bolster its domestic workforce and work toward full participation in STEM, it is also essential that the country remains a destination of choice for the world's best and brightest. International scholars bring their expertise, fresh perspectives, diverse experiences, new ideas and creativity to our universities, national laboratories and companies—both large and small—to positively impact the US R&D ecosystem [2].

In recent years, concerns centered on research security have made the R&D global landscape even more complex. There are legitimate concerns with the potential theft of intellectual property (IP), trade secrets and classified research, as well as systematic efforts by foreign entities to develop covert, undisclosed relationships with US-based researchers. APS supports the federal government making concerted efforts to prevent these actions from occurring. It is also clear that the benefits of open science and the inclusion of talented international students and researchers dictate against broad federal policies that wall off areas of research, stymie international collaborations and put the nation at a disadvantage in the race for global talent.

To ensure the vitality of the US scientific enterprise, it is imperative that the federal government take an approach that balances the benefits of open science and scientific mobility with protections against attempts by foreign entities to illicitly appropriate, acquire or steal US-based science and technology. Here, we present quantitative results from a Fall 2021 survey of APS members that

"Collaborating with researchers internationally is an essential part of how we advance science, attract talent from around the world, and avoid being technologically surprised,"

Alan Stern, National Science Board member and Associate Vice President of the Southwest Research Institute [1].

demonstrate the federal government's current approach to addressing research security concerns is not appropriately balanced, and, as a result, some current policies are weakening, not strengthening, the US scientific enterprise. In response, we offer a series of policy recommendations aimed at reformulating current research security policies, recommitting the United States to open science and collaboration, and increasing our ability to attract and retain international talent.

Benefits of International Students, Scientists and Collaborations

For the last several decades, the United States has been a premier destination for talented international students and scholars to study and/or work. Foreign-born STEM professionals are critical to the US R&D ecosystem, as well as our economy and society more broadly, and the benefits they provide are clear and measurable. For example, 44% of the 2021 Fortune 500 companies have founders who were immigrants or the children of immigrants [3]. Additionally, as of 2019, more than half (50 of 91) of the privately held billion-dollar startup companies in the United States had been founded by immigrants, with 21 having a founder who first came to the country as an international student [4]. As a result, international students and scholars have promoted job growth [5], generated higher average salaries for US workers [6], and become an indispensable part of US competitiveness [7].

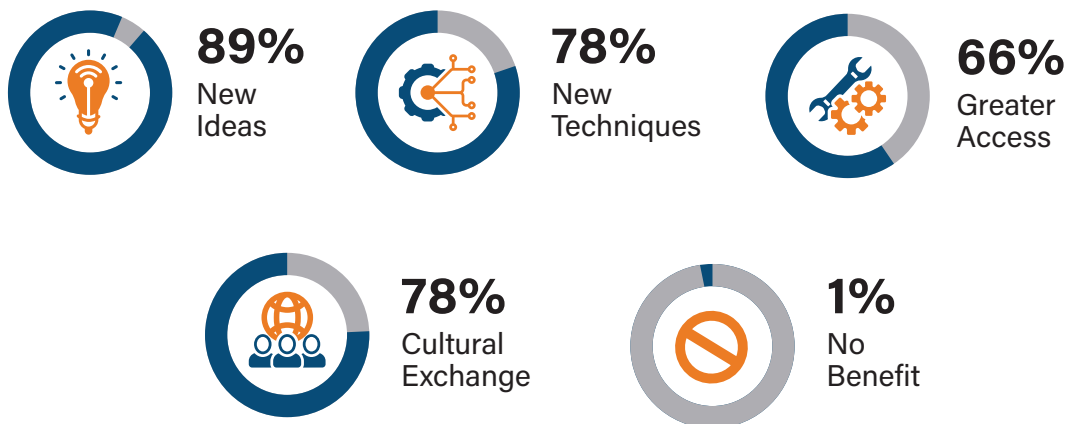
International researchers located outside the United States can also positively impact our scientific enterprise through collaborations with US-based researchers. Today, for example, 40% of the US research publications include co-authors from international collaborations [8]. Additionally, these collaborations enable the US R&D ecosystem to be fully informed of the state of international research and to maintain our global competitiveness.

Physics professionals living in the United States are no exception, according to the Fall 2021 APS member survey. Nearly 80% of US physics professionals reported active collaborations with colleagues in other countries. The reason such a high portion of physicists collaborate with colleagues outside the United States is simple: they find tremendous value in doing so.

According to a September 2021 survey of APS members, US domestic physics professionals who maintain professional collaborations with colleagues outside the United States overwhelmingly agreed that international collaborations bring significant benefits to US laboratories and researchers. Nearly 90% agreed that international collaborations bring new ideas to US laboratories and almost 80% agreed that international collaborations bring new techniques to US laboratories.

The benefits identified by the physics community reinforce findings recently reported by the National Science Board: *The benefits of international collaboration include achieving outcomes that no one nation could achieve.*

Benefits of International Collaborations to US Laboratories and Researchers



Percentage of respondents who chose the above options

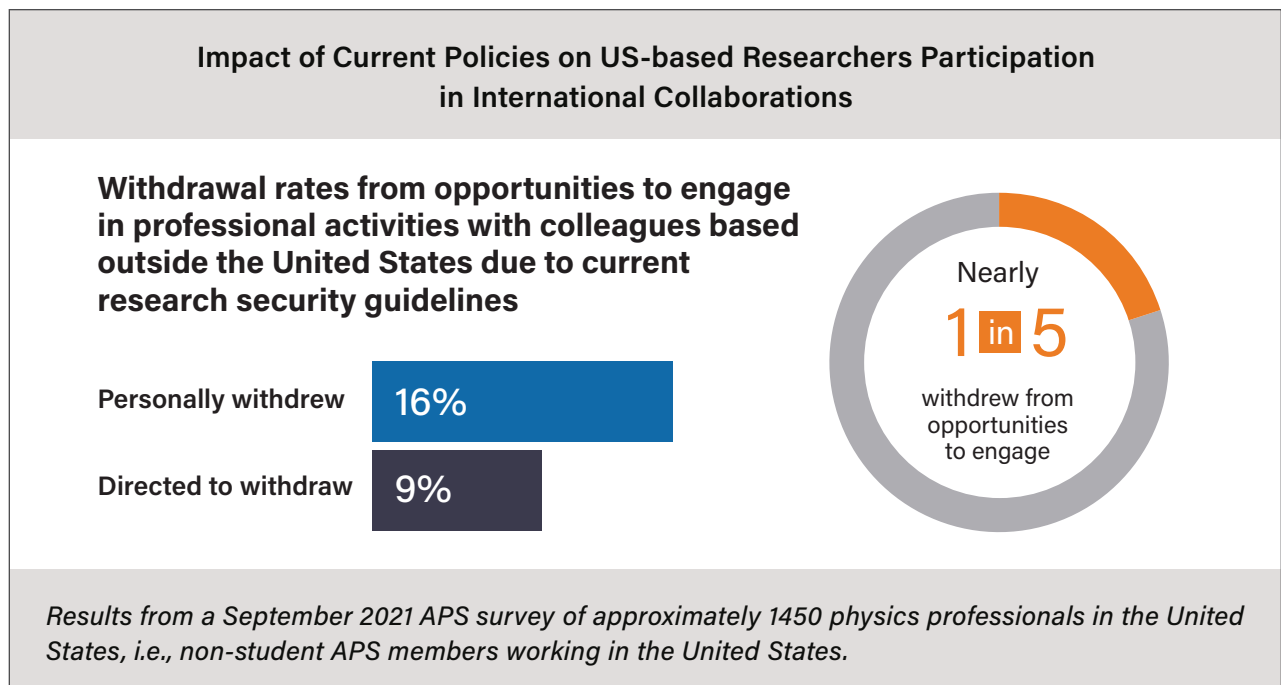
Results from a September 2021 APS survey of more than 900 US domestic physics professionals, i.e., US citizens and permanent residents who are non-student APS members working in the United States.

Current Policies Create a Chilling Effect

Despite the importance of international collaborations and the benefits they have to US laboratories, recent updates by the US federal government to research security policies are driving US-based researchers to withdraw from opportunities to engage with their counterparts abroad. The new APS survey results reveal that **nearly one in five** physics professionals in the United States have either chosen—or been directed—to withdraw from opportunities to engage in professional activities with colleagues based outside the United States due to current research security guidelines.

A reduction in these collaborative activities creates a loss of new ideas and new techniques that would be brought to US laboratories and US-based researchers. Restricting legitimate international collaborations translates into an overall slowing down of our own pace of discovery and innovation and neutralizes one of the United States' key competitive advantages.

Additionally, many free-response comments provided by APS members highlight that the challenges they face are due not only to recent policy updates, but also to the lack of clear guidance from the federal government. In some cases, physics professionals report taking an overly cautious approach out of fear. Their actions include not writing recommendation letters for graduating students who are applying for positions in China and ending collaborations with former post-docs. Such actions negatively affect promising international scholars and the US R&D ecosystem as a whole.



Current Policies Deter World's Best & Brightest

In addition to suppressing US-based researchers' involvement in professional activities with colleagues outside the country, current research security policies are hindering the United States' ability to attract and retain international STEM talent. **Approximately 43%** of international physics graduate students and early career professionals currently living in the United States perceive that *the United States is an unwelcoming country for international students and scholars.*

Moreover, **at least 40%** of international early career professionals and **at least 45%** of international graduate students familiar with research security policies believe that the US government's current response to research security concerns makes their decision to stay in the United States long term less likely or much less likely. These survey results are a clear indication that the US federal government's current approach to addressing research security concerns is negatively impacting our ability to retain international talent.

An unbalanced approach to research security is not the only factor compelling international students and scientists to consider pursuing careers elsewhere. International students and scholars continue to face challenges with the US visa and immigration system, putting the United States at a disadvantage in the global competition for STEM talent. According to a September 2021 APS survey that tracks international scholars' experiences with the US visa and immigration system, **approximately one in four** respondents report facing challenges with proving their intent to return to their home country at the end of their visa term, and **one in three** report career-disrupting delays of more than two months when obtaining and renewing visas. The same survey revealed that **four out of five** international graduate students and early career professionals in the United States encounter significant challenges when obtaining, renewing or travelling on US visas, an increase of more than 10% compared to one year prior. This increase occurred despite COVID-19 pandemic travel restrictions relaxing since September 2020.

The challenges and perceptions created by current US policies could create a severe hole in our international STEM talent pipeline and a critical segment of our future STEM workforce. **More than 80%** of international physics graduate students and early career professionals currently studying and/or working in the United States are considering, or have considered, pursuing their career in a country other than the United States.

"I am very concerned about the future health of the American research enterprise if researchers continue to be prosecuted for standard interactions with foreign colleagues and international graduate students find more welcoming countries for their education."

Physics department chair at US institution

When international early career physics professionals and graduate students were asked what factors are important when considering pursuing a career in a country other than the United States, approximately half of the survey respondents highlighted *pathway to citizenship that other countries offer* and *the perception of the US being unwelcoming to foreigners* as the main factors in their decision. Other nations have recognized that international STEM students and scientists want to pursue their careers in countries that do not have unnecessary hurdles or roadblocks on a path to permanent residency/citizenship.

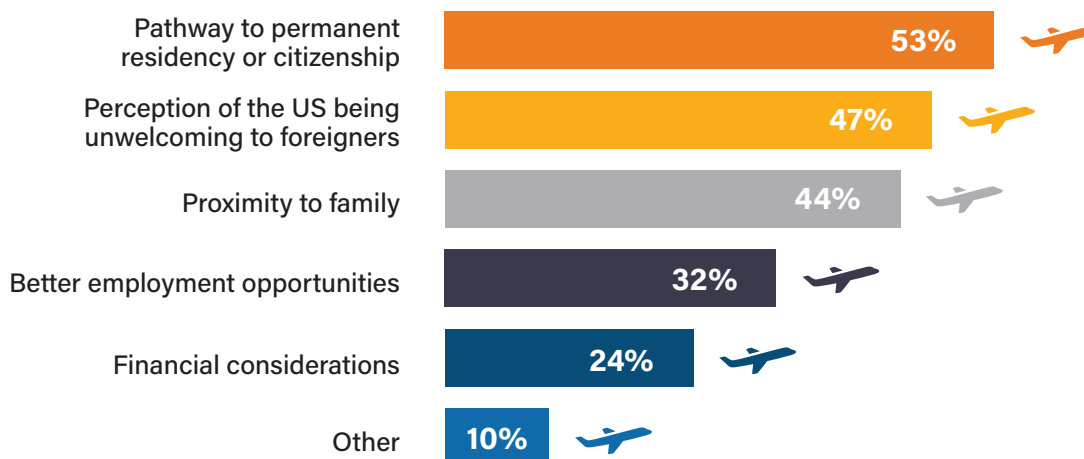
Impact of Current Policies on Recruiting International Physics Talent



At least 40% of international graduate students and early career professionals familiar with research security policies believe that the US government's current response to research security concerns makes their decision to stay in the United States long term less likely.

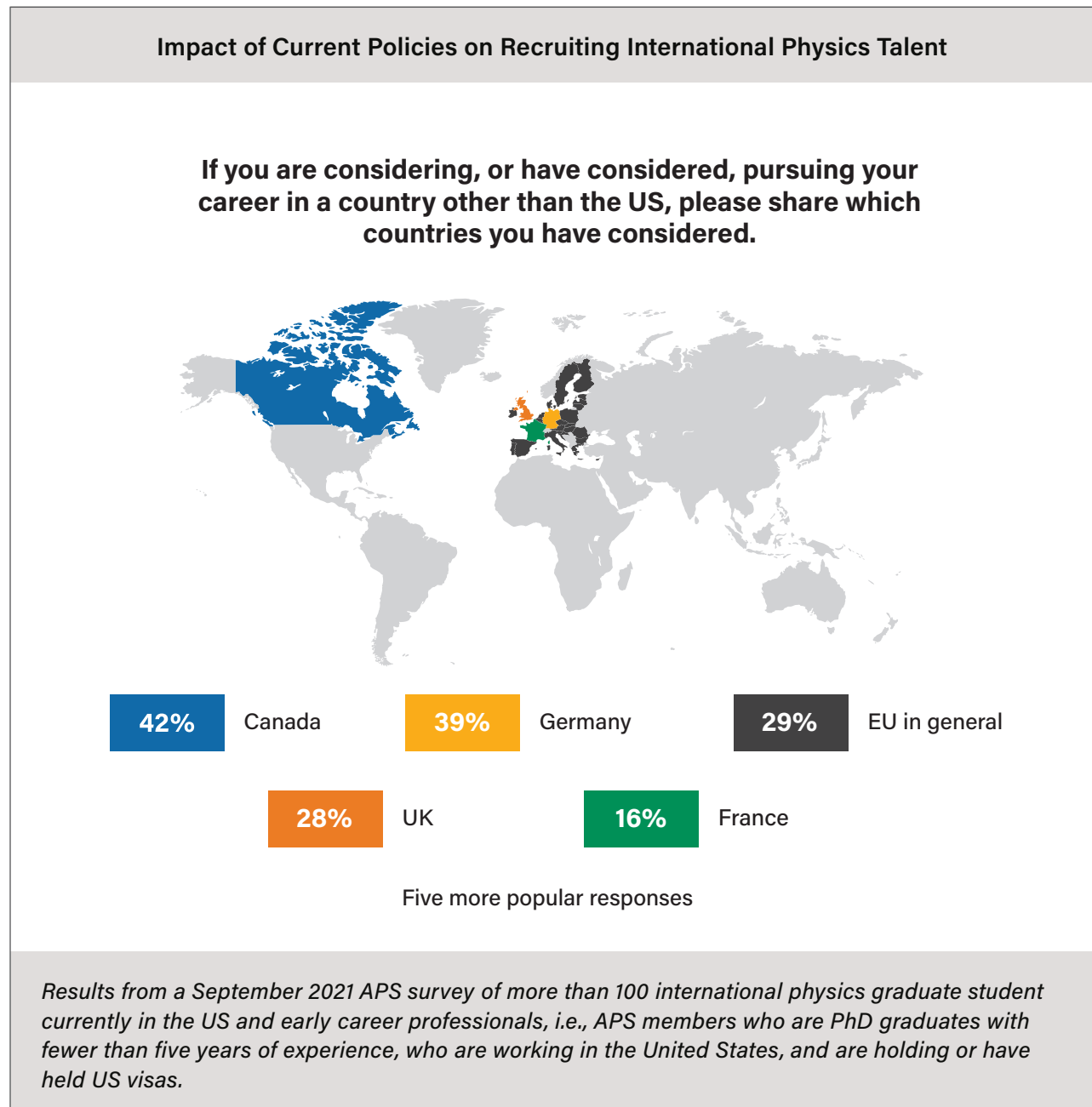
Reported factors in considering pursuing a career in a country other than the US

Percentage of respondents that chose the below options



Results from a September 2021 APS survey of more than 350 international physics graduate student currently in the US and early career professionals, i.e., APS members who are PhD graduates with fewer than five years of experience, who are working in the United States, and are holding or have held US visas.

In recent years, several countries have implemented changes to their visa and immigration policies specifically designed to attract international S&T talent. Some of these countries are also the ones that are mentioned the most by international early career professionals who are considering pursuing their careers outside the US: Germany (39%), Canada (42%), UK (28%), France (16%) and the EU in general (29%).



A New Approach Required: Recommendations for Moving Forward

The issues and survey results outlined above indicate that the US federal government's current approach to addressing research security concerns is negatively impacting both individuals and the US scientific enterprise broadly. For physics professionals in the United States who are familiar with research security policies, **fewer than one in four** agree that the US federal government's current response to research security concerns appropriately balances US security and the research requirements for open science.

The path forward is clear: The United States must continue its commitment to maintaining an open, collaborative environment for science while also protecting itself against attempts by foreign entities to illicitly appropriate, acquire or steal US-based science and technology. Doing so requires reformulating current research security policies—including ensuring that researchers have clear and consistent disclosure policies and processes and that any policy must be implemented fairly and not fuel xenophobia or prejudice—and creating STEM visa and immigration policies that encourage the world's best and brightest minds to come and stay in the United States.

To do so requires a partnership between the federal government and scientific community centered on a recommitment to research principles. Members of the scientific community can do their part by intensifying their commitment to research integrity—which includes openness, honesty, objectivity, fairness, disclosure, accountability and stewardship. These principles were outlined in the 2020 APS Board Statement on Open Science and a Recommitment to Research Principles [9]. APS has begun to enforce these principles with a revocation policy applied to violators.

For the US federal government, we offer the following set of recommendations, which if implemented, would significantly improve the US research environment and protect the nation against evident security risks:

Make a Clear Recommitment to Open Science: The federal government should reaffirm Presidential National Security Decision Directive 189 (NSDD-189), which states that fundamental research is defined as research that is meant to be published in the open literature and that the products of fundamental research should remain unrestricted “to the maximum extent possible.” If control of particular fundamental research is required for national security, the mechanism is classification. Open exchange of information is essential for progress in fundamental science and has been critical to US leadership in science. While some areas of research must employ controls, the benefits of openness in research and the inclusion of talented foreign researchers dictate against broad federal measures that would wall off areas of fundamental research. The federal government must therefore make this clear recommitment to open science.

Reformulate US Research Security Policies: Current policies, including the “China Initiative” and Presidential Proclamation 10043 (PP 10043), are crippling the United States’ ability to attract international students and scientists, and curtailing US-based researchers’ participation in fruitful international collaborations. Policies should be reformulated to better protect the nation against evident risks to our security and strengthen the US research enterprise. Specifically, the US federal government should:

- **Refocus the China Initiative:** The initiative’s focus should be on the evident economic and national security risks, including espionage and theft of US-based intellectual property and trade secrets, and not on cases of administrative and/or unintentional non-disclosure.
- **Rename the China Initiative:** The initiative’s name should change so it does not focus on a particular country, but instead focuses on the crime. State-sponsored theft—stemming from any nation—is a legitimate threat to our national and economic security, and including a specific nation in the initiative’s name raises concerns with ethnic profiling.
- **Mitigate Against Profiling & Attract Global Talent:** Any policy must be applied uniformly and consistently, irrespective of a person’s identity or origin. Additionally, policies should not discourage—or create new, unnecessary barriers—for international students and scientists who want to study and/or work in the United States.

Improve Disclosure Policies: In recent years, federal science agencies have instituted myriad changes to their disclosure policies, including the introduction of “conflicts of commitment,” leading to administrative errors and/or unintentional reporting oversights. Transparency and disclosure by federally funded researchers are essential to our open research environment, and federal policies must both be clear and encourage participation from researchers. The federal government should take the following steps to help ensure researchers comply with the necessary disclosure requirements:

- **Clear and Consistent Disclosure Guidelines:** Federal agencies should appropriately harmonize their conflict of interest (COI) and conflict of commitment (COC) disclosure requirements, which will reduce the administrative burden of reporting on researchers. Disclosure requirements—as well as policies and sanctions for non-compliance—should be clarified and standardized across agencies. These policies should be communicated clearly to all federally funded researchers and associated staff, including principal investigators, university administrators, and grant personnel.

- **Provide Researchers Window to Catch Up:** University researchers who previously did not disclose foreign support appropriately should be provided a limited period to correct any unintentional errors and administrative oversights. To incentivize self-disclosure, the federal government should assure researchers that cases of non-disclosure will be handled on an individual basis and that inadvertent and/or administrative errors will not be treated as criminal activity.
- **Establish Protocol for Scientific Integrity Violations:** The federal government should establish a formal process to handle non-disclosure issues that are exclusively administrative errors and/or unintentional reporting oversights. Breaches of scientific integrity should be addressed by the funding agency, the researcher's home institution and their professional affiliated organizations, while the Department of Justice focuses on instances of malign intent to hide foreign support or engage in espionage.

Improve High-Skilled Visa & Immigration Policies: Recruiting and retaining talented international students and scholars is essential to the future of the United States' scientific enterprise. Today, the S&T global landscape is simply too competitive to ignore what the best and brightest are seeking—a nation that does not create unnecessary barriers for them to come to pursue their studies and stay for their professional careers. The United States needs a 21st century visa and immigration system that attracts, not deters, top global talent. Specifically, the federal government should:

- Allow international students applying for an F-1 visa to indicate they would like to stay in the United States after graduation.
- Provide international students and scholars who earn or have earned advanced STEM degrees from US institutions a clear path to a green card should they choose to stay and work in the United States after graduation.

By following these policy responses, the United States will implement a new approach to addressing research security concerns that balances the benefits of open science and scientific mobility with necessary protections against evident national and economic security threats. Doing so will strengthen the nation's research enterprise and—when paired with robust and stable R&D funding—will ensure the United States continues to be a global leader in science, technology and innovation.

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Appendix

Additional information on survey results included in this report

Respondent definitions:

Respondent type	Definition
US domestic physics professionals	US citizens and permanent residents who are non-student APS members working in the United States
Physics professionals in the United States	Non-student APS members working in in the United States
International early career professionals in the United States	APS members who are PhD graduates with fewer than five years of experience, who are working in the United States, and are holding or have held US visas
International graduate students in the United States	APS members who are currently enrolled in a graduate program at a US institution and hold a US visa
International established physics professionals	APS members who are PhD graduates with six or more years of experience, who are working in the United States, and are holding or have held US visas

Survey results details:

Report Text Including Survey Result	Number of respondents (N)	Result with standard error ($1/\sqrt{N}$)
According to a September 2021 survey of APS members, US domestic physics professionals who maintain professional collaborations with colleagues outside the United States overwhelmingly agreed that international collaborations bring significant benefits to US laboratories and researchers. Nearly 90% agreed that international collaborations bring new ideas to US laboratories and almost 80% agreed that international collaborations bring new techniques to US laboratories.	908	89% +/- 3% 78% +/- 3%
Nearly one in five physics professionals in the United States have either chosen—or been directed—to withdraw from opportunities to engage in professional activities with colleagues based outside the United States due to current research security guidelines.	1445	19% +/- 2%

Report Text Including Survey Result	Number of respondents (N)	Result with standard error (1/√(N))
Approximately 43% of international physics graduate students and early career professionals currently living in the United States perceive that the United States is an unwelcoming country for international students and scholars.	356	43% +/- 5%
When asked if they were considering pursuing their career in a country other than the US, more than 80% of international early career professionals and international graduate students in the US responded yes.	350	84% +/- 5%
At least 40% of international early career professionals familiar with research security policies believe that the US government's current response to research security concerns makes their decision to stay in the United States long term less likely or much less likely.	115	50% +/- 9%
At least 45% of international graduate students familiar with research security policies believe that the US government's current response to research security concerns makes their decision to stay in the United States long term less likely or much less likely.	137	53% +/- 8%
Approximately half of the respondents highlighted pathway to citizenship and the perception of the US being unwelcoming to foreigners as the main factors in their decision.	363	53% +/- 5% 47% +/- 5%
Four out of five graduate students and early career professionals scholars in the US encounter significant challenges when obtaining, renewing, or travelling on US visas, up more than 10% compared to a year ago.	(2021) 408 (2020) 555	(2021) 83% +/- 5% (2020) 72% +/- 4%
A strong increase in delays of more than two months when obtaining and renewing visas to one in three respondents, up from one in four just a year ago.	(2021) 408 (2020) 555	(2021) 38% +/- 5% (2020) 24% +/- 4%
The countries that are mentioned the most by international early career professionals who are considering pursuing their careers outside the US: European Union (75%), Canada (45%), UK (28%).	110	75% +/- 10% 45% +/- 10% 28% +/- 10%
Less than one in four physics professionals in the United States familiar with research security policies agree that the US federal government's current response to research security concerns appropriately balances US security and the research requirements for open science.	1298	23% +/- 3%

