



# 2023 Program Theory Model

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## Why a Program Theory Model?

### **Program:**

Offers “an approximate fit”

Common understanding

Able to compare the program as *designed vs. implemented*

*Context matters* in its implementation

Representative picture of how *change* is expected to happen

**Program Strategies**  **Measurable Program Outcomes**  
**Directs evaluation efforts**



## PTM: What's New?

Changes coincide with renewal grant

New partnerships (e.g., IRIS-HEP)

New program components (e.g., Coding Camp, Cosmic Watches)

Review, update and revise descriptions of other program, as needed

[Link to Full Program Theory Model](#)

# QuarkNet Partners



**NSF:** The National Science Foundation is an independent federal agency created by Congress in 1950 “to promote the progress of science; to advance the national health, prosperity, and welfare; to secure the national defense...” NSF

supports basic research and people to create knowledge that transforms the future. QuarkNet is funded through NSF’s Integrative Activities in Physics Program.

**Advisory Board:** Typically, eight to ten individuals both familiar with and new to the program meet annually to review QuarkNet program achievements and make recommendations for future plans and objectives. Members represent a diverse mix of high school physics teachers, education administrators, research physicists and physics outreach leaders.



QuarkNet: The QuarkNet Collaboration is a long-term, national program that *partners*

*high school science teachers with particle physicists* working in experiments at the scientific frontier. A professional development program, QuarkNet immerses teachers in authentic physics research and seeks to engage them in the development of instructional strategies and best practices that facilitate the implementation of these principles in their classrooms.

**U.S. ATLAS:** A collaboration of scientists from 45 U.S. institutions. ATLAS is one of two general-purpose detectors at the Large Hadron Collider in Geneva, Switzerland. The ATLAS experiment investigates a wide range of physics, from the search for the Higgs boson to extra dimensions and particles that could make up dark matter. U.S. ATLAS is a co-sponsor of QuarkNet.



**Fermilab:** America’s particle physics and accelerator laboratory whose

vision is to solve the mysteries of matter, energy, space and time for the benefit of all. Fermilab, a co-sponsor of QuarkNet, hosts Data Camp held each summer and supports the cosmic ray studies program. Fermilab hosts DUNE and the Long-Baseline Neutrino Facility. DUNE brings together over 1,000 scientists from more than 175 institutions in over 30 countries.



**U.S. CMS:** A collaboration of more than 900 scientists from 50 U.S. institutions who make significant contributions to the Compact Muon Solenoid (CMS) detector. Discoveries from the CMS experiment are revolutionizing our understanding of the universe. USCMS is a co-sponsor of QuarkNet.



**QuarkNet Centers:** Centers both form the essential backbone of and are partners in QuarkNet. A center is housed at a university or laboratory, serving high school physics and physical science teachers; active local centers number 50+.

## Broadening Participation and Community Outreach:

QuarkNet works on multiple fronts to help broaden participation beyond the existing community, including teachers and students who are underrepresented in physics. Examples include center needs assessment workshops that serve to identify ways to reach out to these communities. QuarkNet partners with other STEM organizations to reach more teachers and students. Recent partners are *STEP UP*, *STEMarts Lab*, and *i.am.Angel Foundation*. Many Data Activities Portfolio activities have been translated into Spanish. Often, participating teachers develop classroom implementation plans that integrate culturally sensitive content. Centers integrate QuarkNet in their community outreach efforts, partnering to reach beyond existing QuarkNet schools to students traditionally underrepresented in STEM.



**IRIS-HEP:** A software institute funded by the National Science Foundation. It aims to develop the state-of-the-art software cyberinfrastructure required for the challenges of data intensive scientific research at the High Luminosity Large Hadron Collider (HL-LHC) at CERN, and other planned HEP experiments of the 2020’s. In partnership with IRIS-HEP, QuarkNet offers professional development opportunities for teachers to improve coding skills to enhance classroom implementation of particle physics instructional materials.

**Broader Impacts:** QuarkNet has led in facilitating the public use of large particle physics datasets. Working within the International Particle Physics Outreach group (IPPOG), QuarkNet shares the overall central coordination of International Masterclasses (IMC). QuarkNet schedules and coordinates ATLAS, CMS, MINERvA and NOvA International Masterclasses with videoconferences based at Fermilab. Also, QuarkNet develops and coordinates World Wide Data Day, an IMC extension, and shares leadership in the global cosmic ray studies project. QuarkNet provides a wealth of information for IPPOG members to consider in their own education and outreach programs. QuarkNet staff and teachers attend and present at meetings of the American Association of Physics Teachers and the American Physical Society. These presentations have highlighted how QuarkNet works, e-Labs, the Data Activities Portfolio and scientific discovery for students.

## QuarkNet Program Theory Model

**Program Statement:** The QuarkNet Collaboration is a long-term, national program that partners high school science teachers with particle physicists working in experiments at the scientific frontier. A professional development program, QuarkNet immerses teachers in authentic physics research and seeks to engage them in the development of instructional strategies and best practices that facilitate the implementation of these principles in their classrooms.

**Centers:** QuarkNet delivers its professional development program in partnership with local centers.

