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Communication with U.S. Policy Makers and Opinion Leaders

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51.1 Introduction

The U.S. particle physics community has recognized as part of the 2013 Community Summer Study ("Snowmass") process that it must embark on a coordinated effort that mobilizes a greater fraction of scientists and students to translate the public excitement about and interest in particle physics research into greater support among the policy makers that make decisions about research funding and the opinion leaders whose views they trust to guide them in their decisions.

The particle physics community has engaged for decades in a variety of efforts to educate and inform the public, including policy makers and opinion leaders, about the excitement and importance of particle physics research and its benefits to society. These public outreach efforts have met with success, as demonstrated by the public attention to events in particle physics over the last six years. The saga of the Large Hadron Collider (LHC)—its startup, shutdown, restart and discovery of the Higgs boson—was followed by an unprecedented fraction of the worldwide public audience. Experimental hints of faster-than-light neutrinos made worldwide headlines in publications that rarely, if ever, cover physics news. The transit in 2013 of a large electromagnet from one Department of Energy (DOE) laboratory to another drew crowds of onlookers and live coverage on local television networks. Public lectures and other events on particle physics topics draw crowds that not all other fields of science can attract.

Yet while particle physics research fascinates and excites the American public, their continuing support for the funds required to build new facilities is not guaranteed. In the current climate of fiscal austerity, government-funded programs must make compelling cases for the societal benefit of their work. The bar is set high for scientific fields such as particle physics, which currently receives more than $750 million annually in the budget of the DOE Office of High Energy Physics and has proposed to build new projects with total costs of more than $1 billion.

A survey of more than 600 members of the particle physics community conducted in the first half of 2013 by the Snowmass Communication, Education and Outreach (CE&O) group revealed that only about 30% of respondents are engaged in outreach activities that reach policy makers and opinion leaders (see Appendix). Higher fractions of respondents were engaged in outreach to the general public (approximately 60%), activities that reach K-12 teachers or students (50%), and in activities that reach scientists in other fields (35%).

Translating the excitement and interest about particle physics into public support for funding of particle physics is critical not only to the long-term health of this field, but to the larger scientific enterprise in which particle physics plays an essential role. Maintaining and enhancing support will require a much larger fraction of the particle physics community to engage in activities targeted at policy makers and opinion

leaders, and the effectiveness of those activities to be increased. Greater nationwide coordination, new initiatives to provide resources and training to physicists, and efforts by the U.S. community to convey consistent messaging will all help achieve these goals.

This report defines the policy maker and opinion leader audiences, provides an overview of existing activities targeted to those audiences, and details a set of strategic recommendations for actions that the U.S. particle physics community can take over the next five years to improve communication and outreach to these audiences.

These strategies and recommendations were developed by the Snowmass CE&O group with the input of particle physicists and professionals in the field of public relations, communication and government relations, and discussed with the physics community at the CSS 2013 Snowmass on the Mississippi meeting in July and August of 2013 at the University of Minneapolis [1].

51.2 Audience definition: policy makers and opinion leaders

Policy makers include elected and non-elected officials in federal, state and local government who have influence over particle physics funding, including:

- elected representatives at the federal, state and local level;
- officials at funding agencies; and
- professional staff members who oversee particle physics-related budgets, such as staff members in the Office of Management and Budget, Office of Science and Technology Policy and related state organizations.

Opinion leaders are defined as notable figures whose views on scientific research and science funding are influential with policy makers and the public, including:

- prominent scientists in all fields who are often consulted by policy makers and the media on scientific research and funding in general, such as Nobel Prize winners and scientists who appear in prominent television shows;
- chairmen and CEOs of major corporations associated with scientific research;
- presidents of research universities; and
- science journalists at influential publications such as *The New York Times, Washington Post, Science, Nature* and programs carried on National Public Radio stations.

51.3 Existing activities, resources and infrastructure

The U.S. particle physics community has been engaged for decades in a variety of efforts to inform the public, policy makers and opinion leaders about particle physics research, and to encourage decision makers to support that research. The table below contains a non-exhaustive list of existing efforts to communicate directly to policy makers and opinion leaders. This table demonstrates that a number of successful efforts

are already in place to build support for particle physics research among these audience groups. Going above and beyond existing efforts will require nationwide coordination and support, the creation of resources that reduce participation barriers for physicists and students, and acknowledgement by the community that such efforts are necessary and that they are most beneficial when they convey consistent messaging.

Activities targeted at policy makers			
Who	**What**	**Details**	**Funding**
Users' groups: Fermilab UEC, SLAC Users Organization, US LHC Users Organization	Annual group visit to Washington (typically in spring).	In 2013 37 scientists made 253 visits to offices in DC over two days. Organization is primarily carried out by user volunteers, with some support from Fermi Research Alliance. Training provided.	Yes, from lab contracting organizations to support travel to training session and to DC.
	Email/letter campaigns to members of Congress.	Heads of user groups email member lists to encourage them to contact their members of Congress. Generally coincides with important legislation; tends to be used to counteract negative consequences (funding cuts).	No.
	Participation in Washington events and receptions.	Events held yearly by the National User Facilities Organization; sporadic additional events. Little to no training provided.	Yes. Source varies by event.
Scientific societies: American Physical Society (APS) and American Association for the Advancement of Science (AAAS)	Direct advocacy by societies' government relations professionals; organization of letter-writing campaigns and events in Washington that include scientists.	Activities typically support funding for all fields (AAAS) or all subfields of physics (APS) and include informational services and advocacy resources for scientists, receptions and events in Washington, letter-writing booths at meetings, newsletters for members of Congress. Particle physics-specific events may be organized through APS Division of Particles and Fields.	Yes, from membership dues.
National laboratories and contracting organizations	Direct advocacy by national lab directors, government relations professionals and lobbyists on behalf of science funding.	Focuses on key individuals in DC who have positions of major influence on DOE funding. The reduction in the number of national labs with particle physics as a major component of their research has somewhat reduced the power of this activity.	Yes, from contracting organizations.

Activities targeted at policy makers (continued)			
Who	**What**	**Details**	**Funding**
	symmetry Magazine (Fermilab and SLAC)	Presents news and information about U.S. particle physics in an engaging and attractive format. Format recently revamped to better match information delivery needs of policy makers and opinion leaders (online with mobile versions, flexible subscriptions, greater engagement with social media, newsletter being piloted specifically for policy makers).	Yes, from Fermilab and SLAC.
Industrial groups (e.g. SPAFOA, the Superconducting Particle Accelerator Forum of the Americas)	Capitol Hill briefings; advocacy efforts by SPAFOA members on behalf of federal funding for advanced accelerator technology.	Focused on participation by the U.S. in major future particle accelerators.	Yes, from membership.
Scientists	Individual outreach by motivated scientists to policy makers.	Many scientists carry out their own outreach and communication to their elected representatives and key stakeholders in D.C.; efforts may or may not be coordinated with existing efforts and activities.	Varies.
Activities targeted at opinion leaders			
Who	**What**	**Details**	**Funding**
Media relations professionals at universities and labs; scientists	Outreach and communication to journalists and other members of the press.	Journalists and their publications are both members of the opinion leader audience and a vehicle to reach opinion leaders and policy makers.	Yes, to support media relations professionals and some activities undertaken by scientists.
Scientists	Outreach and communication to their influential peers in particle physics and other fields.	A small number of influential scientists (i.e. Nobel Prize winners) carry a very large amount of weight with opinion leaders and policy makers; it is beneficial for the field that they are educated about and supportive of particle physics research.	No.
	Outreach and communication to business and industry leaders.	The voices of leaders from business and industry can be very powerful. Particle physics has not made a concerted effort recently to mobilize such opinion leaders.	No.

51.4 Overall goals for particle physics communication, education and outreach

The CE&O group identified the following three goals as the overarching aims of U.S. particle physics CE&O activities. Activities aimed at the policy maker and opinion leader audiences generally support the first two goals.

1. Ensure that the U.S. particle physics community has the resources necessary to conduct research and maintain a world leadership role.
2. Ensure that the U.S. public appreciates the value and excitement of particle physics.
3. Ensure that a talented and diverse group of students enter particle physics and other STEM careers, including science teaching.

51.5 Strategies targeted at policy makers and opinion leaders

The following three strategies were identified as high-priority efforts that should be undertaken by the particle physics community over the next five years to maintain and increase support for particle physics research among policy makers and opinion leaders.

1. Empower and enable members of the particle physics community to communicate and advocate coherently, consistently and effectively on behalf of their science.
2. Develop an enduring process to track, update, and disseminate statistics on the impact of particle physics on society.
3. Put informed third-party advocates to work raising the profile of and informing key stakeholders about the importance of particle physics, physics, and discovery science to the United States.

These strategies are targeted to the policy maker and opinion leader audiences, but also support the goals of outreach to the general public and scientists in other fields. They are in turn supported by strategies identified by the General Public [2] and The Scientific Community [3] CE&O subgroups, including:

Develop consensus in our field that we need to prioritize, buy into the mechanism of prioritization and support the resulting plan. The successful implementation of this strategy is a prerequisite for the successful implementation of the first Policy Maker and Opinion Leader strategy. A U.S. community that visibly and consistently supports the P5 plan will be much more effective in its efforts to build support among policy makers. This strategy was supported by remarks in the written statement from by Energy Secretary Moniz presented to the 2013 Community Summer Study meeting in Minneapolis [4].

Make the public aware of direct and indirect applications of research, both historical and potential. Building support for particle physics research among policy makers necessitates communicating the impact of such research on their constituents and the American public. A compelling story, shared by all U.S. particle physicists, about the value of particle physics to society is critical to ensuring that the field has the resources it needs to flourish.

Communicate the role and stories of U.S. physicists in particle physics, particularly in major discoveries and in the context of our international collaborations. Communicating the value to the United States of particle

physics research carried out at facilities in other countries can be challenging, depending on the views of individual policy makers or opinion leaders. Raising the profile of U.S. scientists and groups of scientists working on international projects, and the value their work brings to society as a whole as well as to the United States, helps the case for support of particle physics.

Foster more dialog and understanding with other fields, beginning with other physics subfields. Identify areas of common cause and unite in support of them. The opinion leader audience includes both notable scientists from other fields, and leaders within the laboratory and university communities who hail from and serve other scientific fields. Efforts to increase partnerships with other fields of science, and work with them to communicate jointly on behalf of funding for all of science, helps build support for particle physics.

51.6 Implementing the strategies over the next five years

We recommend seven activities to be undertaken over the next five years to achieve the strategies for the policy maker and opinion leader audiences. These activities do not replace existing efforts. Instead, they augment and enhance ongoing efforts by providing nationwide coordination and support, and by developing needed resources to make a compelling case for support of particle physics research.

Recommendation 1: Augment existing efforts with additional personnel and resources dedicated to nationwide coordination, training and support.

The U.S. particle physics community, as part of the 2013 Snowmass process, has strongly indicated that it wishes to enhance its communication, education and outreach efforts. Taking things "to the next level" requires a nationwide effort that mobilizes a greater fraction of the community and is supported by dedicated personnel and resources. This effort will need to be a partnership between scientists and professionals in the areas of communication, government relations and education. It will need to encompass existing efforts carried out at laboratories and universities and by experimental collaborations.

The greatest initial need for such dedicated national resources is a small team of people to coordinate and support existing activities and spearhead and organize new nationwide initiatives. Such a team would be most effective if coupled closely with existing nationwide efforts, such as the particle physics magazine *symmetry* [5], QuarkNet [6], the Contemporary Physics Education Project [7] and the advocacy efforts of users' groups. The natural first task for team members would be to identify, create and ensure easy access to resources that will help the U.S. particle physics community effectively communicate the results of the P5 process.

Recommendation 2: Develop a central communication, outreach, and education website for physicists.

The results of the CE&O survey indicated that only 30% of physicists are currently engaged in outreach activities targeted at policy makers and opinion leaders. Survey results and discussions that took place at the 2013 Community Summer Study meeting indicate that scientists do not engage directly with policy makers due to three main factors:

1. Lack of knowledge about the most effective and appropriate ways of engaging with policy makers (what do I do?).
2. Lack of knowledge about the most effective messages to use with policy makers (what do I say?).
3. Lack of time to devote to such efforts (how much time is this going to take?).

In an era of constrained federal budgets, we suggest a goal of at least 50% participation by the U.S. particle physics community in efforts to communicate to these key groups at the end of five years. Achieving this goal will require significant efforts to decrease the barriers to participation in such activities. Easy-to-access information and resources must be made available to physicists to educate them about the most effective ways to engage with policy makers, provide them with messages and materials to use in their interactions, and minimize the time required for physicists to prepare for and engage in these activities.

The subgroup recommends that a high-priority activity for the team identified in Recommendation 1 be the creation of a website that would act as physicists' central clearinghouse for CE&O resources. This website would be designed to fulfill the needs of physicists who engage in CE&O activities, not the needs of the general public who wish to learn about particle physics. It would provide physicists with the tools, techniques, information and resources they need to engage effectively with policy makers, opinion leaders, the general public, teachers and students. Website content could include:

- Tips and techniques for engaging with policy makers (and other audiences). Initially, links would be included to existing material on other sites (e.g. AAAS), but particle physics-specific content could later be developed.
- Training materials and videos to help physicists hone their communication skills. Similarly to the tips and techniques described above, some content exists on the web but particle physics-specific content is desirable (see Recommendation 4).
- A summary of and messages about the Snowmass and P5 process appropriate for public audiences.
- Information that the particle physics community will need to communicate the P5 plan, such as fact sheets, brochures, messages and multimedia.
- Updated fact sheets, brochures, and statistics useful for interactions with policy makers and opinion leaders.
- Talking points about the science of particle physics and its impact on society, with supporting examples and data.
- Links to external databases or community-generated databases that track important statistics on workforce development, technology transfer, or economic impact (see Recommendations 5 and 6).
- Links to existing websites and electronic and print materials that support CE&O activities.

Creating and maintaining such a website requires at least one FTE dedicated to nationwide particle physics communication, plus initial funding to create the website framework and minimal continuing funding for website hosting and maintenance. The creation of particle physics-specific training videos, and databases to track various types of statistics, could require significant additional resources.

Recommendation 3: Organize and identify logistical support for year-round campaigns in which particle physicists strategically advocate for scientific research with policy makers.

Many attendees at the 2013 Community Summer Study meeting in Minneapolis expressed the desire for an ongoing, year-round effort that strategically leverages the widespread U.S. particle physics community to keep support high among policy makers. Existing efforts are mainly organized by the users groups associated with Fermilab, SLAC and the US LHC experiments and rely on scientist volunteers. Year-round strategic campaigns require additional logistical support dedicated to nationwide efforts. A minimum of 0.5 FTE, supported by non-governmental resources, would be needed to:

- Provide logistical support that enables the annual facility users groups' D.C. trip to be expanded to a greater fraction of the U.S. particle physics community.
- Provide logistical support to organize a nationwide effort for physicists to visit their Congressional representatives in their home districts.
- Liaise with professional lobbying firms/organizations to organize nationwide letter-writing campaigns at key times during the federal budget cycle.
- Organize a nationwide effort to encourage every recent particle physics Ph.D. graduate from a U.S. university to write a personal letter to his/her Congressional delegation thanking them (if applicable) for the support that made their training possible, providing a brief overview of their research and its value to society, and describing where that student hopes to use their training.
- Set up computers at key particle physics meetings and conferences at which scientists can send letters to their representatives.
- Identify additional opportunities for the particle physics community to engage with policy makers.

Recommendation 4: Provide communication training to the U.S. particle physics community.

Communication training can greatly enhance scientists' ability to build support for their field, as well as enhancing their ability to communicate with their peers and further their career, yet very few scientists have gone through such training. This subgroup recommends that the dedicated personnel identified in Recommendation 1:

- Identify existing training resources and make them available through the central communication website identified in Recommendation 2.
- Investigate, together with the physics community, the most effective training format(s), carry out pilot trainings and expand successful formats nationwide. (Initial discussions at the 2013 Community Summer Study indicated that webinar-style training might be the most practical for professors who wish to expose their students to such training.)
- Organize at least one communication-related seminar or training at each major U.S. particle physics conference.
- Provide yearly assessments of this training and its impact on nationwide communication efforts.

This work requires personnel dedicated to nationwide particle physics communication, education and outreach. The creation and implementation of particle physics-specific trainings may require additional resources.

Recommendation 5: Work with APS to investigate the feasibility of a U.S. economic impact study for physics research that includes particle physics as a key component.

Many policy makers and opinion leaders evaluate requests for funding based on an economic model of investment and return. The particle physics community recognizes this and seeks ways to compile such economic data for its research. Economic impact studies are relatively simple to conduct on behalf of an organizational entity such as a national laboratory or university, when the items studied are based on capital and operating costs such as federal funding, purchases of goods and services, payments of salaries to employees and expenditures by visitors. Studies carried out by CERN [8] and the Canadian Light Source [9]

have gone one step further, including some aspects of the economic and social impact of academic research, and the auxiliary effect of research activities and companies doing businesses with the laboratories on the region surrounding the laboratories. Studies that attempt to rigorously quantify the long-term impact of an entire field of fundamental science on a national economy are very rare, and there is no such study for particle physics.

Due to the complexities and costs involved in such a study, this subgroup recommends that the first step for the particle physics community should be to partner with APS to investigate the feasibility of an economic impact study of physics research in the United States. This study should be balanced with respect to subfields of physics and identify connections of specified disciplines with particular industries. It should work toward an evaluation metric that includes weighted quantities in an attempt to better gauge the indirect economic impact of physics research. This study should also include the direct impact from the purchase of goods and services in particular regions as well as the impact of workforce development.

Recommendation 6: Work with DPF and HEPAP to develop a sustainable process for collecting statistics on workforce development and technology transfer.

Ongoing efforts exist to collect and analyze statistics on particle physics-related workforce development, in particular through the HEPAP Demography Committee and the HEPFolk database maintained at Lawrence Berkeley National Laboratory [12]. We recommend that resources be allocated to extend the work of this committee to set in place long-term, sustainable procedures for collecting and maintaining data on workforce training (including undergraduate training) and the jobs taken by Ph.D. physicists who do not pursue academic careers.

We further recommend that resources be allocated to create and initially populate a database of design and engineering patents that are associated with particle physics experiments. A simple search in August 2013 of the current U.S. patent collection database for the words "particle physics" yields 497 hits [10]. Physicists will be able to use the database to generate reports for communication activities.

Recommendation 7: Generate letters and statements from third-party advocates in support of the impact of particle physics on society.

Third-party advocates such as CEOs, notable scientists in other fields and opinion leaders can be very powerful voices for particle physics research funding. Biologist Harold Varmus advocated for particle physics by pointing out that research instrumentation for biological science research was not developed by biologists, but by physicists [11]. We recommend that the U.S. particle physics community, together with the APS Division of Particles and Fields, identify and solicit support from CEOs of major companies in various U.S. industries in the form of letters of support for particle physics research that can be forwarded to policy makers. Similar letters should also be written and signed by the presidents of the major U.S. particle physics research universities. In conjunction with these communications, testimony before appropriate Congressional committees by CEOs, university presidents, and notable scientists from other fields should be arranged in support of particle physics research, facilities and training.

51.7 Conclusion

It is an extraordinary time for particle physics, with the Higgs boson recently discovered and the potential for more revolutionary discoveries in dark matter, dark energy and other new phenomena just ahead. Next-generation accelerator, detector and computing technologies are now being developed to take particle physics into the next era. The strong support of U.S. policy makers, opinion leaders and the public is essential to the success of this international endeavor. By dedicating personnel and resources to national coordination and

support, the U.S. community can lower the barrier to greater participation in CE&O activities and increase the quality of these efforts. Developing statistics, data and resources relating to the impact of particle physics research on society and the economy will also increase the success of efforts to build support among policy makers and opinion leaders.

Building a comprehensive set of nationwide resources will take years, but the effort must begin immediately. The first and most high-priority set of resources should be made available to the U.S. community by the end of the P5 process. This will enable physicists across the country to seize the opportunity a new ten-year plan presents to communicate the excitement and importance of particle physics research to policy makers, opinion leaders and the American public.

51.8 Appendix: the 2013 Snowmass Communication, Education and Outreach Survey

The 2013 Snowmass Communication, Education and Outreach (CE&O) survey was designed to assess the participation by members of the U.S. particle physics community in activities related to CE&O, their attitudes toward and need for resources to assist with such efforts, and their perception of the responses of audience members to their activities. The 27-question survey was implemented using the free SurveyMonkey online survey software [13]. The survey was advertised through the DPF mailing list and was available for participation between May 20 and August 2, 2013. Over the course of the survey period 697 people started the survey; 641 of those answered at least the first two questions. This appendix includes all results except: 1) the responses participants submitted to questions that required free-form text answers; and 2) the last two questions, which required the submission of email addresses to receive draft reports from the Snowmass CE&O group.

The survey results are shown in Figs. 51-1 through 51-24.

1. Please choose the category that best describes your occupation:

	Response Percent	Response Count
Student	13.6%	87
Postdoc	9.8%	63
Faculty member	**47.0%**	**301**
Research scientist	28.4%	182
K-12 educator	1.2%	8
Other (please specify)		61
answered question		**641**
skipped question		**56**

Figure 51-1. *Survey: responses to question 1.*

2. Rank your interest in attending the following activities at the Community Summer Study (Snowmass on the Mississippi). [Rank from 1 (most interested) to 3 (least interested)] SPECIAL NOTE: The survey tool will rearrange the answers so that your #1 choice always appears at the top of the list.

	1	2	3	Rating Average	Rating Count
A media training (getting the most out of interactions with journalists, ~2 h)	25.0% (160)	29.2% (187)	**45.9% (294)**	2.21	641
A communication training (how to get your message across to policy makers and the public, ~ 2 h)	39.2% (251)	**45.7% (293)**	15.1% (97)	1.76	641
A lecture on the subject of communicating science to the public (1 h)	35.9% (230)	25.1% (161)	**39.0% (250)**	2.03	641
answered question					**641**
skipped question					**56**

Figure 51-2. *Survey: responses to question 2.*

3. How interested are people in the following aspects of our field?

	Least		Moderate		Most	Rating Average	Rating Count
Scientific goals	7.0% (39)	11.1% (62)	27.3% (153)	24.8% (139)	**29.9% (168)**	3.60	561
Potential applications of discoveries	3.0% (17)	5.4% (30)	22.9% (128)	30.7% (172)	**38.0% (213)**	3.95	560
Spin-off applications of technologies	3.2% (18)	10.7% (60)	31.7% (177)	**33.5% (187)**	20.9% (117)	3.58	559
Inspiring and training a high-tech, scientifically educated workforce	10.0% (56)	21.6% (121)	**33.0% (185)**	25.7% (144)	9.8% (55)	3.04	561
						answered question	**564**
						skipped question	**133**

Figure 51-3. *Survey: responses to question 3.*

4. What most increases people's appreciation of our field?

	Least		Moderate		Most	Rating Average	Rating Count
Scientific goals	7.2% (40)	9.9% (55)	**30.3% (168)**	25.4% (141)	27.2% (151)	3.55	555
Potential applications of discoveries	4.1% (23)	6.7% (37)	18.3% (102)	33.5% (186)	**37.4% (208)**	3.93	556
Spin-off applications of technologies	2.9% (16)	7.2% (40)	24.4% (135)	**40.8% (226)**	24.7% (137)	3.77	554
Inspiring and training a high-tech, scientifically educated workforce	8.3% (46)	21.3% (118)	**33.6% (186)**	26.2% (145)	10.6% (59)	3.10	554
						answered question	**558**
						skipped question	**139**

Figure 51-4. *Survey: responses to question 4.*

5. What do people feel best justifies the cost of particle physics research?

	Least interested		Moderately interested		Most interested	Rating Average	Rating Count
Scientific goals	9.1% (50)	15.8% (87)	**29.5% (163)**	23.4% (129)	22.3% (123)	3.34	552
Potential applications of discoveries	3.8% (21)	5.8% (32)	21.1% (116)	30.9% (170)	**38.5% (212)**	3.94	551
Spin-off applications of technologies	2.2% (12)	5.8% (32)	21.9% (121)	**40.8% (225)**	29.3% (162)	3.89	552
Inspiring and training a high-tech, scientifically educated workforce	6.9% (38)	16.4% (91)	**31.9% (177)**	31.2% (173)	13.5% (75)	3.28	554
						answered question	**555**
						skipped question	**142**

Figure 51-5. *Survey: responses to question 5.*

6. Do you feel comfortable or uncomfortable talking about:

	Comfortable	Uncomfortable	Rating Count
The overarching scientific goals of particle physics?	**95.2% (531)**	4.8% (27)	558
The impact particle physics discoveries have on society?	**83.5% (464)**	16.5% (92)	556
Examples of practical applications and spin-offs?	**80.5% (446)**	19.5% (108)	554
Justifications for funding particle physics research?	**77.0% (428)**	23.0% (128)	556
The impact of particle physics on the workforce?	**63.7% (352)**	36.3% (201)	553
The economic impact?	**50.1% (276)**	49.9% (275)	551
		answered question	**558**
		skipped question	**139**

Figure 51-6. *Survey: responses to question 6.*

7. Are you engaged in any communication, education or outreach activities that reach the general public or journalists?

	Response Percent	Response Count
Yes	**61.6%**	**351**
No	38.4%	219
	answered question	**570**
	skipped question	**127**

Figure 51-7. *Survey: responses to question 7.*

8. What kinds of communication, education or outreach activities for the general public are you engaged in?

	Response Percent	Response Count
Giving public lectures and/or participating in science cafes	**68.8%**	**231**
Participating in open houses and/or tours of research facilities	57.7%	194
Writing or producing materials for non-specialists	42.9%	144
Speaking to members of the media about particle physics	50.3%	169
Participating in science festivals	30.4%	102
	Other (please specify)	56
	answered question	**336**
	skipped question	**361**

Figure 51-8. *Survey: responses to question 8.*

9. Are you engaged in any outreach activities that reach scientists in other disciplines?

	Response Percent	Response Count
Yes	35.5%	202
No	**64.5%**	**367**
	answered question	**569**
	skipped question	**128**

Figure 51-9. *Survey: responses to question 9.*

10. In your opinion, how is our field viewed by the broader science community?

	Response Percent	Response Count
Highly regarded	26.4%	52
Well regarded	**56.9%**	**112**
Indifferent to what we do	10.7%	21
Negatively	6.1%	12
	answered question	**197**
	skipped question	**500**

Figure 51-10. *Survey: responses to question 10.*

11. What is the best way to broaden our support in the science community and increase funding for our field? [Choose one]

	Response Percent	Response Count
Publicize our results more through the media	18.5%	36
Stronger outreach to other scientists	14.9%	29
Explore interconnections with projects in other disciplines and increase collaboration	**30.8%**	**60**
Be more prudent when publishing potentially sensational results	7.2%	14
Focus on informing Congress and make sure that particle physics is emphasized in the science portfolio in decisions by Congress and funding agencies	28.7%	56
	answered question	**195**
	skipped question	**502**

Figure 51-11. *Survey: responses to question 11.*

12. Are you engaged in any education or outreach activities that reach K-12 teachers or students?

	Response Percent	Response Count
Yes	48.7%	276
No	**51.3%**	**291**
	answered question	**567**
	skipped question	**130**

Figure 51-12. *Survey: responses to question 12.*

13. What type of outreach to K-12 teachers have you engaged in that brings particle physics into their classrooms?

	Response Percent	Response Count
QuarkNet Mentor	28.1%	52
Other QuarkNet volunteer	21.6%	40
Research mentor	**38.9%**	**72**
Workshop presenter	**38.9%**	**72**
Workshop organizer	16.2%	30
Developer of materials for teachers	23.8%	44
Participant in in-service training at the local school district.	20.5%	38
Participant in development or review of state science standards	8.1%	15
	Other (please specify)	69
	answered question	**185**
	skipped question	**512**

Figure 51-13. *Survey: responses to question 13.*

14. In your experience, what was effective in helping teachers develop better teaching practices?

	Response Count
	112
answered question	**112**
skipped question	**585**

Figure 51-14. *Survey: responses to question 14.*

15. What type of outreach to K-12 students have you engaged in? Do they attract students from underrepresented groups?

	Engaged in	Supports underrepresented groups	Rating Count
Classroom presentation	**98.6% (143)**	39.3% (57)	145
QuarkNet Mentor	**92.7% (51)**	34.5% (19)	55
Other QuarkNet volunteer	**91.9% (34)**	35.1% (13)	37
Developed materials for students	**96.9% (62)**	31.3% (20)	64
Involvement in science fair or science competition	**94.3% (99)**	33.3% (35)	105
Tours at my university or laboratory	**96.8% (152)**	40.8% (64)	157
Research mentor	**97.7% (85)**	35.6% (31)	87
Other [please specify below]	**92.9% (13)**	35.7% (5)	14
		Other (please specify)	32
		answered question	**240**
		skipped question	**457**

Figure 51-15. *Survey: responses to question 15.*

16. How supportive is your department, university or laboratory of outreach efforts to:

	Not supportive		Moderately supportive		Very supportive	Rating Average	Rating Count
K-12 teachers?	3.4% (8)	10.9% (26)	27.3% (65)	20.6% (49)	**37.8% (90)**	3.79	238
K-12 students?	2.5% (6)	10.0% (24)	27.5% (66)	20.8% (50)	**39.2% (94)**	3.84	240
						answered question	**244**
						skipped question	**453**

Figure 51-16. *Survey: responses to question 16.*

17. Are you engaged in any communication, education or outreach activities that reach policy makers and opinion leaders?

	Response Percent	Response Count
Yes	29.5%	165
No	**70.5%**	**394**
	answered question	**559**
	skipped question	**138**

Figure 51-17. *Survey: responses to question 17.*

18. Where do you go, besides scientific publications, to prepare for interactions with policy makers? [Choose all that apply]

	Response Percent	Response Count
Google	61.4%	89
Scientific society websites (APS, AAAS)	53.8%	78
Particle-physics specific websites (DPF, Fermilab, Symmetry Magazine, Particle Adventure)	**66.9%**	**97**
University or laboratory public affairs or government affairs personnel	46.2%	67
	Other (please specify)	21
	answered question	**145**
	skipped question	**552**

Figure 51-18. *Survey: responses to question 18.*

19. What topics do you stress to policy makers as the most important reasons to fund our research? [Rank from 1 (most important) to 6 (least important)] SPECIAL NOTE: The survey tool will rearrange the answers so that your #1 choice always appears at the top of the list.

	1	2	3	4	5	6	Rating Average	Rating Count
opportunity for future scientific discovery	**38.6% (56)**	13.8% (20)	11.7% (17)	14.5% (21)	7.6% (11)	13.8% (20)	2.80	145
training a high-tech, well-educated workforce	**21.4% (31)**	**21.4% (31)**	**21.4% (31)**	15.2% (22)	12.4% (18)	8.3% (12)	3.01	145
overall societal benefit from past investment in particle physics research	**20.0% (29)**	16.6% (24)	18.6% (27)	17.2% (25)	15.2% (22)	12.4% (18)	3.28	145
potential for future applications of current discoveries	9.0% (13)	11.0% (16)	13.8% (20)	19.3% (28)	**25.5% (37)**	21.4% (31)	4.06	145
inspiring the next generation to study science	6.2% (9)	22.1% (32)	17.9% (26)	17.2% (25)	**23.4% (34)**	13.1% (19)	3.69	145
applications of particle physics tools (accelerators, detectors) to society	4.8% (7)	15.2% (22)	16.6% (24)	16.6% (24)	15.9% (23)	**31.0% (45)**	4.17	145
						answered question		**145**
						skipped question		**552**

Figure 51-19. *Survey: responses to question 19.*

20. Which topics would you like more training/resources about? [Rank from 1 (most important) to 6 (least important)] SPECIAL NOTE: The survey tool will rearrange the answers so that your #1 choice always appears at the top of the list.

	1	2	3	4	5	6	Rating Average	Rating Count
opportunity for future scientific discovery	**26.2% (33)**	14.3% (18)	15.1% (19)	11.1% (14)	13.5% (17)	19.8% (25)	3.31	126
overall training a high-tech, well-educated workforce	17.5% (22)	14.3% (18)	**23.8% (30)**	17.5% (22)	20.6% (26)	6.3% (8)	3.29	126
societal benefit from past investment in particle physics research	**27.8% (35)**	21.4% (27)	19.8% (25)	16.7% (21)	7.9% (10)	6.3% (8)	2.75	126
potential for future applications of current discoveries	6.3% (8)	18.3% (23)	18.3% (23)	**22.2% (28)**	21.4% (27)	13.5% (17)	3.75	126
inspiring the next generation to study science	5.6% (7)	11.9% (15)	11.1% (14)	17.5% (22)	25.4% (32)	**28.6% (36)**	4.31	126
applications of particle physics tools (accelerators, detectors) to society	16.7% (21)	19.8% (25)	11.9% (15)	15.1% (19)	11.1% (14)	**25.4% (32)**	3.60	126
							answered question	**126**
							skipped question	**571**

Figure 51-20. *Survey: responses to question 20.*

21. Are you engaged in any education or outreach activities other than coursework that reach undergraduate students?

		Response Percent	Response Count
Yes		**51.7%**	**284**
No		48.3%	265
		answered question	**549**
		skipped question	**148**

Figure 51-21. *Survey: responses to question 21.*

22. If you mentor undergraduate researchers, do you do so for:

	Response Percent	Response Count
The summer?	**84.6%**	**198**
The academic year?	73.1%	171
	answered question	**234**
	skipped question	**463**

Figure 51-22. *Survey: responses to question 22.*

23. What efforts do you lead or participate in that attract undergraduate students from underrepresented groups to physics research?

	Response Count
	120
answered question	**120**
skipped question	**577**

Figure 51-23. *Survey: responses to question 23.*

24. Do you work with School/College of Education and participate in pre-service education?

	Response Percent	Response Count
Yes	10.0%	27
No	**90.0%**	**243**
	answered question	**270**
	skipped question	**427**

Figure 51-24. *Survey: responses to question 24.*

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